

**PEOPLE'S COMMITTEE OF THANH HOA PROVINCE
THANH HOA PROJECT MANAGEMENT UNIT FOR INVESTMENT AND
CONSTRUCTION OF AGRICULTURAL AND RURAL DEVELOPMENT WORKS**

**SUSTAINABLE FISHERY DEVELOPMENT PROJECT IN THANH HOA
PROVINCE**

**ENVIRONMENTAL AND SOCIAL IMPACT
ASSESSMENT (ESIA)**

**Project location: 07 communes including Hoang Tien, Hoang Chau, Nga Son, Tan Tien,
Hoa Loc, Van Loc, and Quang Chinh of Thanh Hoa Province.**



Thanh Hoa – 02/2026

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CLIENT

CONSULTANT

Thanh Hoa – 02/2026

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ABBREVIATIONS AND ACRONYMS

COC ON SEA	Code of Conduct on Sexual Exploitation and Abuse
MAE	Ministry of Agriculture and Environment
MOC	Ministry of Construction
MOH	Ministry of Health
CPC	Commune/ward/People's Committee
CSC	Construction Supervision Consultant
CT	Formula
DARD	Department of Agriculture and Rural Development
D-Fish	Directorate of fishery
DMMP	Dredged Material Management Plan
E&S	Environmental and Social
ECOP	Environmental Code of Practices
EEZ	Exclusive Economic Zone
EIA	Environmental Impacts Assessment (required by GoV)
EM	Ethnic Minority
EMDP	Ethnic Minority Development Plan
EMPF	Ethnic Minority Policy Framework
EPP	Environmental Protection Plan
ESA	Environmental and Social Assessment
ESCP	Environmental and Social Commitment Plan
ESF	Environment and Social Framework (of WB)
ESHGs	World Bank Group's Environmental Social and Health Guidelines
ESIA	Environmental and Social Impact Assessment
ESMF	Environmental and Social Management Framework
ESMP	Environmental and Social Management Plan
ESS	Environmental and Social Standards (of WB)
FS	Feasibility study
GAP	Good Aquaculture Practices
GBV	Gender - Based Violence
GIIP	Good International Industry Practices
GoV	Government of Vietnam
GRM	Grievance Redress Mechanism

IBRD	International Bank for Reconstruction and Development
IDA	International Development Association
IoT	Internet of Things
IPM	Integrated Pest Management
IPMP	Integrated Pest Management Plan
IUU	Illegal Unreported and Unregulated
LMP	Labor Management Procedures
OSH	Occupational Safety and Health
PPC	Provincial People's Committee
PSC	Project Steering Committee
RAP	Resettlement Action Plan
RPF	Resettlement Framework
SEA	Sexual Exploitation and Abuse
SEF	Stakeholder Engagement Framework
SFDP	Sustainable Fishery Development Project
SUBP	Subproject
TOR	Terms of Reference
TWG	Technical Working Group
VAC	Violence against Children
VWU	Vietnam Women's Union
WB	The World Bank

M	Million
\$	US Dollar
m	Meter
km	Kilometer
ha	Hectare

EXECUTIVE SUMMARY

Project Background

The Sustainable Fishery Development Project in Thanh Hoa Province was approved for investment policy by the Thanh Hoa Provincial People's Council under Resolution No. 460/NQ-HĐND dated December 14, 2023, with the objective of building and upgrading infrastructure and reorganizing production in order to develop the fisheries sector of Thanh Hoa Province towards enhanced value, international integration, and climate change adaptation. The project consists of 02 components, including:

- Component 1: Investment in developing infrastructure for seafood exploitation and aquaculture, including the following 9 subprojects: Subproject 1 - Upgrading and expanding Hoang Truong fishing port; Subproject 2 - Upgrading and expanding fishing port combined with storm shelter for fishing boats in Lach Truong commune, Hoa Loc district; Subproject 3 - Upgrading infrastructure of aquaculture areas in Nga Thuy, Nga Tan, Nga Tien communes, Nga Son district; Subproject 4 - Upgrading infrastructure of aquaculture areas in Hoang Yen commune, Hoang Hoa district; Subproject 5 - Upgrading infrastructure of aquaculture areas in Hoang Phong commune, Hoang Hoa district; Subproject 6 - Upgrading infrastructure of aquaculture areas in Hoang Luu commune, Hoang Hoa district; Subproject 7 - Upgrading infrastructure of aquaculture areas in Hoang Chau commune, Hoang Hoa district; Subproject 8 - Upgrading infrastructure of aquaculture areas in Da Loc commune, Hau Loc district; Subproject 9 - Upgrading infrastructure of the aquaculture area of Quang Trung commune, Quang Xuong district

Investment in developing fisheries and aquaculture infrastructure, including 09 subprojects: (1) Subproject 1 - Upgrading and expansion of Hoang Truong fishing port subproject; Subproject 2-Upgrading and expansion of Lach Truong fishing port and storm shelter anchorage in Hoa Loc commune, Hau Loc district; Subproject 3- Upgrading aquaculture infrastructure in Nga Thuy, Nga Tan, and Nga Tien communes, Nga Son district; Subproject 4- Upgrading aquaculture infrastructure in Hoang Yen commune, Hoang Hoa district; Subproject 5- Upgrading aquaculture infrastructure in Hoang Phong commune, Hoang Hoa district; Subproject 6 - Upgrading aquaculture infrastructure in Hoang Luu commune, Hoang Hoa district; Subproject 7 - Upgrading aquaculture infrastructure in Hoang Chau commune, Hoang Hoa district; Subproject 8 - Upgrading aquaculture infrastructure in Da Loc commune, Hau Loc district; Subproject 9 - Upgrading aquaculture infrastructure in Quang Trung commune, Quang Xuong district.

- Component 2: Project management.

Legal and technical basis for ESIA

The environmental assessment conducted during project preparation confirmed that the project's environmental risk is classified as Medium. The applicable Environmental and Social Standards (ESS) for the project are as follows: ESS1: Assessment and Management of Environmental and Social Risks and Impacts; ESS10: Stakeholder Engagement and Information Disclosure; ESS2: Labor and Working Conditions; ESS3: Resource Efficiency and Pollution Prevention and Management; ESS4: Community Health and Safety; ESS5: Land Acquisition, Restrictions on Land Use, and Involuntary Resettlement; ESS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources; ESS8: Cultural Heritage; This Environmental and Social Impact Assessment (ESIA, this document) is prepared in accordance with the Environmental and Social Framework (ESF). The ESIA covers the proposed works under Component 1 of the project.

Project description

The scope of construction investment and upgrading of project items is summarized in the table below:

Subproject	Investment scope
Subproject 1: Upgrading and expanding Hoang Truong fishing port	Port area: Upgrading and constructing port facilities including: - New docking berth: length 330 m, width 10 m, deck elevation +2.35 m, bottom elevation from -2.9 m to -4.0. - Substructure embankment: 330 m long. - Berth yard embankment: 520 m - Wharf yard: Reinforce the wharf yard surface with an approximate length of L = 800.0 m and a width of about 35.0 m. - Wharf canopy system: total length 210 m, width 10.0 m; total construction area 2,100 m². - Water collection ditch: Construct a new water collection ditch system, length about L = 330.0m. - Dredging the water area in front of the port: Length of about L=800.0m, width of 2-20m, dredged bottom elevation from -2.9m to -4.0m. Estimated dredging volume is 7,266.44m³. - Channel layout: width is 40m. width of 40 m; channel curvature radius 150 m; turning basins diameter for fishing vessel areas: <12 m, D=40 m; for fishing vessel <17 m vessels D=55 m; for fishing vessel <24 m, D=75 m. Logistics facilities: construct the following new projects - New administration building: 1 building with 3 storeys, total floor area of 300 m². - Parking building in administration area: 1 storey building, area of 60 m². - Port entrance gate: 03. - Fence surrounding the fishing port area: Length approximately 180.0 m. - 2 toilets with area of 60 m² each. Technical infrastructure works: - Construction of a clean water supply system, stormwater drainage, fire protection and fighting, electricity supply, lighting systems, and greenery along transport route. - Construction of 1 WWTP with a capacity of 200 m³/day; AO technology; treated wastewater quality: Column B, QCVN 40:2011/BTNMT (Kq=0.9, Kf=1.1); Wastewater sources: (i) Production wastewater: generated from fish sorting activities, wharf washing, and ship-hold cleaning; Domestic wastewater: from activities of local residents the the port after preliminary treated via septic tanks.

Subproject	Investment scope
Subproject 2: Upgrading and expanding the fishing port combined with the storm shelter anchorage area for fishing boats in Lach Truong	Port area: - Construction of new berth: length 60 m, width 12 m, top elevation of berth +2.4 m, bottom elevation from -3.6 m to -4.1 m. - Substructure: length 60 m. - Connecting embankment between the port wharf and the outlet of Lach Truong dock basin: Embankment length approximately L = 120.0 m. - Reinforcement of the old docking yard L = 270.0m, yard width B = 10.0m. - Wharf canopy system: length approx 240 m, width 12m. - Water collection ditch: Length of about L = 330.0m - Repair and upgrade of internal traffic roads in the port: Length about L=370.0m. - Dredging of the water area in front of the port: width of B = (40~50) m, length 330-612 m (the dredged area in front of the port does not affect the Lach Truong inland waterway route). Dredged bottom elevation: from -3.6 m to -4.1 m. Estimated dredging volume is 43,380 m³. - Dredging the storm shelter anchorage area for fishing boats in Lach Truong: Length about L=1,150.0m; bottom width about B=90m. Dredged bottom elevation from -3.6m to -4.1m. Estimated dredging volume is 350,072 m³. Logistics facilities: - Build 01 public toilet. Technical infrastructure works: - Construction of a clean water supply system, electricity supply system, and fire-fighting system. - Construction of 01 WWTP with capacity 200 m³/day. AO technology; treated wastewater quality: column B, QCVN 40:2011/BTNMT (Kq=0.9, Kf=1.1); Water sources: (i) production wastewater: generated from fish sorting, wharf washing, and ship-hold cleaning, etc.; Domestic wastewater: from activities of local residents the the port after preliminary treated via septic tanks
Subproject 3: Upgrading infrastructure of aquaculture areas in Nga Thuy, Nga Tan, Nga Tien communes, Nga Son district	Phu Son 2 Canal: - Construct new Phu Son 2 sluices with 2 discharge gates of size (1.8 × 2.0 m), 20 m long. - Dredging Phu Son 2 canal, length of 1,436.34 m. - Construction of an 809.89m long operation management road along the canal, with a 5.0m wide concrete road surface. Reinforcement of the Phu Son canal roof with a length of 809.89m using precast concrete components. - Dredging the main drainage channel of the aquaculture area: trapezoidal channel cross-section: (12 × 2.5) m, canal slope m = 2.0. - Constructing 4 new headwater sluices with reinforced concrete (RC) structure. Bao Trieu canal area (Ong Ty canal): - Dredging Bao Trieu canal with a length of 2,581.70 m. Combined with an operation and management road from K1+356.10 – K2+373: concrete road surface, 6.5 m wide. - Dredging the main drainage canal for Dong Coi and aquaculture areas - + Section 1: 1,356.10 m – cross-section (6 × 2.25) m, canal slope m = 1.5.

Subproject	Investment scope
	- + Section 2: 1,225.60 m – cross-section (8 × 2.35) m, canal slope $m = 1.5$. - Construction of 6 new headwater sluices with reinforced concrete (RC) structure. - Dredging volume of subproject 3 is: 94 m³.
Subproject 4: Upgrading infrastructure of the aquaculture area of Hoang Yen commune, Hoang Hoa district	Zone I: - Construct the embankment dike in Hoang Yen commune, total length of 1,640.64 m, a canal base: 5.0 m wide, and a crest elevation of +3.6 m. Build 3 new box culverts beneath the dike. - Upgrading Son Trang 1 canal with a length of 525.0m includes: Dredging 389.7m, building a 535m-long operation and management road, 4m wide concrete road surface - Construction of 3 new culverts and 2 extended culverts of reinforced concrete structure. - Upgrading Son Trang 2 canal with a length of 1,366m with: Dredging the entire canal, building a 1,366m long operation and management road, with a 4m wide concrete road surface. Zone II: - Upgrading Hung Tien canal with a length of 871.63m includes: Dredging the entire canal, building a 148.12m long operation and management road, with a 4m wide concrete road surface. - Upgrading and reinforcing Nghia Thuc canal with a length of 827.16m. Construction of an operation and management road along the canal, 827.16m long, with a 4.0m wide concrete road surface. - Dredging volume of the subproject 4 is: 17,277 m³.
Subproject 5: Upgrading infrastructure of the aquaculture area of Hoang Phong commune, Hoang Hoa district	- Upgrading the Dong Coi canal with a length of 1,310.20m includes: Dredging the entire route, building an operation and management road on both banks (left bank 456.57m long and right bank 853.63m long), road base of 4.0m wide, crushed stone road surface of 3.0m. Building 4 new box culverts and 2 bridges across the canal with reinforced concrete structure. - Upgrading Hoi Trieu canal with a length of 1,714.57m includes: Dredging the entire route, compacted earth embankments, and use of the existing concrete road as an operation and management route. Construct one new regulation cluster on the canal with a reinforced concrete box culvert structure sized 3×(2.50×2.25) m. - Upgrading the Tay Canal with a length of 1,339.0m includes: Dredging the entire route, the first section is 452m long, the canal slope is reinforced with precast concrete panels. Constructing 4 new box culverts and 1 regulating cluster on the canal, M250 reinforced concrete structure. - Dredging volume of subproject 5 is: 10,775 m³.
Subproject 6: Upgrading infrastructure of the aquaculture area of Hoang Luu commune, Hoang Hoa district	- Upgrade Canal No. 1 with a total length of 819.29 m, including: full dredging of the canal, installation of settlement joints and concrete bracing along the route. The canal embankment will be combined with an operation and management road, with a base width of 4.0 m and a concrete pavement width of 3.0 m. Construct and rehabilitate 11 structures along the canal. - Upgrade Canal No. 2 with a total length of 213.38m, including: dredging to complete the canal cross-section and repairing/upgrading structures along the canal.

Subproject	Investment scope
	- Upgrade the operation and management road (Route No. 01) from the Tay dike of the Cung River to the Con Voi sluice gate, with a total length of L = 2,008.47 m, concrete pavement, and a roadbed width of 4.0 m. - Dredging volume of subproject 6 is: 3,967 m³.
Subproject 7: Upgrading infrastructure of the aquaculture area of Hoang Chau commune, Hoang Hoa district	- Construct a new Khe River sluice gate beneath the left dike of the Ma River: Culvert dimensions (Width × Height) = 2 × (2.2 × 2.2) m; designed to intake water from the Me River for aquaculture purposes and to support flood drainage. - Upgrade the Song Khe canal with a total length of L = 1,336.0 m, including: dredging, canal bank reinforcement, and construction of an operation and management road along the canal with a crushed stone base surface 3.0 m wide. - Upgrade canal branch 1: The section from pile 1 to pile D4 connects to Branch 2 and Branch 3, the existing concrete canal is still in good condition. The total length of upgraded canal branch 1 is L= 487.00m. Dredge to complete the canal cross-section, repair and upgrade structures along the canal. The canal embankment will be combined with a construction and operation management road, with a total length of L = 889.0 m, concrete pavement, and a roadbed width of 4 m. - Canal branch 2: construct operation and management road on the right side with a total length of L=299.0m, concrete pavement, and a roadbed width of 4m. - Canal branch 3: construct operation and management road on the right side with a total length of L=253.0m, concrete pavement, and a roadbed width of 4m. - Dredging volume of subproject 7 is: 10,070 m³.
Subproject 8: Upgrading infrastructure of aquaculture area in Da Loc commune, Hau Loc district	- New construction of Ong Ninh sluice including 2 reinforced concrete box gates (1.3x1.75)m, concrete structure. - Dredge and complete the main drainage canal with a total length of 1,256.13 m, combined with the construction of an operation and management road of 767.23 m long, with a 5.0m-wide reinforced concrete pavement. Reinforce 59.76 m of canal slope using reinforced concrete retaining walls, bamboo piles, and settlement joints. Upgrade 9 sluices (5 at the canal head and 4 crossing roads), all with reinforced concrete structures. - Dredge two in-field canal branches: Canal branch 1 with a length of 283.97 m and a cross-section of (1.8 × 2.0) m; Canal branch 2 with a length of 232.74 m and a cross-section of (1.2~1.5 × 2.0) m. Both canals will have grass planted on the slopes for protection. - Repair and improvement of 02 internal roads in the aquaculture area: Road No. 1 length L = 467.79 m; Road No. 2 length L = 458.57 m. Concrete surface, roadbed width of 5 m, hilly soil foundation, crushed stone type II bedding - Dredging volume of subproject 8 is: 9,291 m³.
Subproject 9: Upgrading infrastructure of the aquaculture area of Quang Trung commune, Quang Xuong district	- Upgrade the supply canal from Ong Thuoc sluice to Ong Vanh sluice, with a total length of approximately 1,273 m, including: dredging the canal, constructing a 900m-long operation and management road with concrete pavement and a roadbed width of 5m. Along the canal, build 2 new bridges across the canal, 2 sluices at the canal head for drainage, and 7 inlet/outlet culverts for aquaculture ponds. - Construction of 02 new culverts, including: Ong Thuoc sluice with a dimensions of (1.6 x 1.8) m, reinforced concrete structure; Ong Vanh sluice with a dimensions of 2 x (1.4 x 1.8) m, reinforced concrete structure. Both culverts will have foundation reinforcement using either reinforced concrete piles or bamboo piles,

Subproject	Investment scope
	and will be equipped with Larsen sheet piles to prevent erosion. - The dredging volume of subproject 9 is: 1,240 m ³ .

Environmental and social conditions

In order to assess the quality of the baseline environment in the subproject area, the Project Owner has coordinated with the environmental monitoring unit, KGZ Investment Joint Stock Company (with VIMCERTS 320 certificate) to conduct surveys, measurements, and sampling for environmental analysis (air, surface water, groundwater, wastewater, soil and sediment) at each sub-project. Environmental sampling was carried out on October 23, 24 and 30, 2024. Information on the quality results of environmental components in the project area is as follows:

Current status of air quality and noise

The results of ambient air quality monitoring in the subproject area show that all indicators are within the permissible limits of QCVN 05:2023/BTNMT – National Technical Regulation on Ambient Air Quality (1-hour average). Noise levels in the project area are also within the allowable limits according to QCVN 26:2010/BTNMT – National Technical Regulation on Nois.

This result shows that the ambient air quality in the project areas is still relatively good, with no signs of pollution.

Current status of groundwater quality

The analysis results indicate that the quality of groundwater in the areas of subprojects 1, 2, 3, 5, 6, 7, 8, and 9 is relatively good, with no signs of pollution. At the sampling positions, most analyzed parameters are within the permissible limits of QCVN 09:2023/BTNMT – National Technical Regulation on Groundwater Quality. However, at sample NN4 in the area of subproject 4, the Ammonium (NH₄⁺) parameter exceeds the standard by 2.44 times compared to QCVN 09:2023/BTNMT, indicating localized groundwater pollution the subproject 4.

Current status of surface water quality

According to the surface water quality monitoring results, most parameters at all monitoring points are below the permissible limits set by QCVN 08:2023/BTNMT – National Technical Regulation on Surface Water Quality. However, certain parameters such as COD, BOD₅, Ammonium, and Surfactants exceed the allowable limits under QCVN 08:2023/BTNMT.

Wastewater characteristics

The measurement results of wastewater parameters in the project area (from existing ports subproject 1 and subproject 2, and aquaculture area) indicate that most industrial wastewater parameters are within the permissible limits under QCVN 40:2011/BTNMT, Column B. However, sample NT9 (wastewater sample at subproject 9) shows that the Total Suspended Solids (TSS) parameter exceeds the standard by 1.52 times.

Current status of soil quality

The analysis results of soil environmental quality show that heavy metal parameters are all within the permissible limits according to QCVN 03:2023/BTNMT (Type 2). During project construction, the topsoil layer will be removed, and depending on the soil characteristics, a decision will be made on whether to reuse or dispose of it. Therefore, the excavated soil from construction areas may be reused for various purposes such as site leveling, or may be disposed of as general waste.

Current status of sediments

The analysis results show that heavy metal concentrations in sediment within the project area are significantly lower than the permissible limits specified in QCVN 43:2017/BTNMT – National Technical Regulation on Sediment Quality. Therefore, the dredged sediment from the subproject component is considered non-hazardous and not contaminated by heavy metals.

The construction areas of subprojects 1 and 2 are mainly located within existing fishing ports and storm shelter anchorages. The remaining subprojects, from subproject 3 to subproject 9, are all implemented along existing canals and ditches within the local aquaculture areas. Sensitive receptors for each subproject are presented in Section 2.6, Chapter 2. No tangible cultural heritage resources are affected by the project.

Alternative analysis

The report has compared the scenarios of “with project” and “without project,” as well as the technical design options for each subproject, including auxiliary components such as dredging methods and material storage locations.

Analysis of Dredging Method Selection: The selection of the dredging method was based on the following conditions: (i) Dredging activities will be carried out in currently active navigation canals; (ii) These canals are currently narrow and shallow, requiring careful guidance during operations; (iii) The distance to designated dredged material disposal sites must be taken into consideration. To ensure safe operating conditions for both dredging vessels and commercial traffic, the dredging method must allow for efficient fleet organization and maximum productivity. These factors have guided the technical analysis and gave the final decision on the dredging approach.

Environmental and Social Impacts and Risks

The ESIA has identified potential negative impacts and risks of the subproject. Most of the impacts are temporary, localized and reversible because the project components are in small to medium scale. These impacts can be mitigated by applying appropriate technology and specific mitigation measures, and the contractor must closely monitor and consult with local residents.

a. In the preparation phase:

Impact of land acquisition: The total area of land permanently acquired for the construction of project components is approximately 201,881 m², affecting 269 households. Among these: 262 households are impacted by land acquisition of less than 30% (accounting for 78% of affected households), the remaining affected from 30% to 70% (accounting for 22%). Additionally, 11 organizations are affected, primarily communal People’s Committees, now reduced to 07 due to administrative commune mergers. Importantly, no households or organizations are subject to relocation or resettlement within the project implementation area.

Safety risks associated with unexploded ordnance: The subprojects will be upgraded and expanded within fishing ports and aquaculture zones, including mine and explosive ordnance clearance activities on both land and water surfaces in areas such as Hoang Truong and Lach Truong fishing ports, as well as existing canals. The total area designated for mine and explosive ordnance clearance is 547,700 m² (54.77 ha), comprising 47.39 ha of land-based clearance and 7.38 ha of underwater clearance.

b. During construction phase:

✓ General impacts and risks

Construction activities and daily worker routines generate dust, emissions, noise, vibration, wastewater, and solid waste. These impacts are considered low to moderate for each individual component and can be mitigated. Overall, construction is expected to cause the following environmental and social impacts: Air pollution due to dust and exhaust emissions; Noise and vibration impacts; Wastewater generation; Solid waste generation; Decline in water quality;

Impact on aquatic ecosystems; Local erosion, sedimentation and flooding; Increased safety risks and traffic disruption (water, road); Risk of damage to existing infrastructure due to transportation of construction materials and machinery; Impact on workers' health and safety; Safety risks for the community; Social impacts due to labor influx; Impact on cultural resources (pagodas, temple, churches, etc.).

✓ ***Specific impacts during the construction phase***

Specific impacts during the construction phase at each subproject area are as follows:

- *Subproject 1*: Disruption to the operation of the existing Hoang Truong fishing port; Impact on the water quality of Lach Truong river due to dredging activities; Impact on the operation of ship repair facilities within the existing port; Impact by the disposal site of dredged materials; Impact on sensitive receptors (temporary disruption of the operation of the existing shipbuilding workshop).
- *Subproject 2*: Disruption to the operation of the existing Lach Truong fishing port; Affect the operation of some nearby seafood processing facilities; Disrupt the operation of the existing Lach Truong fishing port central market; Affect aquaculture activities on Lach Truong river; Impact by the disposal site of dredged materials; Temporarily impact on sensitive receptors (Churches, markets, temples/pagodas).
- *Subproject 3*: Temporarily disruption to water intake and drainage serving aquaculture; Temporarily impacts on local people's livelihoods; Sensitive receptors are temporarily affected (markets, schools).
- *Subproject 4*: Temporarily disruption to water intake and drainage serving aquaculture; Temporarily impacts on local people's livelihoods; Impact due to disposal at the dredging material dumping site; Sensitive receptors are temporarily affected (pagodas, aquaculture areas).
- *Subproject 5*: Temporarily disruption to water intake and drainage serving aquaculture; Temporarily impacts on local people's livelihoods; Impact due to disposal at the dredging material dumping site.
- *Subproject 6*: Temporarily disruption to water intake and drainage serving aquaculture; Temporarily impacts on local people's livelihoods; Impact due to disposal at the dredging material dumping site; Sensitive receptors are temporarily affected (schools).
- *Subproject 7*: Temporarily disruption to water intake and drainage serving aquaculture; Temporarily impacts on local people's livelihoods; Impact due to disposal at the dredging material dumping site; Sensitive receptors are temporarily affected (aquaculture area).
- *Subproject 8*: Temporarily disruption to water intake and drainage serving aquaculture; Temporarily impacts on local people's livelihoods; Impact due to disposal at the dredging material dumping site; Sensitive receptors are temporarily affected (aquaculture area).
- *Subproject 9*: Temporarily disruption to water intake and drainage serving aquaculture; Temporarily impacts on local people's livelihoods; Impact due to disposal at the dredging material dumping site.

c. *During the operating phase:*

For subproject 1 and 2:

The activities of vessels entering and leaving fishing ports/storm shelters will cause the following impacts and risks: Air pollution due to emissions from vessels; Deterioration of surface water quality due to increased oil and grease concentrations from ships; Impact on

aquatic ecosystems in the area.

Periodic dredging activities to maintain navigation channels/storm shelters will cause the following impacts and risks: Decline in air quality due to the operation of dredging vehicles and machinery; Decline in surface water quality due to dredging activities (increased turbidity, TSS, grease, etc.); Impact on aquatic ecosystems in the area; Increased risk of saltwater intrusion.

For Subproject 3,4,5,6,7,8,9:

Impacts and risks during the operation phase of canal/ditch works include: Subsidence and landslides of canals after construction; Cracks on the surface of the management and operation road due to overloading.

d. Cumulative impacts:

Construction phase: (i) Increased pollution (dust, noise, construction wastewater): Total emissions of dust, gas, noise, and construction wastewater may significantly increase across the entire project scale, especially if dredging, material transport, and construction activities occur simultaneously in multiple coastal areas, affecting public health and surface water quality in the area. (ii) Decreased water and soil quality due to excavation and embankment, affecting the ecosystem of rivers, seas, canals, and aquaculture areas; (iii) Increased risk of landslides, collapses, and erosion, especially during construction during the rainy season; (iv) Disruption of transportation—especially waterway traffic—as well as daily life and production of local residents, and impacts on aquaculture activities due to production interruptions if construction occurs near active farming areas, (v) Increased pressure on the supply chain for materials, equipment, and technical labor, potentially affecting implementation progress and efficiency.

Operational phase: (i) Conflicts in the use of coastal resources between sectors such as fisheries, tourism, industry and ecological conservation. (ii) Pressure on social infrastructure, increased long-term operation and maintenance costs for systems such as transportation, water supply, fishermen's livelihoods, and waste management as infrastructure ages or is not properly maintained, repair costs may rise significantly over time. (iii) In the context of climate change, coastal subprojects will face increasing risks such as sea level rise, saline intrusion, and more frequent severe storms, affecting storm shelter effectiveness, domestic water sources, aquaculture areas, and fisheries activities. (iv) Increased environmental pressure from expanding farming areas and long-term intensification of production may lead to water pollution and biodiversity loss if not well managed. (v) Increased risk of aquatic disease outbreaks due to high stocking density and movement between farming areas, which may spread pathogens if not properly controlled. (vi) Land and water resource use conflicts may arise due to competing demands among aquaculture, agriculture, domestic use, and conservation. (vii) Dependence on a single production model, if farming areas rely on only one or a few species or a specific market, may increase risks in the event of market fluctuations or disease outbreaks.

Environmental and Social Management Plan (ESMP)

The Environmental and Social Management Plan (ESMP) outlines detailed implementation, monitoring, supervision and reporting procedures to ensure effective management of these impacts. The plan also includes a capacity building program to enhance the skills and knowledge of stakeholders, as well as a comprehensive cost estimate for all proposed measures. Key components of the ESMP include: measures to mitigate environmental and social risks and impacts; implementation agreements; project compliance framework; environmental monitoring program; capacity building activities; cost estimates; and grievance redress mechanism.

Mitigation measures

The project's environmental and social (E&S) mitigation measures are designed to address risks across all project phases – feasibility study, detailed design, site preparation, construction and operation. These measures are developed and implemented according to the World Bank's mitigation hierarchy, which prioritizes measures to prevent, minimize, mitigate and compensate or offset negative impacts.

Proposed mitigation measures for FS and detailed design

Mitigation measures for the detailed design phase of all subprojects are presented in Section 5.1.1. In summary, during the detailed design phase, mitigation measures will be implemented to address environmental and social risks associated with dredging, fisheries logistics and port infrastructure, as well as wastewater and solid waste management.

For dredging activities, stakeholder consultation will guide the selection of appropriate locations, timing, and techniques, while also supporting the development of waterway safety signage and channel routing plans to minimize disruptions to local communities and aquatic livelihoods.

For port infrastructure, comprehensive geological and hydrological surveys will provide inputs for resilient designs, taking into account sediment dynamics, sustainable materials, and revetment techniques to counter subsidence and tidal surge. Port facilities will incorporate wastewater collection, drainage systems, and green space, while minimizing vegetation clearance and promoting energy-efficient building design.

Wastewater and solid waste treatment plants will be located away from vulnerable areas, designed to operate efficiently and in compliance with national standards, and equipped with appropriate treatment technologies and odor control measures. Qualified personnel will be responsible for management of activities, with reinforced pits and robust emergency response plans to address potential risks at fishing ports.

Mitigation measures in the preparation phase

Section 5.1.2 specifies the mitigation measures that need to be implemented during the preparation phase.

To address the impacts due to land acquisition, during the preparation phase, the project developed a Resettlement Plan (RP) outlining compensation, assistance and livelihood restoration measures for project-affected people (PAP), based on the principles of full replacement cost and comprehensive consultation. The RP also includes a grievance redress mechanism (GRM), preliminary cost estimates, ensuring that all mitigation actions are consistent with the ESS principles of the World Bank and the Government of Vietnam.

To address the risks from unexploded ordnance (UXO), the project will conduct UXO clearance prior to ground leveling or dredging at six project sites. Unexploded ordnance clearance will be carried out by authorized agencies, with public notification, and construction will not be permitted until the sites are certified safe and officially handed over. The total budget is VND 2.3 billion.

Mitigation measures in construction phase

Environmental and social impact mitigation measures are detailed for each source of impact, corresponding to each project construction phase, including: (i) general impact mitigation measures (ESCOPs); (ii) site-specific impact mitigation measures.

Measures to mitigate the Environment and Social (E&S) risks and impacts during construction phase are outlined in section 5.1.3. The Environmental and Social Management Plan (ESMP) consists of two main parts. Since most of the major impacts will occur due to construction and transportation of construction materials and waste, a range of potential negative impacts on the

physical, biological and social environment – such as noise, dust, water pollution, waste generation and social disturbances, health and safety of workers and the community – can be addressed through a set of general measures commonly applied to construction projects. In the project ESMP, these general measures have been translated into standard environmental and social specifications, namely the Environmental and Social Code of Practice (ESCOP). The ESCOPs are designed to mitigate typical construction-related impacts in all subprojects and will be included in all construction contracts. Details of the ESCOPs are provided in Section 5.1.3.1.

In addition to these general measures, each of the nine subprojects has site-specific impacts that require site-specific impact mitigation measures during construction. Sections 5.1.3.2 to 5.1.3.3 describe the site-specific measures that need to be taken during construction for each subproject 1, 2 and subproject 3 to 9, which include additional actions beyond those prescribed in the ESCOP. All site-specific construction measures will also be incorporated into the relevant construction contracts.

Mitigation measures in the operating phase

Similarly, Section 5.1.4 details the mitigation measures to be implemented during the operational phase. This section is divided into two subsections: Section 5.1.4.1 describes the mitigation measures in the operation phase of subproject 1 and 2, while Section 5.1.4.2 describes the mitigation measures in the operation phase of subprojects 3 to 9.

General mitigation measures during the operational phase of the 9 subprojects include: dust and emission control; noise management; wastewater treatment and discharge; solid waste treatment; prevention of environmental risks and incidents; mitigation of impacts and risks related to traffic (for both waterways and roads); protection against surface water quality degradation; and mitigation of adverse impacts on aquatic life; Site-specific mitigation measures in the operational phase, applicable to each subproject as described above.

Mitigation of cumulative impacts

To address the cumulative environmental and social impacts of the Thanh Hoa SFDP and regional development, mitigation measures are taken at the subproject, whole-project and inter-regional levels, tailored to each phase of the project. Integrated climate-adaptive and environmentally protective design is achieved through enhanced regional planning, permeable infrastructure, green materials, and efficient water management, while policy-level planning ensures that climate risks are systematically addressed.

During construction and operation, coordinated planning, traffic regulation, and stakeholder engagement help minimize emissions and social disruptions. Regional coordination, independent monitoring, and digital tools support the management of overlapping activities and risks. Investment in social infrastructure, livelihood support, and continuous community feedback ensures inclusive, adaptive, and long-term sustainable governance across coastal regions.

Community Engagement: Establish feedback systems to address public concerns, improve access to public services, and provide trainings on environmental protection, waterway safety, and disaster risk management.

ESMP implementation arrangement

The Thanh Hoa SFDP's Environmental and Social Management Plan (ESMP) includes roles and responsibilities for ESMP implementation, monitoring staff, environmental compliance framework, reporting organization, environmental monitoring program, capacity building program, and ESMP implementation costs. The implementation cost is estimated at USD124,491.

During the construction process, the ESMP requires the participation of a number of

stakeholders and agencies: PMU, Contractor, Construction Supervision Consultant (CSC), Independent Environmental and Social Monitoring Consultant (IESMC) and the local community. Each will have distinct roles and responsibilities.

Public Consultation and Information Dissemination

Community consultation:

Direct consultation with the communal/ward People's Committee, the community and stakeholders was carried out in November 2024 with the following main contents: General introduction about the project, project's investment works, identification of residential areas/residential groups in the project area; Introduction of basic requirements of the World Bank's Environmental - Social Framework (ESF); Current status of environmental sanitation of works in the area and existing problems; Potential environmental - social impacts and risks of the project on the local community; Solutions proposed by the community to limit environmental impacts and problems during project implementation; Contributions to the construction of project works.

Information dissemination:

The initial drafts of the ESIA, SEP, LMP, and ESCP in Vietnamese were disclosed locally in the project communes and at the Project Management Unit (PMU) office in November 2024 for community consultation. Based on the ESIA content presented during consultation meetings, local residents were informed about the Project and voiced their feedback/comments on related environmental and social issues. The final draft ESIA and RP, SEP, LMP, and ESCP in English were disclosed on the World Bank's external website in September 2025 for public consultation. The final ESIA in both Vietnamese and English is expected to be disclosed locally at project sites and on the World Bank's website in October 2025.

OVERVIEW

I.1. Project Background

I.1.1. General Information

The Sustainable Fishery Development Project in Thanh Hoa Province was approved for investment policy by the Thanh Hoa Provincial People's Council under Resolution No. 460/NQ-HĐND dated December 14, 2023, with the objective of building and upgrading infrastructure and reorganizing production in order to develop the fisheries sector of Thanh Hoa Province towards enhanced value, international integration, and climate change adaptation.

To establish an integrated system of marine fisheries infrastructure associated with supporting industries and logistics services to improve the efficiency of marine exploitation, reduce post-harvest losses; to develop brackish-water aquaculture infrastructure to improve shrimp productivity and quality while protecting the ecological environment. The project includes 2 investment components, of which:

Component 1: Investment in developing fisheries and aquaculture infrastructure, including 09 subprojects: (1) Subproject 1 - Upgrading and expansion of Hoang Truong fishing port subproject; Subproject 2-Upgrading and expansion of Lach Truong fishing port and storm shelter anchorage in Hoa Loc commune, Hau Loc district; Subproject 3- Upgrading aquaculture infrastructure in Nga Thuy, Nga Tan, and Nga Tien communes, Nga Son district; Subproject 4- Upgrading aquaculture infrastructure in Hoang Yen commune, Hoang Hoa district; Subproject 5- Upgrading aquaculture infrastructure in Hoang Phong commune, Hoang Hoa district; Subproject 6 - Upgrading aquaculture infrastructure in Hoang Luu commune, Hoang Hoa district; Subproject 7 - Upgrading aquaculture infrastructure in Hoang Chau commune, Hoang Hoa district; Subproject 8 - Upgrading aquaculture infrastructure in Da Loc commune, Hau Loc district; Subproject 9 - Upgrading aquaculture infrastructure in Quang Trung commune, Quang Xuong district.

Component 2: Project management.

I.1.2. Thanh Hoa SFDP's Consistency with Other Plans and Development Projects

The project complies with the Construction Law, Decree No. 56/2020/ND-CP dated May 25, 2020 of the Government on the management and use of official development assistance (ODA) capital and concessional loans from foreign donors, as well as Government's policies on priority areas for using official development assistance capital and concessional loans.

The project complies with Law on Public Investment No. 39/2019/QH14; Resolution No. 973/2020/UBTVQH14 July 8, 2020 of the National Assembly Standing Committee on stipulating principles, criteria and norms for allocating public investment capital from state budget capital in the 2021 period -2025;

In addition, the project complies with Directive No. 18/CT-TTg dated June 29, 2019 of the Prime Minister on strengthening management and improving the efficiency of using ODA loans and concessional foreign loans in the new context, strictly for development investment purposes and not for recurrent expenditures.

Consistency with National Fisheries Development Strategies

In Decision No. 339/QĐ TTg dated March 11, 2021 of the Prime Minister on approving the fisheries industry development strategy to 2030 and vision to 2045, it was determined: Investment project to upgrade infrastructure fisheries infrastructure, comprehensively improving the fishery infrastructure and seafood logistics service systems to meet the seafood supply chain requirements. The project includes: investment in major fishery centers, grade I and II fishing ports, storm shelters for fishing vessels, infrastructure for seed production, shrimp farming, marine seed farming, and centralized industrial aquaculture zones, offshore

aquaculture infrastructure, cold storage facilities, and the development of a fisheries database. It is prioritized for implementation during 2021-2030 period.

Consistency with Sectoral and Local Planning

The fishing ports and aquaculture infrastructure are consistent with the master plan to 2020, with an orientation to 2030, approved by the Prime Minister under Decision No. 1976/QĐ-TTg dated November 12, 2015.

In addition to the existing ports implemented in line with Thanh Hoa Province's development plan, the province is currently performing new investment projects according to the approved detailed planning, specifically: (i) Hoang Truong Fishing Port: Approved under Decision No. 779/QĐ-UBND dated February 23, 2024, of the Thanh Hoa Provincial People's Committee regarding the "Approval of the 1/500 detailed planning project for Hoang Truong Fishing Port, Hoang Hoa District, Thanh Hoa Province"; (ii) Hoa Loc Fishing Port and Lach Truong storm shelter anchorage for fishing vessels: Approved under Decision No. 5017/QĐ-UBND dated December 18, 2024, of the Thanh Hoa Provincial People's Committee regarding the "Approval of the 1/500 detailed planning project for Hoa Loc Fishing Port and Lach Truong storm shelter anchorage for fishing vessels, Hau Loc District, Thanh Hoa Province.

The remaining fishing ports and storm shelter anchorages have been proposed by the locality for implementation based on spatial arrangements in line with the province's development plan.

Consistency with the National Environmental Protection Strategy

Locations for the implementation of the Project's works/investment items are in line with the National Environmental Protection Strategy to 2030, with a vision to 2050 under Decision No. 450/QĐ-TTg dated April 13, 2022. The project's investments that do not pose a potential risk of environmental pollution, do not affect the health of the community, aim at the goal of sustainable socio-economic development, climate change adaptation and resilience through structural and non-structural works on sustainable fisheries development and response to with local climate change to minimize damage caused by natural disasters and climate change for fishermen in the project area.

Consistency with the National Climate Change Adaptation Plan

The project is to build and upgrade infrastructure at 2 fishing ports and aquaculture areas in Hoang Chau, Nga Son, Tan Tien, Van Loc, and Quang Chinh communes to develop the fisheries sector of Thanh Hoa Province and response to climate change. The project is consistent with Decision No. 1055/QĐ-TTg dated July 20, 2020, of the Prime Minister promulgating the National Climate Change Adaptation Plan for the period 2021–2030, with a vision to 2050.

I.2. LEGAL GROUND

The proposed project will fully comply with the current environmental and social laws of Vietnam and the World Bank's Environmental and Social Safety Framework (ESF). Environmental and Social Assessments are conducted for the project in accordance with the Environmental and Social Standards (ESSs) under the ESF and Vietnam's requirements.

I.2.1. Legal documents and technical basis of the Government of Vietnam

Law

- The Law on Environmental Protection No. 72/2020/QH14 dated November 17, 2020 and takes effect from January 1, 2022. This Law provides for environmental protection activities; policies, measures and resources for environmental protection; rights and obligations of organizations, households and individuals in environmental protection.
- Land Law No. 31/2024/QH15 dated 18/01/2024.
- The Law on Natural Disaster Prevention and Control No. 33/2013/QH13 dated June 19,

- 2013, stipulating natural disaster prevention and control activities, rights and obligations of agencies, organizations, households and individuals participating in natural disaster prevention and control activities, state management and resources to ensure the implementation of natural disaster prevention and control. against natural disasters.
- The Law on Water Resources No. 28/2023/QH15 dated November 27, 2023;
 - Law on Cultural Heritage No. 10/VBHN-VPQH dated 23/7/2013.
 - Labor Code No. 45/2019/QH14 dated January 20, 2019.
 - Law on Gender Equality No. 73/2006/QH11 dated June 29, 2006.
 - Law on Biodiversity No. 20/2008/QH12 dated November 13, 2008, stipulating the conservation and sustainable development of biodiversity; rights and obligations of organizations, households, and individuals in the conservation and sustainable development of biodiversity.
 - Law on Forestry No. 16/2017/QH14 dated November 15, 2017, stipulating the management, protection, development and use of forests, and the processing and trading of forest products.
 - Law on Fisheries No. 18/2017/QH14 dated November 21, 2017, stipulating fisheries activities, the rights and responsibilities of individuals and organizations engaged in fisheries, and state management of fisheries.
 - Law on Natural Resources and Environment of Sea and Island No. 82/2015/QH13 dated June 25, 2015, stipulating the integrated management of marine and island resources and environment, and the rights, obligations, and responsibilities of agencies, organizations, and individuals in general management and protection of marine and island resources and environment in Vietnam.
 - Law on Construction No. 50/2014/QH13 dated June 18, 2014, stipulating the rights, obligations, and responsibilities of agencies, organizations, individuals, and state management in construction investment activities.
 - Law on Complaints No. 02/2011/QH13 dated November 11, 2011, stipulating complaints and settlement of complaints, as well as management and monitoring of complaint settlement.
 - Amended Law on Fire Prevention and Fighting No. 55/2024/QH15 dated November 29, 2024.
 - Law on Electricity No. 28/2004/QH11 dated December 14, 2004, stipulating planning and investment in the electricity sector; electricity saving; electricity market; rights and obligations of organizations and individuals in electricity use; protection of electrical equipment and works; and electrical safety.
 - Law on Road Traffic No. 23/2008/QH12 dated November 13, 2008, stipulating road traffic rules, road structures, vehicles and road users, road traffic, and state management of road traffic.
 - Law on Inland Waterway Traffic No. 23/2004/QH11 dated June 15, 2004, stipulating inland waterway traffic activities, safety conditions for inland waterways in relation to infrastructure, people, and vehicles; and Law No. 48/2014/QH13 amending and supplementing several articles of the Law on Inland Waterway Traffic No. 23/2004/QH11.
 - Labor Code No. 45/2019/QH13 dated November 20, 2019, effective from January 1, 2021.
 - Law on Children No. 102/2016/QH13 dated April 5, 2016.
 - Law on Occupational Safety and Hygiene No. 84/2015/QH13 dated June 25, 2015.

- Law on Irrigation No. 08/2017/QH14 dated June 19, 2017, effective from July 1, 2018.

✓ **Decrees**

- Decree No. 05/2025/NĐ-CP dated January 6, 2025 of the Government amending and supplementing a number of articles of Decree No. 08/2022/NĐ-CP dated January 10, 2022 of the Government detailing the implementation of a number of articles of the Law on Environmental Protection;
- Decree No. 153/2024/NĐ-CP dated November 21, 2024 of the Government stipulating environmental protection fees for emissions;
- Decree No. 06/2024/NĐ-CP dated January 25, 2024 of the Government amending and supplementing a number of articles of Decree No. 08/2021/NĐ-CP dated January 28, 2021 of the Government on the management of inland waterway transport activities;
- Decree No. 26/2019/NĐ-CP dated March 8, 2019 of the Government detailing a number of articles and measures for implementation of the Law on Fisheries;
- Decree No. 37/2024/NĐ-CP dated April 4, 2024 of the Government amending and supplementing a number of articles of Decree No. 26/2019/NĐ-CP dated March 8, 2019 of the Government detailing a number of articles and measures for implementation of the Law on Fisheries;
- Decree No. 38/2024/NĐ-CP dated April 5, 2024 of the Government on administrative sanctions in the fisheries sector;
- Decree No. 100/2019/NĐ-CP dated December 30, 2019 of the Government on administrative sanctions in the road and railway sectors;
- Decree No. 39/2015/NĐ-CP dated April 27, 2015 of the Government on assistance policies for ethnic minority women and poor women in compliance with population policies;
- Decree No. 08/2022/NĐ-CP dated January 10, 2022 of the Government detailing the implementation of a number of articles of the Law on Environmental Protection;
- Decree No. 53/2024/NĐ-CP dated May 16, 2024 of the Government detailing the implementation of a number of articles of the Law on Water Resources;
- Decree No. 53/2020/NĐ-CP dated May 5, 2020 of the Government on environmental protection fees for wastewater;
- Decree No. 67/2018/NĐ-CP dated May 14, 2018 of the Government detailing the implementation of a number of articles of the Law on Irrigation;
- Decree No. 40/2023/NĐ-CP dated June 27, 2023 of the Government amending and supplementing a number of articles of Decree No. 67/2018/NĐ-CP dated May 14, 2018 of the Government detailing the implementation of a number of articles of the Law on Irrigation;
- Decree No. 57/2024/NĐ-CP dated May 20, 2024 of the Government on dredging activities in seaport waters and inland waterways;
- Decree No. 45/2022/NĐ-CP dated July 7, 2022 of the Government on administrative sanctions in the field of environmental protection;
- Decree No. 156/2018/NĐ-CP dated November 16, 2018 of the Government detailing the implementation of a number of articles of the Law on Forestry;
- Decree No. 102/2024/NĐ-CP dated July 30, 2024 of the Government detailing the implementation of a number of articles of the Land Law;
- Decree No. 71/2024/NĐ-CP dated June 27, 2024 of the Government on land prices;

- Decree No. 27/2024/NĐ-CP dated March 6, 2024 of the Government amending and supplementing a number of articles of Decree No. 156/2018/NĐ-CP dated November 16, 2018 of the Government detailing the implementation of a number of articles of the Law on Forestry;
- Decree No. 06/2021/NĐ-CP dated January 26, 2021 of the Government detailing a number of contents on quality management, construction, and maintenance of construction works;
- Decree No. 79/2021/NĐ-CP dated August 16, 2021 of the Government amending and supplementing a number of articles of Decree No. 97/2018/NĐ-CP dated June 30, 2018 on on-lending of ODA loans and foreign concessional loans of the Government;
- Decree No. 114/2021/NĐ-CP dated December 16, 2021 of the Government on the management and use of official development assistance (ODA) and concessional loans from foreign donors;
- Decree No. 105/2025/NĐ-CP dated May 15, 2025 of the Government detailing a number of articles and measures for implementation of the Law on Fire Prevention, Firefighting, Rescue, and Salvage;
- Decree No. 124/2020/NĐ-CP dated October 19, 2020 of the Government detailing a number of articles and measures for implementation of the Law on Complaints.

✓ **Circular**

- Circular No. 07/2025/TT-BTNMT dated February 28, 2025 of the Ministry of Natural Resources and Environment on amendments and supplements to a number of articles of Circular No. 02/2022/TT-BTNMT dated January 10, 2022 of the Ministry of Natural Resources and Environment detailing the Law on Environmental Protection;
- Circular No. 02/2022/TT-BTNMT dated January 10, 2022 of the Ministry of Natural Resources and Environment detailing the Law on Environmental Protection;
- Circular No. 01/2023/TT-BTNMT dated March 13, 2023 of the Ministry of Natural Resources and Environment promulgating 5 national technical regulations on the quality of the surrounding environment;
- Circular No. 24/2019/TT-BTNMT dated December 31, 2019 of the Ministry of Natural Resources and Environment amending and abolishing a number of legal normative documents under the promulgation authority and joint issuance of the Ministry of Natural Resources and Environment;
- Circular No. 17/2021/TT-BTNMT dated October 14, 2021 of the Ministry of Natural Resources and Environment providing regulations on monitoring the exploitation and use of water resources;
- Circular No. 36/2025/TT-BCA dated May 15, 2025 of the Ministry of Public Security providing detailed regulations on a number of articles of the Law on Fire Prevention, Firefighting and Rescue and Government Decree No. 105/2025/ND-CP dated May 15, 2025 on detailing a number of articles and implementation measures of the Law on Fire Prevention, Firefighting and Rescue;
- Circular No. 16/2021/TT-BXD dated December 20, 2021 of the Ministry of Construction promulgating QCVN 18:2021/BXD – National Technical Regulation on Safety in Construction Works;
- Circular No. 19/2016/TT-BYT dated June 30, 2016 of the Ministry of Health providing guidance on occupational hygiene management and workers' health;
- Circular No. 16/2021/TT-BXD dated December 20, 2021 of the Ministry of Construction promulgating QCVN 18:2021/BXD – National Technical Regulation on Safety in

Construction Works;

- Decision No. 3733/2002/QĐ-BYT dated October 10, 2002: Promulgating 21 occupational hygiene standards, 05 principles, and 07 occupational hygiene measurement methods.

✓ ***Applicable standards and regulations***

- QCVN 01-1:2018/BYT – National Technical Regulation on Domestic Water Quality.
- QCVN 03:2023/BTNMT – National Technical Regulation on Soil Quality.
- QCVN 05:2023/BTNMT – National Technical Regulation on Air Quality.
- QCVN 07:2009/BTNMT – National Technical Regulation on Hazardous Waste Thresholds.
- QCVN 50:2013/BTNMT – National Technical Regulation on Hazardous Thresholds for Sludge from Wastewater Treatment Process.
- QCVN 07:2016/BXD – National Technical Regulation on “Technical Infrastructure System.”
- QCVN 01:2021/BXD – National Technical Regulation on Construction Planning.
- QCVN 08:2023/BTNMT – National Technical Regulation on Surface Water Quality.
- QCVN 09:2023/BTNMT – National Technical Regulation on Groundwater Quality.
- QCVN 14:2025/BTNMT – National Technical Regulation on Domestic and Municipal Wastewater.
- QCVN 40:2025/BTNMT – National Technical Regulation on Industrial Effluent.
- QCVN 10:2023/BTNMT – National Technical Regulation on Marine Water Quality.
- QCVN 17:2011/BGTVT – National Technical Regulation on Rules for Pollution Prevention from Inland Waterway Vessels.
- QCVN 18:2021/BXD – National Technical Regulation on Safety in Construction.
- QCVN 26:2010/BTNMT – National Technical Regulation on Noise.
- QCVN 27:2010/BTNMT – National Technical Regulation on Vibration.
- QCVN 43:2017/BTNMT – National Technical Regulation on Sediment Quality.
- QCVN 02-15:2009/BNNPTNT – National Technical Regulation on Food Safety, Biosafety, and Environmental.
- QCVN 26:2024/BGTVT – National Technical Regulation on Marine Pollution Prevention Systems of Ships.
- TCVN 7222:2002 – General Environmental Requirements for central domestic (municipal) wastewater treatment plants.
- TCVN 7957:2008 – Drainage – External Networks and Facilities – Design Standard; TCVN 3890:2023 – Fire protection - Fire protection equipments for building and construction –Equipment, Installation.
- TCXDVN 13606:2023 – Water Supply – Pipeline Networks and Facilities – Design Requirements.
- Sector Standard 20TCN 33-85 – Water Supply, External Networks and Facilities – Design standard.
- TCVN 6705:2009 – Normal Solid Waste – Classification.

- TCVN 6706:2009 – Hazardous Waste – Classification.
- TCVN 9167:2012 – Hydraulic Works – Saline Soil – Saline Leaching Procedure.
- Other relevant sectoral technical regulations and standards.

✓ ***Legal documents related to the project***

- Official Letter No. 1694/TTg-QHQT dated December 10, 2021 of the Prime Minister on approving the Project Proposal for the “Sustainable Fisheries Development Project in Thanh Hoa Province,” financed by WB.
- Official Letters of the Chairman of Thanh Hoa Provincial People’s Committee: No. 19920/UBND-NN dated December 16, 2021 on assigning the preparation of the Investment Policy Proposal for the Sustainable Fisheries Development Project in Thanh Hoa Province, financed by WB; No. 4846/UBND-THKH dated April 12, 2022 on assigning the completion of the Investment Policy Proposal for the Sustainable Fisheries Development Project in Thanh Hoa Province, financed by WB.
- Official Letter No. 16240/UBND-THKH dated October 27, 2023 of Thanh Hoa Provincial People’s Committee on completing the Investment Policy Proposal for the Sustainable Fisheries Development Project in Thanh Hoa Province.
- Resolution No. 460/NQ-HĐND dated December 14, 2023 of the Thanh Hoa Provincial People’s Council on approving the Investment Policy for the “Sustainable Fisheries Development Project in Thanh Hoa Province.”
- Decision No. 779/QĐ-UBND dated February 23, 2024 of Thanh Hoa Provincial People’s Committee on approving the 1/500 detailed planning of Hoang Truong Fishing Port, Hoang Hoa District, Thanh Hoa Province.
- Decision No. 5017/QĐ-UBND dated December 18, 2024 of Thanh Hoa Provincial People’s Committee on approving the 1/500 detailed planning of Hoa Loc Fishing Port and Lach Truong storm shelter anchorage for fishing vessels, Hau Loc District, Thanh Hoa Province.

I.2.2. World Bank’s policies and guidelines on environmental and social safeguard

The project will apply the World Bank’s Environmental and Social Framework (ESF) and eight Environmental and Social Standards (ESSs), specifically from ESS1 to ESS10, excluding ESS7 and ESS9. The project will also comply with the World Bank’s operational policy on international waterways (OP/BP 7.50).

The Project’s E&S documents: Stakeholder Engagement Plan (SEP), Labour Management Plan (LMP) and Environmental and Social Commitment Plan (ESCP). The scope of application of social support institutions is discussed below.

ESS1: Assessment and Management of Environmental and Social Risks and Impacts

ESS1 requires borrowers to assess, manage and monitor relevant environmental and social risks and impacts at each stage of subprojects/projects funded by WB in order to achieve environmental and social outcomes in consistent with ESSs.

Overall, the proposed project offers several potential environmental benefits, such as positive impacts on waste and wastewater management through investments, improved regulatory compliance, reduced storm-related damage, and enhanced post-harvest loss control through effective management. However, overall, the environmental and social risks and adverse impacts caused by the project are considered significant due to the following reasons:

- Socially, key risks and impacts will include: loss of land, on-land assets, livelihoods and other properties due to temporary and permanent land acquisition and resettlement;

disruption to livelihood activities of farmers and fishermen (due to upgrading/construction and operation of fisheries infrastructure and capacity enhancement); occupational safety and health concern; gender-based violence and abuse of sexual exploitation associated with migrant workers and risks to public health and safety; farmer's lack of adaptability to new livelihood; risks from failed livelihood models negatively affecting the welfare of project beneficiaries; unequal access to project benefits among vulnerable groups such as the poor and female-headed households. Although these risks and impacts are considerable, they are manageable and can be mitigated through feasible environmental and social assessment and mitigation plans to be developed during the preparation and implementation of the project.

- The main environmental risks and impacts during project implementation include (i) safety risks associated with unexploded ordnance; (ii) environmental pollution due to the generation of dust, waste, wastewater and dredged materials; (iii) degradation of water quality and impacts on aquatic ecosystems and aquatic species ; (iv) the risk of erosion and subsidence during construction; (v) impacts on sensitive areas such as natural habitats and altered habitats; (vi) the risk of erosion, subsidence and loss of protection forests during the construction of embankments, harbors and storm shelter anchorages. Major environmental risks and impacts during operation include: (i) soil erosion and embankment subsidence; (ii) Threats to aquatic biodiversity due to the potential introduction of artificial and exotic species into local water environment; (iii) Pollution of aquatic ecosystems and water sources may occur if treated wastewater from aquaculture activities is discharged directly into the environment; (iv) air pollution and noise caused by the operation of fishing vessels and road vehicles; (v) water pollution and disturbance to aquatic life due to improper waste management. These risks and impacts are predictable, mostly at moderate level and few are significant, local, and can be managed and mitigated.
- Based on the type and location of the proposed investment project, its sensitivity and the capacity of the implementation and management agency, environmental and social risks and negative impacts are assessed as Significant.

Although Vietnam has an advanced system of legal documents, certain differences still exist between national regulations and international practices in environmental and social assessment. The application of the Environmental and Social Standards (ESSs) for the project is discussed below, while Table 0-3 presents the key differences between national environmental and social assessment requirements and those under the World Bank's Environmental and Social Standards.

ESS2: Labor and Working Conditions

ESS2 recognizes the importance of job and income creation in the pursuit of poverty reduction and inclusive economic development. The project can promote a healthy relationship between workers and management and enhance the development of project interests by treating workers in the project with equality and providing safe, secure and healthy working conditions.

With the initial project design, the project owner is expected to employ labor (mostly from local sources) to support the project management and carry out the construction/renovation/upgrade of existing fishing ports, storm shelter anchorages, hatcheries, and shrimp ponds/farms. Most fish port upgrade works are expected to be of medium scale, with a few of larger scale, involving approximately 50 workers per port—most of whom will be locally recruited. Other construction sites are expected to have around 20 workers each, also primarily recruited locally. Most risks related to disease outbreaks and other construction-related risks, including occupational health and safety (OHS), gender-based violence (GBV), and sexual exploitation and abuse (SEA) associated with construction activities such as fishing port development are considered to be of medium risk level.

To comply with the ESS2, as part of the environmental assessment process, a Labor Management Plan (LMP) has been developed. The LMP outlines the approach to managing project workers in accordance with national labor laws and the provisions of ESS2.

ESS3: Resource Efficiency and Pollution Prevention and Management

ESS3 acknowledges that economic activity, agricultural and fishery production and widespread urbanization often cause air, water and soil pollution, and that consumption of finite resources may pose threats to human health, ecosystem services, and habitats at the local, regional, and global levels. The EES3 sets out requirements to address resource efficiency and pollution prevention throughout the project lifecycle. Given the nature and scale of the proposed investment, the project is expected to consume a substantial amount of resources and construction materials, resulting in medium to significant risks and adverse impacts on human health and the environment. Risks and impacts related to generated waste/wastewater, the management of antibiotics and hazardous chemicals, potential effects on communities, and resource use efficiency will be assessed. Corresponding management and mitigation measures will be proposed during the preparation of subprojects as part of the Environmental and Social Assessment (ESA).

Dredged materials from ports, channels, fishing ports, storm shelters and water supply canals for shrimp farming areas may be contaminated with organic pollutants or naturally occurring acidity (e.g., alum). The adverse impacts and risks associated with dredging, storage, transportation and handling of dredged materials will be identified and addressed during Environmental and social assessment (ESIA) of each subproject. The Dredged Material Management Plan (DMMP) have been prepared as part of the Environmental and Social Impact Assessment (ESIA) process for the project.

If the project is identified as potentially generating significant greenhouse gas (GHG) emissions during its construction and operation phases, an estimation of the total GHG emissions from the project will be required, provided that such estimation is financially and technically feasible. The project will apply measures outlined in the World Bank Group Environmental, Health, and Safety Guidelines (WBG EHS) and Good International Industry Practice (GIIP) to ensure efficient use of raw materials and to optimize energy consumption to the extent that is technically and financially feasible..

ESS4: Community Health and Safety

ESS4 addressed the risks and impacts on health, safety and security to communities potentially affected by the project and outlines the responsibilities of the project owners in avoiding or mitigating such risks and impacts. This includes exposure and disease prevention, with particular attention to individuals who may be vulnerable due to their specific circumstances. With the existing nature and scale, the project is not expected to discharge a large amount of hazardous substances and dredging materials without proper management that could affect public health. Also, it is not expected to expose local communities to high or significant risks related to waterway and road traffic accidents, electricity use, or social disruption due to migrant labor influx. The project does not involve the construction or rehabilitation of dams, or depends on water supplies from existing dams;

Therefore, the standard measures set forth the Environmental, Health and Safety Guidelines (EHS) are considered sufficient to ensure public health and community safety during the construction and operation of the infrastructure financed by the project. The guidance covers general measures for design and operation, communication and training, and measures to address risks to physical and chemical hazards, personal protective equipment, special hazardous environments, and monitoring.

ESS5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement

ESS5 recognizes the adverse impacts of the project on local people, especially those considered vulnerable or disadvantaged. Involuntary resettlement will be avoided. In the event that involuntary resettlement is unavoidable, mitigation measures and the implementation of appropriate measures to minimize the negative impact on displaced persons (and for host communities hosting displaced persons) should be taken.

Although most of the project's infrastructure works will be carried out within the boundaries of existing facilities (such as fish ports, storm shelter anchorages, and existing canals) for renovation and upgrading, the construction/rehabilitation of infrastructure may require land acquisition for project purposes. This could lead to involuntary resettlement and affect the livelihoods and economic opportunities of local people. Land acquisition may also be required for the disposal and treatment of dredged materials resulting from the upgrading/construction of fish ports, storm shelter anchorages, and canals, potentially causing permanent loss of land and associated assets. A mitigation hierarchy and alternative analysis will be applied during the project design phase to avoid or minimize land acquisition and restrictions on land use, thereby reducing adverse socio-economic impacts on local communities, especially vulnerable groups. A Resettlement Action Plan (RAP) will be developed in compliance with the ESS5.

ESS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources

ESS6 recognizes that the protection and conservation of biodiversity and the sustainable management of living natural resources are fundamental for sustainable development. It emphasizes the importance of maintaining the core ecological functions of habitats, including forests, riparian zones, coastal and marine areas and the biodiversity that these ecological functions support. ESS6 also addresses the sustainable management of primary production and harvesting of living natural resources, and acknowledges the need to consider the livelihoods of parties affected by the project, including local people of ethnic minorities regarding their access to and use of biodiversity use or living natural resources that may be affected by the project.

Given the nature and scope, the project's activities will be carried out on existing canals and rivers [coastal areas and bays] that have been used as waterways for fishing, storm shelter anchorage, water supply and drainage for aquaculture. These rivers and canals may be considered aquatic ecosystems and habitats for aquatic species; however, they are classified as modified habitats under ESS6. All project construction activities are expected to avoid adverse impact on the protected areas/areas requiring conservation.

The relevance of ESS6 will be further discussed and assessed during preparation of ESIA/ESMP for the project. Mitigation measures will be taken to protect or minimize adverse impacts on aquatic ecosystems during construction activities (e.g., increased water turbidity, pollution due to spillage of construction materials, and oil or grease leakage).

ESS7: Ethnic Minorities

ESS7 aims to ensure that the development process encourages full respect for the human rights, dignity, aspirations, identities, cultures and natural resource-based livelihoods of ethnic minorities (definition equivalent to Indigenous Peoples). ESS7 also means that in order to avoid the adverse impacts of subprojects, or when it cannot be avoided, mitigation measures applied to mitigate and/or offset those impacts should be implemented.

For the Sustainable Fisheries Development Project in Thanh Hoa Province, no significant adverse socio-economic or cultural impacts on ethnic minorities are anticipated, as there are no ethnic minority populations residing scatteredly alongside the Kinh people in the coastal areas where the project will be implemented. Therefore, this standard is not relevant.

ESS8: Cultural Heritage

ESS8 recognizes cultural heritage as a continuum of tangible and intangible forms across past, present, and future generations. ESS8 sets out measures designed to protect cultural heritage throughout the project lifecycle. Given the nature, scale and location of the project, its implementation will not have a significant negative impact on tangible and intangible cultural heritage. However, due to potentially large scale of excavation/dredging accidents, chance finds may occur during the project construction. A chance find procedure has been included in the project's ESMP during the ESA process. The project has been screened and assessed for potential impacts on cultural heritage, and relevant mitigation measures has been incorporated into the project's ESMP and construction contracts.

ESS10: Stakeholder Engagement and Information Disclosure

ESS10 recognizes the importance of open and transparent engagement between project owners and stakeholders as an essential element of Good International Practice. Effective stakeholder engagement can improve the environmental and sustainability, increase project acceptance, and contribute significantly to the successful project design and implementation. For the Thanh Hoa SFDP Project, key stakeholders include beneficiary communities and households, project-affected persons, national-level implementing agencies (Ministry of Finance and Ministry of Agriculture and Rural Development), and local authorities in participating provinces (including Provincial People's Committees, Departments of Agriculture and Rural Development, Departments of Finance, and relevant Commune People's Committees).

During the preparation of environmental and social (E&S) documentation, project owners has been required to prepare a Stakeholder Engagement Plan (SEP) for the project. This is to ensure transparency and meaningful consultation with affected parties and interested stakeholders. Stakeholder engagement and consultation will be conducted throughout the project/subproject lifecycle. This will include discussions on the subproject design and impacts with potential beneficiary communities as well as consultation with provincial stakeholders on environmental and social issues during the project preparation phase. Special attention should be paid to identifying individuals or groups affected by the subproject who are "disadvantaged or vulnerable" during stakeholder identification and analysis. The SEP, along with other environmental and social instruments will be disclosed during the public consultation and project information disclosure process as required by the ESS10 and will be considered as a living document that needs to be updated regularly during the project implementation .

(b) Other applicable policies

This policy is triggered because certain construction activities in the project province belong to the Thanh Hoa SFDP will take place within the basins of international waterways, such as the Ma River. This international waterway are shared by countries including Laos and Vietnam.

Thanh Hoa is located in the Ma River Basin. The Ma River is an international waterway flowing from Vietnam through Laos and return to Vietnam. Vietnam is lowest downstream country among those sharing this international river. The determination of notification exemptions or required notifications is currently under discussion, and will be appropriately addressed prior to project appraisal.

The WB's policy on access to information ¹. The World Bank's Access to Information Policy aims to ensure that individuals and groups affected by the project are informed of the project's objectives and impacts, and are consulted throughout the project to ensure that their interests are represented. Environmental and social documents re disclosed locally in project areas and made publicly accessible through the World Bank's internal and external websites, providing public access to information about the Bank's projects and programs.

¹ For detailed information on the World Bank's Access to Information Policy, please visit the website. <http://www.worldbank.org/en/access-to-information>

The World Bank's policy requires that, during the ESA process, the Government must conduct meaningful consultations with stakeholders such as project-affected groups and local non-governmental organizations (NGOs) on the environmental and social aspects of the project, and take their views into account in project design. All draft environmental and social instruments must be disclosed locally in accessible locations and in formats and languages understandable to key stakeholders, and in English on the World Bank's internal and external websites prior to project appraisal.

Environmental, Health, and Safety Guidelines². Projects funded by the World Bank (WB) should also refer to the World Bank Group Environmental, Health, and Safety Guidelines (WBG EHSG), hereafter called the "EHS Guidelines," as well as the relevant World Bank Group Environmental, Social, Health, and Safety (ESHS) guidelines related to aquaculture, ports, and harbors³. The EHS Guidelines serve as both general technical references and sector-specific guidance aligned with Good International Industry Practice (GIIP). The levels and measures outlined in the Guidelines are generally accepted by the WBG and considered achievable for new construction projects at reasonable cost using existing technologies. The environmental assessment process may propose alternative implementation levels or measures (higher or lower), subject to WBG approval, which will then become specific requirements at designated project sites. The applicable EHS Guidelines for the project are reflected in the Environmental Code of Practice (ECOPs), which will be integrated into construction contracts.

1.2.3. Relevant International Treaties and Agreements

Vietnam has signed several international agreements and conventions related to environmental management, community rights, and ethnic minorities. International conventions are not always incorporated into national law. Some key agreements are listed below.

² For Environmental Safeguards Guidelines, visit website www.ifc.org/ifcext/enviro.nsf/Content/EnvironmentalGuidelines.

³ <https://www.ifc.org/wps/wcm/connect/9237a8dd-de88-4b3c-a55b-552d9361c91f/Final%2B-%2BAquaculture.pdf?MOD=AJPERES&CVID=jqes4FP>
https://www.ifc.org/wps/wcm/connect/ddfac751-6220-48e1-9f1b-465654445c18/20170201-FINAL_EHS+Guidelines+for+Ports+Harbors+and+Terminals.pdf?MOD=AJPERES&CVID=ID.CzO9

Table 0-1: International Agreements/convention/treaties Relevant to the project

Agreements/Conventions	Status	Objectives/Relevance
A. ENVIRONMENT		
United Nations Convention on Biological Diversity, 1992	Signed in May 1993	Promotes development of national strategies for the conservation and sustainable use of biological diversity. Often seen as the key document regarding sustainable development.
Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention), 1982	Joined in 1989	The conservation and sustainable utilization of wetlands, i.e. to stem progressive encroachment on and loss of wetlands now and in the future, recognizing the fundamental ecological functions of wetlands and their economic, cultural, scientific, and recreational value.
Convention on the International Trade of Endangered Species of Wild Fauna and Flora (CITES), 1973	Joined in 1994	To ensure that international trade in specimens of wild animals and plants does not threaten their survival and it accords varying degrees of protection to more than 33,000 species of animals and plants.
Cartagena Protocol on Bio-safety	Jointed in 2004	To ensure an adequate level of protection in the field of the safe transfer, handling and use of living modified organisms resulting from modern biotechnology that may have adverse effects on the conservation and sustainable use of biological diversity and risks to human health.
United Nations Convention on the Law of the Sea (UNCLOS)	Jointed in July 1994	Promotes the peaceful use of the seas and oceans, facilitates international communications, enables equitable and efficient utilization of ocean resources, protects marine environment and promotes maritime safety.
MARPOL International Convention for the Prevention of Pollution from Ships	Signed in August 1991	Achieves the complete elimination of intentional pollution of the marine environment by oil and other harmful substances and the minimization of accidental discharge of such substances.
B. SOCIAL AND CULTURAL		
UNESCO Convention Concerning the Protection of the World Cultural and Natural Heritage, 1972 (World Heritage Convention)	Joined in 1987	Promotes cooperation among nations to protect heritage from around the world that is of such outstanding universal value that its conservation is important for current and future generations.
Convention on the Elimination of All Forms of Discrimination Against Women (CEDAW) 1979	Signed in July 1980	The Convention defines what constitutes discrimination against women and mandates actions on a national level to put an end to discrimination.

Agreements/Conventions	Status	Objectives/Relevance
International Covenant on Economic, Social and Cultural Rights (ICESCR)	Joined in 1982	This could protect the rights of minority ethnic groups

Vietnam has ratified several key conventions of the International Labour Organization (ILO), as detailed in the table below. To date, Vietnam has ratified 6 out of the 8 fundamental ILO Conventions, becoming the 167th ILO Member State to ratify Convention No. 98, and the 20th country in the Asia-Pacific region to accede.

Table 0-2. Vietnam Ratification to ILO Conventions

Convention	Date	Status
C029 - Forced Labour Convention, 1930 (No. 29)	March 05, 2007	Effective
C098 - Right to Organise and Collective Bargaining Convention, 1949 (No. 98)	June, 05 2019	Effective
C100 - Equal Remuneration Convention, 1951 (No. 100)	October 07, 1997	Effective
C111 - Discrimination (Employment and Occupation) Convention, 1958 (No. 111)	October 07, 1997	Effective
C138 - Minimum Age Convention, 1973 (No. 138) Minimum age specified: 15 years	June 24, 2003	Effective
C182 - Worst Forms of Child Labour Convention, 1999 (No. 182)	December 19, 2000	Effective
C155 - Occupational Safety and Health Convention, 1981 (No. 155)	October 03, 1994	Effective

I.2.4. Analysis of the differences between the GoV's regulations and WB's ESF

The application of environmental assessment policies in Vietnam, as well as various efforts directed to policy harmonization between GoV and donors, has gradually narrowed the gap between the two systems. However, starting October 2018, the WB applies the Environment and Social Framework (ESF) to all WB-financing projects. The ESF describes the WB E&S policy to ensure that all WB's financing investment projects will meet the 10 Environmental and Social Standards (ESSs) which were designed to avoid, minimize, reduce or mitigate the adverse E&S risks and impacts of projects. These ESSs are:

- ESS1 - Assessment and Management of Environmental and Social Risks and Impacts;
- ESS2 - Labor and Working Conditions;
- ESS3 - Resource Efficiency and Pollution Prevention and Management;
- ESS4 - Community Health and Safety;
- ESS5 - Land Acquisition, Restrictions on Land Use and Involuntary Resettlement;
- ESS6 - Biodiversity Conservation and Sustainable Management of Living Natural Resources;
- ESS7 - Indigenous Peoples;
- ESS8 - Cultural Heritage;
- ESS9 - Financial Intermediaries; and

- ESS10 - Stakeholder Engagement and Information Disclosure

In late 2018 - early 2019, the WB team conducted a comprehensive assessment of Vietnam's National System Framework Assessment to identify key differences between the national legal system and the ESSs and priority needs to ensure full compliance of the ESSs. The assessment concluded that Vietnam has a comprehensive legal framework that, in many cases, meets the requirements of the 10 ESSs and key issues that are more associated with implementation and varying capacity among the central and provincial project management units. There are opportunities to accelerate implementation of recent improvements in the national legal system, especially on labor, community safety and stakeholder engagement.

Initial screening of the proposed project suggested that the E&S risks and negative impacts of the proposed activities can be classified as Moderate. In this context, it is expected that national regulations and relevant requirements under the Environmental and Social Standards (ESSs) will apply to most of the proposed investment works. Specific attention and capacity building for contractors will be necessary to ensure they can adequately address issues related to contract management, community safety, and worker protection. Table 0-3 below summarizes the key differences between the World Bank's Environmental and Social Assessment (ESA) process and the Government's Environmental Impact Assessment (EIA) requirements, along with the solutions proposed by the project.

Table 0-3: Summary of the World Bank (WB) ESA and National EIA Processes and proposed harmonized measures for the project

Environmental & Social Assessment Process	WB (stipulating in the ESF and ESSs)	Vietnam (stipulating in Decree 08/2022/NĐ-CP, Circular 02/2022/TT-BTNMT Amended and supplemented by Decree No. 05/2025/ND-CP; Circular No. 02/2022/TT-BTNMT amended and supplemented by Circular No. 07/2025/TT-BTNMT).	Measures proposed for the differences
Objectives	- The ESF consists of 10 ESSs which are designed to assess and manage the environmental and social (E&S) risks and adverse impacts of sustainable development project.	The Law on Environmental Protection and related laws, decrees, standards, and regulations on environmental protection. This law is supplemented and supported by a system of legislation and legal normative documents related to natural resource management, labor, construction management, etc. The following comparison focuses on Environmental Protection Law 2020, No. 72/2020/QH14, and its implementing guidelines (Decree 08/2022/ND, as amended and supplemented by Decree 05/2025/ND-CP, Circular 02/2022/TT-BTNMT, as amended and supplemented by Circular 07/2025/TT-BTNMT).	The World Bank's ESF is applied to projects financed by the World Bank.
ESA instrument	- Instruments developed under the ESS may include ESMF, ESIA, ESMP, regional and local ESIA; SESA, LMP for hazard or risk assessment; and ES audits. - Based on information provided by the Borrower, the World Bank assesses the E&S instruments of proposed projects expected to be financed by the Bank. - The Borrower prepares, submits, and discloses all E&S documents (including the Environmental and Social Commitment Plan (ESCP), Stakeholder Engagement Plan (SEP), LMP, ESIA/ESMP, EMDP, and RP) to the World Bank prior to appraisal.	- Environmental and social assessment instruments, such as SEA, EIA, Environmental Permits, and Environmental Registration, are determined based on Annexes I to V of Decree 08/2022/ND-CP, revised, supplemented in the Decree No.05/2025/ND-CP	- ESIA/ESMP, ESCP, SEP, EMDP, and RP meet ESSs 1, 2, 3, 4, 5, 6, 8, and 10; the EIA satisfies Vietnam's requirements.
Scope and Approval	- The Borrower conducts the ESIA for the project. The level of assessment depends on the environmental and social risks of the project.	- Typically, after consulting the local Department of Natural Resources and Environment (DONRE) or Ministry of Natural Resources and Environment (MONRE), if the project is listed as requiring an EIA, the project owner will	- The preparation of ESIA/ESMP, ESCP, SEP, EMDP, RP, LMP, and Gender Action Plan for the

Environmental & Social Assessment Process	WB (stipulating in the ESF and ESSs)	Vietnam (stipulating in Decree 08/2022/NĐ-CP, Circular 02/2022/TT-BTNMT Amended and supplemented by Decree No. 05/2025/ND-CP; Circular No. 02/2022/TT-BTNMT amended and supplemented by Circular No. 07/2025/TT-BTNMT).	Measures proposed for the differences
	- If the Borrower and the World Bank propose applying part or all of the national Socio-Economic Development Plan (SEDP), the World Bank will assess that legal framework to ensure the project meets the objectives under the ESS (Article 20, ESS1). - The Borrower manages environmental and social impacts and risks throughout the project lifecycle, from preparation to construction and operation. - The World Bank reviews E&S documents prior to project appraisal. - Mitigation measures are considered during project siting, design, construction, and operation. Management requirements apply to contractors and workers. - E&S assessments are required for major suppliers.	prepare the Environmental Impact Assessment (EIA) report. - Submit a preliminary environmental impact assessment report together with the EIA and the FS report. - There are provisions on labor management and construction management in certain legal documents, but there are no strict regulations on environmental and social requirements in bidding documents, as required by the World Bank. - There are legal regulations on mine and sediment management. Relevant authorities will supervise and inspect compliance with environmental laws (DONRE) and labor laws (Department of Home Affairs).	project will comply with the ESS. These documents will be submitted to the World Bank prior to project appraisal. - Prepare the Environmental Impact Assessment (EIA) report and submit it to the Provincial People's Committee or Ministry of Agriculture and Environment. - Requirements for environmental mitigation measures are included in the bidding documents and are monitored throughout project implementation.
Public consultation, stakeholder engagement, and GRM	- The Borrower will consult with project stakeholders and stakeholders. - The Borrower must prepare a Stakeholder Engagement Plan (SEP), including identification of stakeholders, consultation, information disclosure, and establishment and operation of a Grievance Redress Mechanism (GRM) for project workers. - ESS2 also requires the preparation of Labor Management Procedures (LMP) as well as the	Pursuant to Article 33 of Law No. 72/2020/QH14 (as stipulated in Article 26 of Decree No. 08/2022/ND-CP on consultation in environmental assessment, amended and supplemented by Clause 8, Article 1 of Decree No. 05/2025/ND-CP) as follows: When conducting an Environmental Impact Assessment (EIA), the project owner must consult the following two groups of subjects:	Consultation under ESS10. The results of the consultation will be incorporated into the ESIA/ESMP, ESCP, SEP, EMDP, RP, LMP, and Gender Action Plan.

Environmental & Social Assessment Process	WB (stipulating in the ESF and ESSs)	Vietnam (stipulating in Decree 08/2022/NĐ-CP, Circular 02/2022/TT-BTNMT Amended and supplemented by Decree No. 05/2025/ND-CP; Circular No. 02/2022/TT-BTNMT amended and supplemented by Circular No. 07/2025/TT-BTNMT).	Measures proposed for the differences
	establishment and operation of a GRM for project workers. - If ethnic minority groups are present and adversely affected, Free, Prior, and Informed Consent (FPIC) is required. - Consultations with affected persons, including vulnerable groups, are conducted throughout the project implementation. - To obtain informed consent, the Borrower provides relevant project documents in a timely manner before consultations, in a form and language that is understandable and accessible to the consulted group. - Minutes of public meetings are included in the report.	a) Communities and individuals directly affected by the project's environmental impacts, specifically: - Communities and individuals living, production, or business on land, water surface, land-water areas, or sea areas allocated for the project investment. - Communities and individuals directly affected by wastewater, air emissions, dust, noise, solid waste, or hazardous waste generated by the project. - Communities and individuals affected by subsidence, landslides, and sedimentation along rivers and coasts caused by the project. - Other communities and individuals identified through the environmental impact assessment process. b) Agencies and organizations directly related to the project investment, including: - People's Committees at the commune level and the Vietnam Fatherland Front Committees at the commune where the project is implemented. - Management boards or investors responsible for construction and operation of infrastructure in production, business, service areas, or industrial clusters where the project falls within their management boundary. - State agencies managing irrigation works for projects that discharge wastewater into or occupy irrigation works. - State agencies assigned to manage areas with environmentally sensitive elements, if any.	

Environmental & Social Assessment Process	WB (stipulating in the ESF and ESSs)	Vietnam (stipulating in Decree 08/2022/NĐ-CP, Circular 02/2022/TT-BTNMT Amended and supplemented by Decree No. 05/2025/ND-CP; Circular No. 02/2022/TT-BTNMT amended and supplemented by Circular No. 07/2025/TT-BTNMT).	Measures proposed for the differences
		- Ministry of National Defense, Ministry of Public Security, Provincial Military Command, or Provincial Police for projects related to security or national defense, if applicable. The project owner submits the EIA report to the relevant commune-level People's Committee (as listed above) along with a request for consultation. Within 15 working days from the date of receipt of the EIA report, the commune-level People's Committee must respond in writing if the project is not approved.	
Disclosure	- The World Bank requires that E&S documents be disclosed to the local authorities prior to project appraisal. - The World Bank will publicly disclose E&S documents of large, high-risk, and medium-risk projects prior to project appraisal.	After the EIA report is approved, the project owner shall carry out the necessary procedures to disclose the Environmental Management Plan (ESMP) at the W/CPC office in the project area, including community consultations so that residents are informed, can review, and monitor. (Article 26, Decree No. 08/2022/ND-CP, amended and supplemented by Clause 8, Article 1 of Decree No. 05/2025/ND-CP).	ESIA/ESMP, ESCP, SEP, EMDP, RP, LMP, and Gender Action Plan will be disclosed in accordance with the requirements of ESS10 and the Government of Vietnam.
Independent expert	For complex and high-risk projects, the Borrower may be required to hire independent ESA experts not affiliated with the project to carry out the ESA.	The project owner must establish or contract with an organization that meets the eligibility requirements under the current Enterprise Law ⁴ .	The project risk is moderate. The project will not require independent experts.
Clearance procedure	The World Bank screens and classifies the project risks, and the documents are reviewed and approved at different levels.	- The Ministry of Natural Resources and Environment (MONRE) shall assess and approve the EIA on projects prescribed in Appendix III of this Decree, except for projects subject to national defense and security secrets.	- WB's review and clearance of the ESMF, ESMP, RPF, ARAPs, EMPF, EMDP, ESCP, SEP, and LMP Gender Actionplan prior project

Environmental & Social Assessment Process	WB (stipulating in the ESF and ESSs)	Vietnam (stipulating in Decree 08/2022/NĐ-CP, Circular 02/2022/TT-BTNMT Amended and supplemented by Decree No. 05/2025/ND-CP; Circular No. 02/2022/TT-BTNMT amended and supplemented by Circular No. 07/2025/TT-BTNMT).	Measures proposed for the differences
		- The People's Committee of the province shall assess and approve EIA on projects in the province, except for projects prescribed above.	appraisal. In general, the documents will be completed for the appraisal ends. - Thanh Hoa province will approve all project's E&S documents
ESIA content	- In accordance with ESS1	The Environmental and Social Impact Assessment (ESIA) report must comply with Circular No. 02/2022/TT-BTNMT, as amended and supplemented by Circular No. 07/2025/TT-BTNMT.	The content of the ESIA must comply with both WB's and GoV's requirements.
ESIA supervision	During project implementation, the World Bank supervises the fulfillment of environmental and social commitments in accordance with the approved documents	- The Department of Natural Resources and Environment (DONRE) is assigned the task of monitoring the project's compliance with environmental regulations. - In the event of a safety or environmental incident, the regulatory authorities usually establish an inspection team (typically including all relevant parties) to assess, conclude, and require corrective actions.	Implemented in accordance with the approved ESCP, ESIA/ESMP, RP, Gender Action Plan, SEP, EMDP, and LMP; approved EIA of the project.

I.3. ESIA PREPARATION METHOD

During the preparation of the ESIA report, the consultant employed a combination of the following research methods:

Listing method: This is a commonly used method to identify the study area, sampling locations, and to determine the areas to be studied, sampling positions, identify the impacted as well as sensitive areas that may be affected by project activities during the pre-construction and construction phases.

Rapid assessment method: Experience-based emission factors and coefficients were applied to calculate fugitive emissions and dust emissions (TSP); predict noise and vibration dispersion to the nearest settlements; greenhouse gas emissions; solid and hazardous waste, etc. For air emissions, the Sutton model was applied to model dust and air emissions as a rapid assessment for project activities. In this report, pollution load coefficients were taken from World Bank guidance documents (Volume II, Sector Guidelines, Environment, World Bank, Washington DC, 8/1991) and the Emission Handbook, Non-industrial and Industrial Sources, Netherlands, and were used for rapid assessments.

Expert method: This method is implemented with the knowledge and experience of experts, related to the survey of the project implementation area, including: location, socio-economic development, people's lives, cultural and religious assets; natural environment (existing status of basic air quality conditions, water and soil); regional and local climatic characteristics such as hydrometeorology, geology, geography, linkage structures and landscapes; and ecology (animal and plant characteristics).

Matrix method: This technique is applied to predict potential impacts caused by project activities. The matrix is established based on the sources causing impacts and the potential receptors affected by the project.

Comparative method: Survey results on the natural environment and laboratory analyses are compared with national technical standards for physical environmental components to assess the baseline environmental conditions in the project area.

GIS mapping method: GIS is used in combination with existing maps (such as topographic maps) and specialized software (such as MapInfo, AutoCAD) to create comprehensive maps to support the ESIA process, including: maps of sampling locations for vegetation surveys; maps of sampling locations for air and surface water quality.

Field survey and investigation: Based on available environmental data and maps (topographic maps, existing land-use maps of communes in the project area, etc.), on-site measurements, sampling, investigations, and field surveys of natural environmental components (air, water, soil, and flora and fauna) in the project area are conducted throughout the year during both the dry and rainy seasons.

Sampling and analysis: All water, air, soil, and sediment samples collected in the field are stored and taken to laboratories for analysis. The samples are analyzed at the laboratory of KGZ Investment Joint Stock Company (certified by VIMCERTS 320), recognized by the Ministry of Natural Resources and Environment as competent to perform environmental parameter testing. Sample storage, preservation, transportation, and analysis are carried out in strict compliance with regulations.

Public consultation: Public consultation is used to help identify opportunities and risks, improve subproject design and implementation, and increase ownership and sustainability of the subproject. During the preparation of the project's ESIA report, 12 public consultations were conducted in the communes of Hoang Tien, Hoang Chau, Hoa Loc, Van Loc, Tan Tien, Nga Son, and Quang Chinh. Public consultation is specifically required by the World Bank's Environmental and Social Safeguard policies. Meaningful public feedback is considered. This

is a two-way process in which beneficiaries provide advice and input on how the proposed subproject design may affect their lives and environment, promoting dialogue between the government, community, and implementing agencies to discuss all aspects of the proposed subproject. Feedback from consultations is incorporated into the ESIA design and subproject. Affected persons include those to be resettled and those in nearby communities impacted by subproject activities, intended subproject beneficiaries, primary and secondary stakeholder groups, local mass organizations including women's associations, local, provincial, and central authorities, other donors and development agencies, and other relevant stakeholders. In particular, stakeholder engagement was conducted during the ES assessment to meet ESS10 requirements.

Data processing and statistics: All data and statistical documents obtained from local levels (commune level), as well as on-site measurements, are processed and presented in tables, figures, and charts for interpretation. This data is systematized over time and adjusted to support the identification of natural and socio-economic environmental conditions; analysis of environmental change trends in the project area. These data are essential as a basis for assessing and predicting environmental impacts during project implementation, as well as proposing mitigation measures.

I.4. LIST OF ESIA PREPARATION EXPERTS

List of experts involving in preparation of this ESIA is presented in the following table.

Table 0-4. ESIA preparation expert list

No.	Full name	Qualification	Responsible for	Signature
A	<i>Project Owner's representative: Thanh Hoa Project Management Unit of Construction Investment Works for Agriculture and Rural Development</i>			
1.	Le Anh Duc	Civil Engineer	Deputy Director	
2.	Le Chi Long	Technical Officer	Project Management Department 3	
3.	Nguyen Dang Sinh	Technical Officer	Project Management Department 3	
4.	Le Thai Son	Technical Officer	Project Management Department 3	
B	<i>Consultant: LHC Vietnam Investment and Trading Co., Ltd.</i>			
1.	Nguyen Thi Thuy	Master of Environmental Science	ESIA preparation team leader	
2.	Nguyen Thi Mai Hoa	Master of Environmental Science	Participated in ESIA preparation	
3.	Nguyen Phuc Hung	Master of Environmental Science	Participated in ESIA preparation	
4.	Vu Thi Kim Chi	Environmental Engineer	Participated in ESIA preparation	
5.	Nguyen Duy Tung	Environmental Engineer	Participated in ESIA preparation	
6.	Nguyen Thi Hai	Environmental Engineering Technology	Participated in ESIA preparation	

CHAPTER 1. PROJECT DESCRIPTION

1.1. Project information

- ✓ **Project name:** *Sustainable Fishery Development Project in Thanh Hoa province*
- ✓ **Executive agency:** *People's Committee of Thanh Hoa province*
 - + Address: 35 Le Loi Boulevard, Hac Thanh Ward, Thanh Hoa Province.
 - + Phone: (0373) 857 290
- ✓ **Project's owner:** *Thanh Hoa Project Management Unit of Construction Investment Works for Agriculture and Rural Development*
 - + Address: 06 Hac Thanh, Hac Thanh Ward, Thanh Hoa Province.
 - + Phone: (02373) 853 406

1.2. Project objectives and components

Overall objective of the Project: To construct and upgrade infrastructure and reorganize production system for the development of fisheries sector in Thanh Hoa Province, aiming to enhance value, promote international integration, and strengthen climate change adaptation.

Specific objectives of the Project: To establish an integrated marine fisheries infrastructure system, linked with supporting industries and logistics services to enhance fishing efficiency and reduce post-harvest losses; to develop brackish water aquaculture infrastructure to increase shrimp productivity and quality while protecting the ecological environment.

1.3. Project location

The project will be implemented in seven communes: Hoang Tien, Hoang Chau, Nga Son, Tan Tien, Hoa Loc, Van Loc, and Quang Chinh. Specifically:

Subprojects	Name of subproject	Location
1	Upgrading and expansion of Hoang Truong fishing port	Hoang Tien commune (formerly Hoang Truong commune, Hoang Hoa district)
2	Upgrading and expansion of Lach Truong fishing port and storm shelter area in Hoa Loc commune, Hau Loc district	Hoa Loc commune (formerly Hoa Loc commune, Hau Loc district)
3	Upgrading aquaculture area infrastructure in Nga Thuy, Nga Tan, and Nga Tien communes, Nga Son district	Nga Son commune (formerly Nga Thuy commune, Nga Son district) Tan Tien commune (formerly Nga Tan and Nga Tien communes, Nga Son district)
4	Upgrading aquaculture area infrastructure in Hoang Yen commune, Hoang Hoa district	Hoang Tien commune (formerly Hoang Yen commune, Hoang Hoa district)
5	Upgrading aquaculture area infrastructure in Hoang Phong commune, Hoang Hoa district	Hoang Chau commune (formerly Hoang Phong commune, Hoang Hoa district)
6	Upgrading aquaculture area infrastructure in Hoang Luu	Hoang Chau commune (formerly Hoang Luu commune, Hoang Hoa district)

Subprojects	Name of subproject	Location
	commune, Hoang Hoa district.	
7	Upgrading aquaculture area infrastructure in Hoang Chau commune, Hoang Hoa district.	Hoang Chau commune (formerly Hoang Chau commune, Hoang Hoa district)
8	Upgrading aquaculture area infrastructure in Da Loc commune, Hau Loc district.	Van Loc commune (formerly Da Loc commune, Hau Loc district)
9	Upgrading aquaculture area infrastructure Quang Trung commune, Quang Xuong district	Quang Chinh commune (formerly Quang Trung commune, Quang Xuong district.

The subproject locations are shown in the below figure:

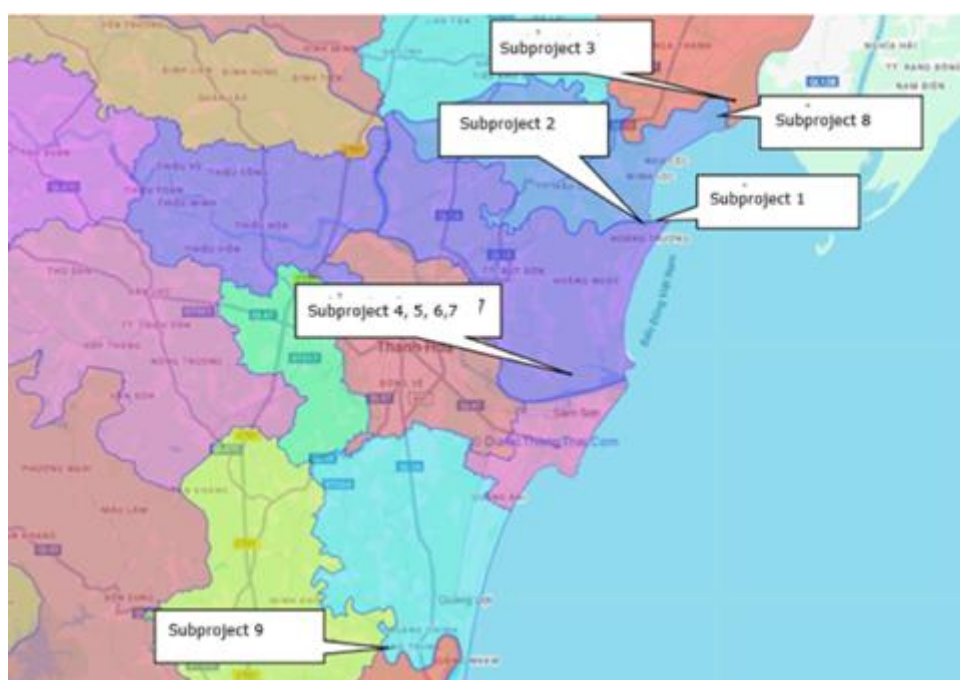
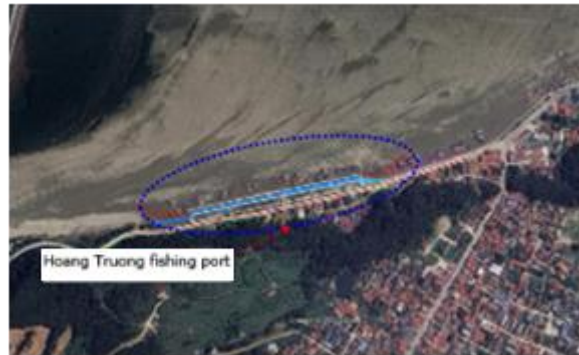
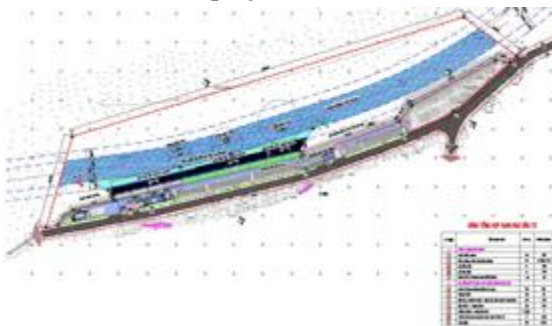
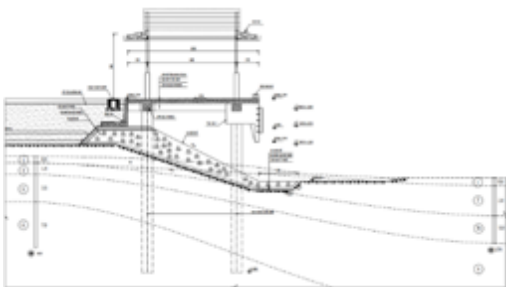


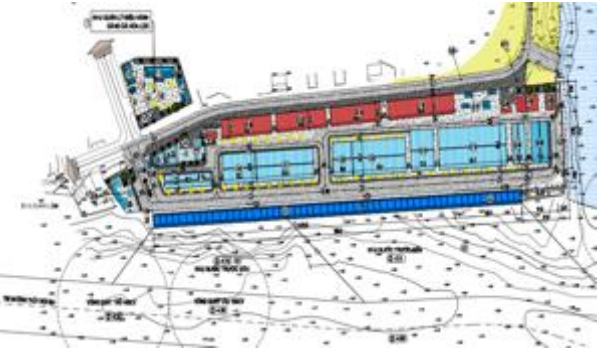
Figure 1-1: Subproject location

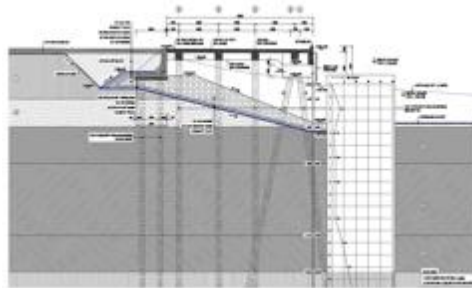
The location of each subproject is described in Table 1-1.

Table 1-1: Description of project's investments

Subproject	Description	Investment scale	Land acquisition, resettlement	Image
1	- Location: Hoang Tien commune. - Position: border Lach Truong river to the north, Linh Truong wharf to the East, Linh Truong mountain to the West and Hoang Tien commune residential area to the South. - Construction duration: 24 months - Existing environmental status: air quality in the area is quite good with no signs of pollution. Water in the Lach Truong river within the project area is contaminated with organic and nutrient substances due to fishing activities and domestic wastewater. - Current land use status: located within the existing Hoang Truong fishing port. The project does not require land acquisition or resettlement. - Existing infrastructure: there is an access concrete	- Port area: upgrade and construction of: - New docking berth: length 330 m, width 10 m, deck elevation +2.35 m, bottom elevation from -2.9 m to -4.0 m. - Substructure embankment: 330 m long. - Berth yard embankment: 520 m. - Berth yard: upgraded and reinforced, an area of 0.6 ha. - Wharf canopy system: total length 210 m, width 10.0 m; total construction area 2,100 m². - Dredging of water area in front of the port: length approx. 800 m, width 12–20 m, dredged bottom elevation from -2.9 m to -4.0 m; dredged volume 18,800 m³. - Channel layout: width 40 m, channel bottom elevation -2.9 m; channel curvature radius 150 m; turning basins diameter for fishing vessel areas: <12 m, D=40 m; for fishing vessel <17 m vessels D=55 m; for fishing vessel <24 m, D=75 m. Logistics facilities: - New administration building: 1	Acquisition area for subproject construction - Affected household: 01 - Displaced household: 0 - Total acquired area: 0.23 ha, including: 0.2ha of river/canal land (surface water of Lach Truong river), unused flat land 0.03 ha - Land acquisition for storage of dredged material (for subproject 1, 2) - Location: Van Loc commune - Affected households: 56 - Displaced household: 0 - Total acquisition area: approx. 8.03 ha, primarily covering salt	 Hoang Truong fishing port Subproject location  Layout

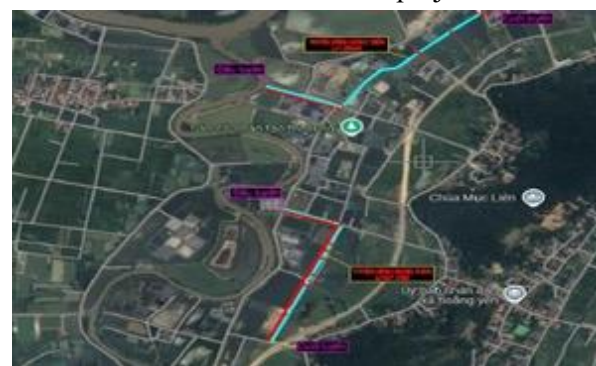
Subproject	Description	Investment scale	Land acquisition, resettlement	Image
	road (about 8m wide), electricity and water supply system and Wastewater and rainwater drainage systems discharging into the Lach Truong river. - Existing fishing port status: Several sections of the anchorage area have deteriorated with signs of sedimentation and unauthorized landfilling. The ship repair area is privately operated, outside the project boundary, but the a rail system for hauling vessels and rail-surrounding area fall within the project site. - Navigation channel: shallow and has not been dredged, making it difficult for large-capacity vessels to enter the port. Other infrastructure (wharf, roads, lighting system, shelter structures, etc.): have not yet been developed.	building with 3 storeys, total floor area of 300 m². - Parking building in administration area: 1 storey building, area of 60 m². - Port entrance gates: 3 - Guard houses: 3 - Fence around the fishing port: length approx. 650 m. - Public toilets: 2 toilets with area of 60 m² each. Technical infrastructure works: - Construction of a clean water supply system, stormwater drainage, fire protection and fighting, electricity supply, lighting systems, and greenery along transport route. - Construction of 1 WWTP with a capacity of 200 m³/day; AO technology; treated wastewater quality: column B, QCVN 11-MT:2015/BTNMT (K_q=0.9, K_f=1.1) and QCVN 14:2025/BTNMT, column B (F ≤20,000); wastewater receiving source: canal along the road to the south of Hoang Truong fishing port. - Wastewater sources: (i) production wastewater: generated from fish sorting activities, wharf washing, and ship-hold cleaning;	production land with 7.93 ha (inefficient salt production area in van loc commune) and unused flat land with 0.087 ha.	 Typical cross section of the fishing port

Subproject	Description	Investment scale	Land acquisition, resettlement	Image
		(ii) domestic wastewater: from activities of local residents the the port after preliminary treated via septic tanks.		
2	- Location: Hoa Loc commune, Thanh Hoa province. - Position: border water surface of Kenh De river to the North (existing Vich ferry terminal); coastal transport road near Kenh De dike to the east; coastal transport road near Kenh De dike to the west, Lach Truong river to the south. - Construction duration: 24 months - Environmental status: Air quality in the area is quite good, with no signs of pollution. The water quality of Lach Truong river in the project area is heavily contaminated with chloride. This is likely caused by washing fishing vessel, salting of fish, leading to salt leakage into the environment. - Current land use: Located	Port area: - Construction of new berth: length 60 m, width 12 m, top elevation of berth +2.4 m, bottom elevation from -3.6 m to -4.1 m. - Substructure: length 60 m. - Construction of a connecting embankment between the docking berth and the outlet of Lach Truong dock basin: length L = 110.0m. - Reinforcement of the old docking yard: L = 270 m, width B = 10 m. - Wharf canopy syste: length approx 240 m, width 10 m. - Repair and upgrade of internal traffic roads with area 3,260 m², width 10 m. - Construction of new internal port roads with area 1,295.5 m², width 10 m. - Dredging of the water area in front of the port: width B = 40–50 m, length 330 m (the dredged area in front of the port does not affect the Lach Truong inland waterway route). Dredged bottom elevation: from -3.6	Acquisition area for subproject construction - Affected household: 0 - Displaced household: 0 - Total acquired area: approx 0.072 ha, specialized water surface land (Lach Truong River).	 Subproject location  Subproject layout

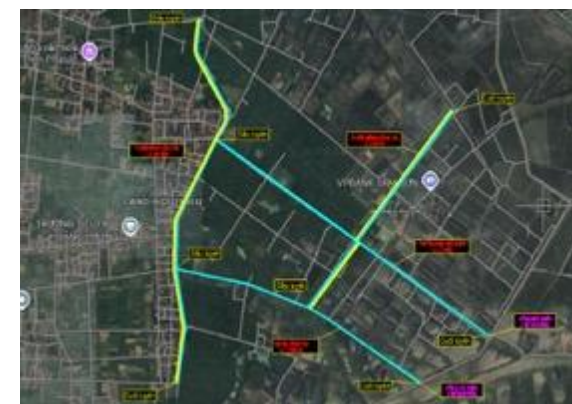
Subproject	Description	Investment scale	Land acquisition, resettlement	Image
	within the existing Lach Truong fishing port; no land acquisition and resettlement is required. - Existing infrastructure: The wharf surface is severely deteriorated, with peeling and uneven patches, leading to the frequent formation of stagnant water puddles on both the wharf and road surfaces. Internal transport roads in the port area are structured of cement concrete, with a width of 23–28 m and length of about 400 m; These roads are damaged, subsiding, and frequently experience water accumulation. Lighting system has been deteriorated. - Existing status of Lach Truong storm shelter anchorage: Divided into three zones (zone 1 for 250–400 CV vessels, zone 2 for 90–250 CV vessels, zone 3 for <90 CV vessels). The anchorage area has experienced significant sedimentation, especially at the entrance to the dock	m to -4.1 m. Estimated dredging volume: 43,380 m³. Dredging of the storm shelter area: dredging the navigation channel and storm shelter anchorage for Lach Truong fishing vessels: length approximately L = 1,150 m; bottom width B = 89–96 m. Dredged bottom elevation from -3.6 m to -4.1 m. Estimated dredged volume: 321,620 m³. Logistics facilities: - Construction of 01 public toilet, area 60 m². Technical infrastructure works: - Construction of a clean water supply system, electricity supply system, and fire-fighting system. - Construction of 01 WWTP with capacity 200 m³/day. AO technology; treated wastewater quality: column B, QCVN 11-MT:2015/BTNMT ($K_q=0.9$, $K_f=1.1$) and QCVN 14:2025/BTNMT, column B ($F \leq 20,000$). Receiving water body: De Canal; wastewater sources: (i) production wastewater: generated from fish sorting, wharf washing, and ship-hold cleaning, etc.; (ii) domestic wastewater: from activities of local residents the the port after preliminary		 Typical cross section

Subproject	Description	Investment scale	Land acquisition, resettlement	Image
	basin. During low tide, the water level drops to approximately elevation –1.0 meters, making it accessible only to small-capacity vessels under 50 CV.	treated via septic tanks.		

3	- Construction location: 02 communes, Nga Son and Tan Tien - Construction duration: 24 months - Existing environmental conditions: Air quality in the area is quite good, with no signs of pollution. The water in the project canal area is contaminated with organic matter. Therefore, the pollution status of the canal should be paid attention by contractor during construction. - Existing infrastructure: - Phu Son 2 canal: Start point is accessed by the main road of Tan Tien commune, about 8.5m wide; along the canal, there is a 4m-wide concrete road; the end point is accessed by a 4.5m-wide dyke road. The existing road surface condition is quite good; there is no lighting or drainage system along the road. - Bao Trieu canal: The starting point of the canal is accessed by a 4m-wide concrete road; the end point	Phu Son 2 canal area: - Dredging of Phu Son 2 canal with a length of 1,436.34 m. - Constructing an operation management road along the canal with a length of 809.89 m, concrete structure with width 5.0 m. Reinforce the canal embankment along Phu Son canal with a length of 809.89 m using precast concrete elements. - Dredging the main drainage canal for the aquaculture area: trapezoidal cross-section (12×2.5) m, canal slope $m = 2.0$. - Constructing 4 new headwater sluices with reinforced concrete (RC) structure. Bao Trieu canal area (Ong Ty canal): - Dredging Bao Trieu canal with a total length of 2,581.70 m. - Section 1: 1,356.10 m – cross-section (6×2.25) m, canal slope $m = 1.5$. - Section 2: 1,225.60 m – cross-section (8×2.35) m, canal slope $m = 1.5$. - Constructing an operation management road from K1+356.10 to K2+525.6: length 1,169.5 m, concrete structure with width 6.5 m. - Constructing 6 new headwater sluices with reinforced concrete (RC)	- Affected households: 23 - Displaced household: 0 - Total acquired area: 1.06 ha, including: 0.39 ha annual crop land, 0.16 ha aquaculture land, 0.28 ha unused land, 0.22 ha irrigation land	 Subproject location

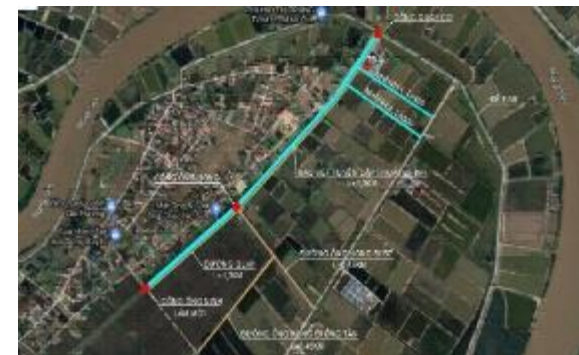
Subproject	Description	Investment scale	Land acquisition, resettlement	Image
	of the canal is accessed by a 4.5m-wide dyke road. The existing road surface condition is quite good; there is no lighting or drainage system along the road.	structure, 2 new RC bridges across the canal, and 1 new regulation cluster combined with a bridge across the canal (reinforcement concrete structure). Dredging volume of subproject 3 is 94 m ³ .		
4	- Location: Hoang Tien commune - Construction duration: 24 months - Environmental status: Air quality in the area is quite good, with no signs of pollution. The water in the project canal area is contaminated with organic matter. Therefore, the pollution status of the canal should be paid attention by contractor during construction. - Infrastructure status: The area has a concrete dyke road with 4 m width, providing access to the subproject area. The dyke road is currently deteriorated, with a lighting system along the route.	Zone I: - Construct new Son Trang 1 culvert to replace the old one. - Construct new Son Trang 2 culvert to replace the old one. - Construct a dike with a length of 1,560.64 m, dyke base width 5.0 m, crest elevation +3.6 m. Construct 03 new box culverts under the dyke. - Upgrade Son Trang 1 canal with a length of 535.0 m including: dredging 535 m with a width of 3 m; construct operation and management road of 535 m long, concrete structure with a width 4 m; construct 4 new box culverts. - Upgrade Son Trang 2 canal with a length of 1,366 m including: dredging entire 1,366 m, width of 3 m; construct an operation and management road of 1,366 m, concrete structure with width 4 m; construct 4 new box culverts, 01	- Affected households: 19 - Displaced household: 0 - Total acquired land area: about 2.36 ha, mainly including 1.80 ha of aquaculture land, 0.00055 ha of transport land, 0.55 ha of annual crop land, and 0.0014 ha of unused land.	 Zone 1 under the subproject 

Subproject	Description	Investment scale	Land acquisition, resettlement	Image
		regulating cluster, and 02 RC culverts across the road. Zone II: - Upgrade Hung Tien canal with a length of 871.63 m including: dredging entire 871.63 m, width of 3 m; construct an operation and management road of 148.12 m long, concrete structure with width 4 m; construct 03 new box culverts and 02 RC culverts crossing the road. - Upgrade and reinforce Nghia Thuc canal with a length of 827.16 m: dredging entire 827.16 m, width of 2 m; construct an operation and management road of 827.16 m, concrete structure with width 4.0 m; construct 06 new box culverts and 03 RC culverts crossing the road. - Dredging volume of subproject 4: 12,219 m³.		

Subproject	Description	Investment scale	Land acquisition, resettlement	Image
5	- Location: Hoang Chau Commune - Construction duration: 24 months - Current environmental conditions: The water in the project canal area is contaminated with organic matter. Therefore, the pollution status of the canal should be paid attention by contractor during construction. - Existing infrastructure conditions: The area has a concrete road about 4 m wide, providing accessing to the subproject area. The road surface is still in fairly good condition; however, there is no lighting or drainage system along the road.	- Upgrading Dong Coi canal with a length of 1,310.20 m, including: dredging entire 1,310.2 m canal with a width of 3 m; constructing operation and management roads along both banks (left bank: 456.57 m and right bank: 853.63 m) with a roadbed width of 4.0 m; constructing 4 new box culverts and 2 new RC bridges across the canal. - Upgrading Hoi Trieu canal with a length of 1,714.57 m, including: dredging entire 1,714.57 m canal with a width of 5 m; compacted earth embankment banks, using the existing concrete road as the operation and management road; constructing 1 new regulation cluster on the canal with RC box culvert structure. - Upgrading Tay canal with a length of 1,339.0 m, including: dredging the entire 1,339 m canal with a width of 5 m; the first section of 452 m is reinforced with precast concrete slabs; constructing 4 new box culverts, 3 new RC culverts across the road, and 1 stairway. -The dredging volume of subproject 5 is: 10,829 m³.	- Affected households: 54 - Displaced household: 0 - Total acquired land area: about 1.77 ha, mainly irrigation land (river/stream land) with 0.56 ha, 0.52 ha of annual cropland, 0.43 ha of transportation land, and 0.26 ha aquaculture land.	 Zone II under the subproject

Subproject	Description	Investment scale	Land acquisition, resettlement	Image
6	- Location: Hoang Chau Commune - Construction duration: 24 months - Current environmental status: Air quality in the area is quite good, with no signs of pollution. The water in the project canal area is contaminated with organic matter. Therefore, the pollution status of the canal should be paid attention by contractor during construction. - Existing infrastructure status: The area has a concrete road of 2 m width, providing access to the subproject area. The road has no lighting or drainage system.	- Upgrading Canal 1 with a length of 819.29 m: dredging the entire canal, installation of settlement joints and reinforced concrete tie beams along the route. The canal bank will developed into an operation and management road, with a roadbed width of 4.0 m and a concrete pavement width of 3.0 m. Construction of 11 new culverts along the canal. - Upgrading Canal 2 with a length of 213.38 m: dredging to complete the canal cross-section and repairing/upgrading existing structures along the canal. - Upgrading operation and management road - Route No. 01 from the Tay dyke of the Cung River to Con Voi culvert, with a length of $L = 2,008.47$ m, concrete pavement, and a roadbed width of 4.0 m. - Estimated dredging volume of Subproject 6 is: $4,142 \text{ m}^3$.	- Affected household: 52 - Displaced household: 0 - Total acquired land area: about 1.9 ha, mainly including annual cropland with 1.83 ha, transportation land with 0.0054 ha, and irrigation land with 0.022 ha	 Subproject location

Subproject	Description	Investment scale	Land acquisition, resettlement	Image
7	- Location: Hoang Chau Commune - Construction duration: 24 months - Current environmental status: Air quality in the area is quite good, with no signs of pollution. The water in the project canal area is contaminated with organic matter. Therefore, the pollution status of the canal should be paid attention by contractor during construction. - Existing infrastructure status: The area has a concrete dyke road of 5.5 m width, providing access to the subproject area. The existing road surface of the dyke is still in fairly good condition, but it has no no lighting or drainage system.	- Upgrade Song Khe Canal with a length of $L = 1,200$ m: including dredging entire 1,200 m canal with a width of 4.5 m. Reinforce the canal banks and construct an operation management road of 1,200 m with a roadbed width of 4.0 m. - Upgrade Branch Canal 1 with a length of 487.00 m; including dredging to complete the canal cross-section, repairing and upgrading structures on the canal. The canal bank is developed into the operation management road with a length of $L = 890.0$ m, concrete surface, and a roadbed width of 4 m. - Branch Canal 2: construct an operation management road on the right bank with a length of $L = 299.0$ m, concrete surface, and a roadbed width of 4 m. - Branch Canal 3: construct an operation management road on the right bank with a length of $L = 253.0$ m, concrete surface, and a roadbed width of 4 m. -The dredging volume of Subproject 7 is: $8,931 \text{ m}^3$.	- Affected households: 46 - Displaced household: 0 - Total land acquisition area: 1.06 ha, mainly including 0.43 ha of annual cropland, 0.24 ha of transportation land, 0.19 ha of aquaculture land, and 0.20 ha of irrigation land.	 Subproject location

Subproject	Description	Investment scale	Land acquisition, resettlement	Image
8	- Location: Van Loc Commune - Construction duration: 24 months - Current environmental status: Air quality in the area is quite good, with no signs of pollution. Water in the project canal area is not contaminated with organic matter. - Existing infrastructure: The area has a concrete dike road with a width of 5.5 m, proving access to the subproject area, a concrete road of 4 m width, running along the upgraded canal, and an earth road of about 3 m width, providing access to the start point of the subproject (Ong Ninh sluice). The dike road surface has deteriorated, while the road along the canal is still in relatively good condition. There are no lighting or drainage systems along these roads.	- Construction of a new Ong Ninh culvert consisting of 2 reinforced concrete box gates (1.3 x 1.75) m, culvert body is 6.5 m long and of reinforced concrete structure. - Dredging and completion of the main irrigation and drainage canal with a length of 1,256.13 m: dredging entire 1,256.13 m canal with a width of 9 m. Construction of an operation management road with a length of 767.23 m and a concrete pavement with a width of 5.0 m. Reinforcement of 59.76 m-long canal banks with reinforced concrete retaining walls, bamboo piling, and settlement joints. Upgrade of 9 culverts (5 headwater culverts, 4 road culverts), reinforced concrete structure. -Repair and improvement of 02 internal roads in the aquaculture area: Road No. 1 length L = 467.79 m; Road No. 2 length L = 458.57 m. Concrete surface, roadbed width of 5 m, hilly soil foundation, crushed stone type II bedding. -The dredging volume of Subproject 8 is: 8,731 m³.	- Affected household: 12 - Displaced household: 0 - Current land use status: The subproject construction area is about 1.13 ha, mainly including 0.83 ha of transportation land and 0.3 ha of aquaculture land	 Subproject location

Subproject	Description	Investment scale	Land acquisition, resettlement	Image
9	- Location: Quang Chinh Commune - Construction period: 24 months - Current environmental status: Air quality in the area is quite good, with no signs of pollution. Water in the project canal area is not contaminated with organic matter. - Existing infrastructure: At the start point of the subproject, there is a concrete road with 4.5 m wide, in relatively good condition. At the end point, there is a concrete dike road with about 5.5 m wide, but its surface has deteriorated. There are no lighting or drainage systems along these roads.	- Upgrading the main canal from Ong Thuoc culvert to Ong Vanh culvert with a total length of about 1,273 m, including: - Section from K0–K0+373 (length of 373 m), structured of reinforced concrete. - Dredging the canal, constructing 900 m- long operation management road, concrete pavement with a roadbed width of 5 m. Along the route, constructing 2 new canal bridges, 2 drainage headwater culverts, and 07 water intake/drainage culverts for aquaculture ponds. - Construction of 02 new culverts, including: Ong Thuoc culvert with a dimensions of (1.6x1.8) m, reinforced concrete structure; Ong Vanh Culvert with a dimensions of 2x(1.4x1.8) m, reinforced concrete structure. Both culverts will have foundation reinforcement using either reinforced concrete piles or bamboo piles, and will be equipped with Larsen sheet piles to prevent erosion. - The dredging volume of the subproject is: 1,240 m³.	- Affected household: 3 - Displaced household: 0 - Total land acquisition area: 0.43 ha, mainly including 0.35 ha of irrigation land and 0.08 ha of aquaculture land	 Subproject location

1.4. List of machinery and equipment

List of the main machinery and equipment to be mobilized for construction work is presented in the table below. Depending on the nature of the work, the contractor's capacity, and weather conditions, the equipment used at each subproject may vary.

Table 1-2: List of machinery and equipment for Subproject 1

No.	Machinery/equipment	Quantity (pcs)	No.	Machinery/equipment	Quantity (pcs)
1	Pneumatic pile hammer 3 m ³ /h	4	24	Tugboat 150 HP	2
2	Vibratory hammer 170 kW	2	25	Concrete batching plant capacity 50 m ³ /h	1
3	Crane 10 tons	1	26	Canoes 23 CV	2
4	Crane 16 tons	1	27	Sand pump with diesel engine 126 CV	2
6	Crane 25 tons	1	28	Water pump with diesel engine 30 CV	2
7	Crane 5 tons	2	29	Excavator 1.25 m ³	3
8	Crane 50 tons	1	30	Dragline excavator 1.6 m ³	2
9	Floating crane 30 tons	1	31	Steel-wheel roller 16 tons	2
10	Concrete pump 50 m ³ /h	3	32	Barge 250T	1
11	Cutting and bending machine 5 kW	4	33	Tugboat 360 HP	1
12	Poker vibrator 1.5 kW	4	34	Boat (5T) with pump installation	2
13	Welding machine 23 kW	1	35	Plate compactor 1 kW	2
14	Drilling machine 80 kNm – 125 kNm	1	36	Steel-wheel roller 10 tons	1
15	Drilling machine >200 kNm – 300 kNm	1	37	Vibratory roller 25 tons	1
16	Air compressor 360 m ³ /h	1	38	Air compressor 600 m ³ /h	1
17	Bulldozer 110 HP	5	39	Spreader 50–60 m ³ /h	1
18	Pipe bending machine 2.8 kW	2	40	Concrete mixer 250 L	2
19	Wheel loader 1.25 m ³	3	41	Watering truck 5 m ³	1
20	Concrete mixer truck 6 m ³	2	42	Boat (5T) with pump installation	1
21	Steel pontoon 60T	1	43	Diving station	1
22	Barge 200T	1	44	Crane 6T	1
23	Barge 400T	1	45	Handheld thermal welding machine	1
			46	Heating machine D315	1

(Source: Cost estimate for the project basic design, 2024)

Table 1-3: List of machinery and equipment for subproject

No.	Machinery/equipment	Quantity (item)	No.	Machinery/equipment	Quantity (item)
1	Crane 16T	3	32	Diving station	1
2	Crane 25T	3	33	Wirtgen C100 Cold milling machine	1
3	Crane 6T	2	34	Concrete drill 0.62 kW	1

No.	Machinery/equipment	Quantity (item)	No.	Machinery/equipment	Quantity (item)
4	Canoes 150 CV	1	35	Concrete drill 1.5 kW	1
5	Gantry crane 60T	2	36	Diesel air compressor 420 m ³ /h	1
6	Concrete pump 50 m ³ /h	3	37	Fuel truck 2.5T	1
7	Cutting & bending machine 5 kW	4	38	Dump truck 7T	5
8	Edge compactor 1 kW	5	39	Air compressor 600 m ³ /h	1
9	Poker vibrator 1.5 kW	5	40	Steel-wheel roller 10T	1
10	Welding machine 23 kW	1	41	Vibratory roller 25T	1
11	Air compressor 360 m ³ /h	1	42	Spreader 50–60 m ³ /h	1
12	Bulldozer 110 HP	4	43	Crane 10T	1
13	Wheel loader 1.25 m ³	1	44	AC welding transformer – capacity: 23 kW	3
14	Concrete mixer truck 6 m ³	3	45	Tower crane – lifting capacity: 25T	1
15	Dump truck 10T	1	46	Rebar cutting & bending machine – capacity: 5 kW	1
16	Cargo truck 12T	2	47	Concrete vibrator, plate type – capacity: 1.0 kW	1
17	Steel pontoon 60T	1	48	Concrete vibrator, poker type – capacity: 1.5 kW	1
18	Barge 200T	1	49	Hand compactor – weight: 70 kg	1
19	Barge 250T	1	50	Crawler excavator, single bucket – bucket capacity: 0.40 m ³	1
20	Barge 400T	1	51	Concrete mixer – capacity: 250 liters	1
21	Pile-driving vessel with 3.5T hammer	1	52	Mortar mixer – capacity: 150 liters	1
22	Tugboat 150 CV	1	53	Hoist – lifting capacity: 0.8T	1
23	Concrete batching plant 50 m ³ /h	1	54	Cage hoist – lifting capacity: 3T	1
24	Motorboat 23 CV	2	55	Pneumatic pile hammer (compressor not included) – air consumption: 3 m ³ /min	1
25	Floating crane 30T	2	56	Water pump, diesel engine – power: 5 HP	2
26	Vibratory roller 18T	1	57	Concrete cutter – power: 12 HP (MCD 218)	1
27	Generator 62.5 kVA	1	58	Plastic pipe welding machine: Heating unit D315 mm	1
28	Dredger 1200 CV (or equivalent)	1	59	Stone & tile cutter 1.7 kW	1
29	Tugboat 150 CV	1	60	Handheld concrete drill – capacity: 0.62 kW	1
30	Tugboat 360 CV	1	61	Concrete cutter – power: 12 CV (MCD 218)	1

No.	Machinery/equipment	Quantity (item)	No.	Machinery/equipment	Quantity (item)
31	Electric winch 3T	2			

(Source: Cost estimate for the project basic design, 2024)

Table 1-4: List of machinery and equipment for subproject 3

No.	Machinery/equipment	Quantity (item)	No.	Machinery/equipment	Quantity (item)
1	AC welding transformer –capacity: 23 kW	3	27	Mortar mixer – capacity: 150 li	1
2	Pneumatic tire crane – lifting capacity: 16T	1	28	Bulldozer – Capacity: 110 CV	3
3	Pneumatic tire crane – lifting capacity: 40T	1	29	Hoist (cage type) – lifting capacity: 3T	1
4	Crawler crane – lifting capacity: 10T	30	32	Dump truck – payload: 2.5T	1
5	Crawler crane - lifting capacity: 16T	1	33	Potoon	1
6	Truck-mounted crane-lifting capacity: 20T	2	34	Construction barge – capacity: 200T	1
7	Tower crane - lifting capacity: 25T	3	35	Construction barge – capacity: 400T	1
9	Paint melting furnace (YHK 3A) Includes adhesive heating chamber	1	36	Tugboat and marine support vessel (mooring, fuel supply, etc.) – Capacity: 150 CV	1
10	Concrete cuter – capacity: 5 kW	3	37	Line marking painting equipment YHK 10A	1
11	Rebar cutting and bending machine: 5 kW	1	38	Electric winch – capacity: 3T	1
12	Concrete vibrator (plate type)– weight: 70 kg	1	39	Electric winch – capacity: 7.5T	1
13	Concrete vibrator, immersion type: capacity 1.5 kW	1	40	Crawler crane – lifting capacity: 25T	1
14	Handheld soil compactor, Weight: 70 kg	1	41	Rail mounted pile driver – hammer weight: 1.2T	1
15	Single-bucket crawler excavator, Bucket capacity: 0.50 m ³	1	42	Hydraulic press (KGK-130C4) – pressing force: 130T	1
16	Single-bucket crawler excavator, Bucket capacity: 1.25 m ³	1	43	Self-propelled pneumatic tire roller: 16T	1
17	Electric welding machine, 50kW	1	44	Diesel air compressor – capacity: 360 m ³ /h	1
18	Gas welding machine, Capacity: 1000l/h	1	45	Diesel water pump – Capacity: 10.0 CV	1
19	Vertical drilling machine Capacity: 4.5 kW	1	46	1.25 m ³ Excavator with hydraulic hammer/grapple	1
21	Self-propelled steel-wheel roller, Weight: 10 tons	1	47	Dump truck – payload: 10T	1

No.	Machinery/equipment	Quantity (item)	No.	Machinery/equipment	Quantity (item)
22	Self-propelled steel-wheel roller, Weight: 8.5-9 tons	1	48	Water spraying truck – capacity: 5 m ³	1
23	Self-propelled vibratory roller, Weight: 25 tons	1	49	Crawler crane – lifting capacity: 16T	2
24	Diesel air compressor, Output: 240 m ³ /h	1			
25	Crushed stone base spreader, Output: 50–60 m ³ /h	1			
26	Concrete mixer, Capacity: 250	1			

(Source: Cost estimate for the project basic design, 2024)

Table 1-5: List of machinery and equipment for subproject 4 to subproject 9

No.	Machinery/equipment	Quantity (item)	No.	Machinery/equipment	Quantity (item)
1	Bulldozer - capacity: 110 CV	2	14	Water pump	2
2	Excavator – bucket capacity: 1.25 m ³	2	15	Water tanker truck	1
3	Concrete mixer – capacity: 250.0 liters	3	16	Trucks	4
4	Concrete compactor, tamping – capacity: 1.5 kW	4	17	Drilling machines	4
5	Mortar mixer – capacity: 80.0 liters	1			
6	Rebar cutting-bending machine – capacity: 5.0 kW	1			
7	Excavator – bucket capacity: 0.80 m ³	2			
8	Hand-held soil compactor – weight: 80 kg	8			
9	Concrete compactor, plate – capacity: 1.0 kW	1			

(Source: Cost estimate for the project basic design, 2024)

1.5. Demand for construction materials, personnel, and temporary storage yards

1.5.1. Material demand and supply sources

✓ Material demands

According to the project's feasibility study report, the demand for construction input materials is estimated as follows:

Table 1-6: Volume of main construction materials for the project

No.	Name of material	Unit	Volume (m3)	Specific volume	Mass (ton)
I	Subproject 1				
-	Sand	m ³	71,475.69	1.45 ton/m ³	103,640
-	Stone	m ³	19,767.91	1.5-1.55 ton/m ³	29,922
-	Steel wire	kg	7,517.21	0.001 ton/kg	2,641

-	Steel (various types)	Ton	1,111,282.64	0.001 ton/kg	6,767
-	Cement PCB40	kg	2,641,214.68	0.001 ton/kg	13,536
	TOTAL				1,247,493
II	Subproject 2				
-	Stone	m ³	18,660.47	1.5-1.55 ton/m ³	28,117
-	Sand	m ³	7,477.86	1.45 ton/m ³	10,843
-	Steel wire	kg	2,610.89	0.001 ton/kg	3
-	Steel (various types)	Kg	299,716.13	0.001 ton/kg	300
-	Cement (various types)	kg	1,112,081.99	0.001 ton/kg	1,112
	TOTAL				10,375
III	Subproject 3				
-	Sand	m ³	6,521.92	1.5-1.55 ton/m ³	9,922
-	Stone	m ³	1661.674	1.45 ton/m ³	2,410
-	Steel (various types)	kg	68,628.47	0.001 ton/kg	69
-	Cement of all kinds	kg	903,343.26	1000 kg/ton	903
	TOTAL				13,304
IV	Subproject 4				
-	Crushed stone aggregate	m ³	2,948.61	1.5 ton/m ³	4,423
-	Concrete (various types)	m ³	939.45	2.23 ton/m ³	2,09
-	Steel (various types)	Ton	33.69	-	34
	TOTAL				6,552
V	Subproject 5				
-	Crushed stone aggregate	m ³	1,315.14	1.5 ton/m ³	1,973
-	Concrete (various types)	m ³	935.18	2.23 ton/m ³	2,085
-	Steel (various types)	Ton	65.06	-	65
	TOTAL				4,123
VI	Subproject 6				
-	Crushed stone aggregate	m ³	1,955.12	1.5 ton/m ³	2,933
-	Concrete (various types)	m ³	2,149.52	2.23 ton/m ³	4,793
-	Steel (various types)	Ton	35.73	-	36
	TOTAL				7,762
VII	Subproject 7				
-	Crushed stone aggregate	m ³	1,558.16	1.5 ton/m ³	2,337
-	Rubble stones, tightly packed	m ³	15.19	1.5 ton/m ³	23
-	Concrete (various types)	m ³	9,581.21	2.23 ton/m ³	21,366
-	Steel (various types)	Ton	119.10	-	119
	TOTAL				23,845
VIII	Subproject 8				
-	Crushed stone aggregate	m ³	1,196.34	1.5 ton/m ³	1,795
-	Rubble stones, tightly packed	m ³	104.51	1.5 ton/m ³	157
-	Concrete (various types)	m ³	2,669.58	2.23 ton/m ³	5,953
-	Steel (various types)	Ton	10.24	-	10
	TOTAL				18,282
IX	Subproject 9				
-	Crushed stone aggregate	m ³	144.87	1.5 ton/m ³	217
-	Rubble stones, tightly packed	m ³	530.75	1.5 ton/m ³	796
-	Concrete (various types)	m ³	2,646.05	2.23 ton/m ³	5,900
-	Steel (various types)	Ton	79.58	-	80
	TOTAL				6,993

(Source: Cost estimate for the project basic design, 2024)

✓ **Sources of construction materials and main transportation routes**

- Materials such as sand, soil, stone, and gravel will be purchased from suppliers in the local area, districts within the Province/City, or neighboring Provinces/Cities.
- Steel and cement: Steel will be purchased from suppliers within the project commune in the Province or from neighboring Provinces/Cities.

The project (all 9 subprojects) does not include any component involving large-scale extraction of sand, stone, or soil; therefore, no new quarries are required. No quarry serves as an exclusive source for the project. All materials will be quality-verified and priced according to official announcements issued Department of Construction of each Province where the project is located. This ensure that all materials are sourced from legally licensed suppliers. A summary of the material sources for the project is presented in the table below:

No.	Materials	Material source/quarry	Transportation distance
I	Materials for subprojects in Hoang Hoa district (Subprojects 1, 4, 5, 6, 7)		
1	Sand	Management unit: Le Hoang Development Investment JSC (transferred from Tam Duc Co., Ltd.) Address: Mine 59, Ham Rong License No.: 39 dated 19/04/2019 (valid until 14/08/2027) Exploitation reserve: 969,183.0 m ³ /Capacity: 116,302 m ³ /year	20-25km
		Management unit: Ngoc Tam Binh JSC (transferred from Hung Do Construction & Trading JSC) Address: Mine 05, Thieu Hoa Commune License No.: 87 dated 15/06/2020 Exploitation reserve: 203,667.0 m ³ /Capacity: 47,000 m ³ /year	20-25km
		Company: Thanh Tam Construction & Trading JSC Address: Mine 02 conversion, Thieu Hoa Commune License No.: 136 dated 13/04/2017 (valid until 26/06/2026) Exploitation reserve: 634,831 m ³ /Capacity: 45,345 m ³ /year	20-25km
		Company: Vinh An JSC Address: Sand Mine 62, Thieu Quang Commune License No.: 177 dated 12/10/2020 (valid for 9 years) Exploitation reserve: 194,756 m ³ /Capacity: 22,000 m ³ /year	20-25km
2	Backfill soil	Duc Cuong Co., Ltd. Address: Ha Trung Commune License No.: 50 dated 03/02/2016 (valid for 30 years) Reserve: 600,000 m ³ (Filling soil: 570,133 m ³ ; Silica: 29,867 m ³)/Capacity: 30,000 m ³ /year	20-25km
		Mai Huong D-L One-Member Co., Ltd. Address: Dong Thanh Commune License No.: 184 dated 12/05/2016 (valid for 14 years 11 months) Reserve: 177,272 m ³ /Capacity: 12,000 m ³ /year	15km

No.	Materials	Material source/quarry	Transportation distance
		Huy Hoang Co., Ltd. Address: Trieu Loc Commune License No.: 363 dated 15/09/2015 (valid for 30 years) Reserve: 4,493,448 m ³ (Filling soil: 4,280,458 m ³)/Capacity: 150,000 m ³ /year	
3	Stone	Thanh Hoa Commercial Concrete JSC Address: Hac Thanh License No.: 335 dated 23/09/2014 (Valid for 15 years 7 months) Reserve: 849,994 m ³ /Capacity: 60,000 m ³ /year	15km
		Tan Thanh 9 LLC Address: Nui Vuc, Dong Quang Commune License No.: 265 dated 28/07/2014 (Valid for 29 years 2 months) Reserve: 859,790 m ³ /Capacity: 30,000 m ³ /year	15km
		Long Thanh Private Enterprise Address: Dong Quang Commune License No.: 387 dated 07/10/2015 (Valid for 30 years) Reserve: 1,306,022 m ³ /Capacity: 35,000 m ³ /year	15km
		Dong Vinh Construction Material Production Cooperative Address: Dong Quang Commune License No.: 64 dated 05/02/2015 (Valid for 14 years) Reserve: 403,500 m ³ /Capacity: 30,000 m ³ /year	15km
4	Supply of steel, cement, bricks, and other materials	Local companies and enterprises in the project communes and neighboring communes	10km
II	Materials for subproject 2 and subproject 8		
1	Sand	Le Hoang Investment and Development JSC Address: Mine 59, Ham Rong License No.: 39 dated 19/04/2019 (Valid until 14/08/2027) Reserve: 969,183 m ³ /Capacity: 116,302 m ³ /year	15km
		Ngoc Tam Binh JSC Address: Mine 05, Thieu Hoa Commune License No.: 87 dated 15/06/2020 Reserve: 203,667 m ³ /Capacity: 47,000 m ³ /year	20km
2	Backfill soil	Huy Hoang Co., Ltd Address: Trieu Loc Commune License No.: 363 dated 15/9/2015 (Valid for 30 years) Reserves: 4,493,448 m ³ /Capacity: 150,000 m ³ /year	10km

No.	Materials	Material source/quarry	Transportation distance
		Mai Huong D-L One Member Co., Ltd Address: Dong Thanh Commune License No.: 184 dated 12/5/2016 (Valid for 14 years 11 months) Reserves: 177,272 m ³ /Capacity: 12,000 m ³ /year	10km
3	Stone	Phuc Thinh Production and Construction Co., Ltd Address: Ha Trung Commune License No.: 46 dated 20/3/2020 (Valid for 28 years 9 months) Reserves: 560,363 m ³ /Capacity: 20,000 m ³ /year	25km
		Quyet Thang Mining and Construction Co., Ltd Address: Ha Trung Commune License No.: 210 dated 30/12/2019 (Valid for 24 years) Reserves: 708,054 m ³ /Capacity: 30,000 m ³ /year	25km
III	Materials for subproject 3		
1	Sand	Le Hoang Investment and Development JSC Address: Mine 59, Ham Rong License No.: 39 dated 19/04/2019 (Valid until 14/08/2027) Reserve: 969,183 m ³ /Capacity: 116,302 m ³ /year	30km
		Ngoc Tam Binh JSC Address: Mine 05, Thiệu Hóa Commune License No.: 87 dated 15/06/2020 Reserve: 203,667 m ³ /Capacity: 47,000 m ³ /year	35km
		Duc Loc Trading and Investment JSC Address: Mine 30, Tay Do Commune License No.: 222 dated 23/06/2014 (Valid for 13 years 8 months) Reserve: 272,615 m ³ /Capacity: 20,000 m ³ /year	20km
2	Backfill soil	Cuong Giang Trading Co., Ltd Address: Quang Trung Ward License No.: 46 dated 20/01/2017 (Valid for 30 years) Reserves: 774,698 m ³ /Capacity: 26,000 m ³ /year	25km
		Long Son Co., Ltd Address: Ha Trung Commune License No.: 188 dated 27/9/2021 (Valid for 10 years) Reserves: 1,017,037 m ³ /Capacity: 105,000 m ³ /year	40km
		Duc Cuong Co., Ltd Address: Ha Trung License No.: 50 dated 03/02/2016 (Valid for 30 years) Reserves: 600,000 m ³ /Capacity: 30,000 m ³ /year	40km
3	Stone	Phu Son Trading Co., Ltd Address: Nga An Commune	10km

No.	Materials	Material source/quarry	Transportation distance
		License No.: 92 dated 14/02/2015 (Valid for 30 years) Reserves: 1,763,432 m ³ /Capacity: 60,000 m ³ /year	
		Dai Phong Co., Ltd Address: Nga An Commune License No.: 90 dated 14/02/2015 (Valid for 30 years) Reserves: 1,778,335 m ³ /Capacity: 60,000 m ³ /year	10km
		Phu Tai Construction Consulting and Trading JSC Address: Nga Phu License No.: 269 dated 05/7/2017 (Valid until 28/01/2034) Reserves: 252,000 m ³ /Capacity: 15,000 m ³ /year	10km
IV	Material for subproject 9		
1	Stone	Dong Vinh Production & Construction Cooperative Address: Stone Mine, Dong Quang Commune License No.: 64 dated 05/02/2015 (valid for 14 years) Reserve: 403,500 m ³ /Capacity: 30,000 m ³ /year	25km
		Thai Son Construction & Mineral Exploitation JSC Address: Stone Mine, Trung Chinh Commune License No.: 382 dated 22/10/2014 (valid for 29 years 9 months) Reserve: 439,607 m ³ /Capacity: 15,000 m ³ /year	15km
2	Sand	Minh Thinh Construction & Trading Co., Ltd. Address: Sand Mine No. 04, Thieu Hoa Commune License No.: 01 dated 05/01/2021 (valid for 7 years 7 months) Reserve: 279,533 m ³ /Capacity: 39,000 m ³ /year	30km
3	Backfill soil	Thanh Ba General Construction & Trading Mineral JSC Address: Soil Mine, Tuong Linh Commune License No.: 260 dated 09/12/2016 (valid for 14 years) Reserve: 412,286 m ³ /Capacity: 30,000 m ³ /year	15km

✓ **Material transportation route:**

The materials used for the project will be transported by 10-ton trucks via the existing road network. Transportation routes for each subproject are detailed below.

Table 1-7: Summary of project's material transportation routes

No.	Subprojects	Transportation routes
1	Subproject 1	- Road: Construction material mines and pits → National Highway 10 → Provincial Road No. 6 → Road 510 → subproject area. - Average transportation distance: 15 km
2	Subproject 2	- Road: Construction material mines and pits → National Highway 10 → access road to Hoa Loc fishing pond → subproject area. - Average transportation distance: 15 km

No.	Subprojects	Transportation routes
3	Subproject 3	- Construction material material mines and pits → National Highway 10 → dike road, inter-communal road of Nga Son, Tan Tien → subproject area. - Average transportation distance: 30 km
4	Subproject 4 – Subproject 7	- Road: Construction material mines and pits → National Highway 10 → subproject area. - Average transportation distance: 15 km
8	Subproject 8	- Road: Construction material mines and pits → National Highway 10 → dike road → subproject area. - Average transportation distance: 15 km
9	Subproject 9	- Road: Construction material mines and pits → National Highway 1A → dike road → subproject area. - Average transportation distance: 15 km

✓ **Electricity, water, and fuel supply**

- Water supply: water for construction and for the workers' daily use will source from available clean water sources in each project area or from nearby households.
- Electricity demand: the electricity for the project will be connected from the 10kv medium-voltage line running across the site to the substation. The distance from the connection point to the project substation is approximately 100–200 meters.
- Diesel and gasoline: fuels for operating construction machinery will be supplied by local petroleum companies. Thanks to the existing distribution network, fuel supply for each subproject is relatively convenient and reliable.

1.5.2. Other auxiliary works

❖ **Worker demand**

During the construction phase of each subproject, temporary camps for workers are expected to be built. The total estimated number of workers serving the project is approximately 1,395, with the number of workers required for each subproject ranging from about 130 to 200. The projected number of workers mobilized is presented in the table below:

Table 1-8: Estimated number of construction workers at the subprojects

No.	Subprojects	Number of workerd	Expected construction duration (month)
1	Subproject 1	200	24
2	Subproject 2	175	24
3	Subproject 3	145	24
4	Subproject 4	155	24
5	Subproject 5	140	24
6	Subproject 6	155	24
7	Subproject 7	150	24
8	Subproject 8	145	24
9	Subproject 9	130	24
	Total	1395	

(Source: Cost estimate for the project basic design, 2025)

❖ **The project's volume of demolition, excavated soil, and dredged material:** Solid waste generated during the construction phase that must properly handled includes dredged materials,

biomass from site clearance, and excavated soil from the construction of the subprojects; domestic waste from worker camps; and debris from the demolition of existing structures. The estimated waste volume for each subproject is summarized below.

Table 1-9: Volume of demolition, excavated soil, and dredged material of the project

No.	Subproject	Demolition (m ³)	Excavation (m ³)	Dredging material (m ³)	Embankment soil (fill soil) (m ³)	Excavated soil reused for on-site embankment (m ³)	Excavated soil and dredged material to be disposed (m ³)
		1	2	3	4	5	6=2+3-5
1	Subpro.1	0	14,290	18,800	26,952	14,290	18,800
2	Subpro.2	1511	5,135	365,000	41307	5,135	365,000
3	Subpro.3	0	253	94	20,049	253	94
4	Subpro. 4	49	13,683	12,219	38,598	11,611	22,892
5	Subpro.5	135	9,813	10,829	11,737	4,924	15,717
6	Subpro. 6	146	8,728	4,142	14,517	2,894	9,976
7	Subpro. 7	18	9,392	8,931	17,687	3,645	14,677
8	Subpro.8	297	7,599	8,731	12,604	4,813	11,517
9	Subpro.9	420	17,789	1,240	18,860	15,560	3,469
	Total	2,576	86,682	429,986	202,311	63,125	462,142

(SOURCE: Cost estimate for project basic design, 2025)

1.6. Disposal sites

The volume of debris from the demolition of existing structures will be collected and disposed of by a contracted local authority unit at disposal sites designated by the local government.

The volume of excavated soil and surplus dredged material from the construction phase of the project must be transported to designated disposal sites to prevent environmental impacts and to allow future resource utilization. Most of the dredged material (mainly sand) can be reused as a sand resource (fill sand – provided that it meets the construction material standards). This reuse will be subject to future resource auctions in accordance with the provisions of the Mineral Law. The disposal sites for excavated soil and surplus material for each subproject are as follows:

Table 1-10: Disposal site for dredged material/excavated soil and surplus material for each subproject

No.	Subproject	Volume of excavated soil/dredged material to be disposed of (m ³)	Area of disposal site (ha)	Capacity of disposal site (m ³)	Transportation distance (km)
1	Subpro.1	18,800	8.,15	383,800	Subproject 1- 2.5 Subproject 2- 0.5
2	Subpro.2	365,000			
3	Subpro.3	94	15	225.00	0.5
			45	650,000	1.0
4	Subpro.4	22,892	2.0	40,000	3
5	Subpro.5	15,717	0.33	4,519	1.5

No.	Subproject	Volume of excavated soil/dredged material to be disposed of (m ³)	Area of disposal site (ha)	Capacity of disposal site (m ³)	Transportation distance (km)
			0.6	12,000	1.5
6	Subpro.6	9,976	1.2	17,500	0.75
7	Subpro.7	14,677	1.5	18,000	1.0
8	Subpro.8	11,517	1.04	22,500	1.5
9	Subpro.9	3,469	0.5	10,000	2.1

The volume of excavated soil and surplus dredged material will be transported to temporary disposal sites by 10-ton trucks. Specifically: For subproject 1: dredged material will be pumped onto 200T and 250T barges, transported along the Lach Truong River, and then pumped onto the disposal site. For subproject 2: dredged material from the storm shelter mooring area will be sucked by dredger vessels and pumped directly to the disposal site via a pipeline system, with an average pipeline length of L = 0.5 km.

All disposal sites serving the project have obtained official disposal agreements and have been approved by the commune People's Committee. Existing status of the temporary disposal sites serving each subproject is stated in the table below:

Table 1-11: Project's disposal sites

Subproject	Name of disposal site/area/capacity	Location	Existing status of the disposal site
Subproject 1, Subproject 2 (Disposal site 2)	Area: 8,15ha; Capacity: 383.800 m ³	-Location: Van Loc commune, Hau Loc district (formerly Hai Loc commune, Hau Loc district). - Position: border a pond; adjacent to traffic road to the west and east; adjacent to vacant land to the south. -Access route and transportation distance: subproject construction area → Lach Truong river disposal site, 0.5 km	- According to the field survey, the disposal site is located in the low-efficiency salt field in Hai Loc commune, Hau Loc district. It is surrounded embankments that are elevated above the ground level.  Location of the disposal site

Subproject	Name of disposal site/area/capacity	Location	Existing status of the disposal site
			 Hầu Lộc Thanh Hóa 13 thg 11, 2024 16:51:50 Existing status of the disposal site
Subproject 3 (Disposal site No.1 – receiving dredged materials from Phu Son 2 canal)	Area: 15ha; Capacity: 225,000 m ³	- Location: Tan Tien commune (formerly Nga Tan commune, Nga Son district) - Access route, transportation distance: subproject construction area → disposal site, 0.5 km	- The disposal site is surrounded by vacant land owned by Mr. Mai Sy Tuan and there are no residences or buildings on it. 
Subproject 3 (disposal site No. 2 – storing dredged material from Bao Trieu Channel)	Area: 45ha; Capacity: 650.000 m ³	- Location: Tan Tien commune (formerly Nga Tan commune, Nga Son district) - access route, transport distance: subproject area → internal concrete road → disposal site, 1 km	 Location of the disposal site

Subproject	Name of disposal site/area/capacity	Location	Existing status of the disposal site
			 Existing status of the disposal site No. 1  Existing status of the disposal site No. 2
Subproject 4	Area: 2ha; Capacity: 40.000 m ³	-Location: Son Trang village, Hoang Tien commune (formerly Hoang Yen commune). - Access route, transportation distance: subproject construction area → disposal site, approximately 3 km.	The disposal site is surrounded by vacant land, with no residential houses or other buildings.
Subproject 5	- Disposal site 1: Area: 0,33ha; Capacity: 4,519 m ³ - Disposal site 2: Area: 0,6ha; capacity of 12,000m ³	- Location: Bac Hoi Trau village, Hoang Chau commune (formerly Hoang Phong commune, Hoang Hoa district). Access route, transport distance: Subproject construction area → disposal site, 2 km.	- The designated disposal site is currently a former fishpond area managed by the Commune People's Committee, previously leased to local residents for production purposes. However, the lease contract has expired. To the south of the disposal site is the inter-commune road, convenient for transportation to the disposal site

Subproject	Name of disposal site/area/capacity	Location	Existing status of the disposal site
			 Existing status of the disposal site
Subproject 6	Area: 1,2 ha; Capacity: 17,500 m ³	- Location: Phuong Ngo 1 village, Hoang Chau commune (formerly Hoang Luu commune). Access route and transportation distance: Subproject construction area → disposal site, approximately 0.75 km.	- The site is currently the pond area, managed by the commune People's Committee. - To the south of the disposal site is the inter-commune road, convenient for transportation to the disposal site. Disposal site location 

Subproject	Name of disposal site/area/capacity	Location	Existing status of the disposal site
			 Existing status of the disposal site
Subproject 7	Area: 1.5ha; Capacity: 18,000 m ³	- Location: Chau Trieu village, Hoang Chau commune -Boundaries: borders to the east agricultural land; drainage canal to the west; agricultural land to the south; a road to the north -Access route and transportation distance: Subproject construction area → disposal site, approx 1 km	- The land area is currently used as crop land, managed by local households. - To the North of the disposal site is the inter-commune road, convenient for transportation to the disposal site.   Existing status of the disposal site
Subproject 8	Area: 1.04ha; Capacity: 22,500 m ³	- Location: Hung Thanh village, Van Loc commune (formerly Da Loc commune, Hau Loc district).	- This land area is under management by the communal People's Committee, with an inter-communal road, providing convenient access to the disposal site.

Subproject	Name of disposal site/area/capacity	Location	Existing status of the disposal site
		- Boundaries: borders the existing inter-communal road to the North; crop production areas to West, South, and North; residential houses to the East. - Access route and transportation distance: Subproject construction area → disposal site, approximately 1.5 km	 Existing status of the disposal site
Subproject 9	Area: 0.5 ha Capacity: 10,000 m ³	- Location: Dung village, Quang Chinh commune (formerly Quang Trung commune, Quang Xuong district) - Boundaries: border the existing concrete road and Hoang River to the east; border vegetable production areas north, west, and south. - Access route and transportation distance: subproject construction area → disposal site, 2.1 km	- The site is currently being used as a temporary gathering area for surplus construction materials, under the management of communal People's Committee. - To the East of the disposal site is the existing concrete road, providing convenient access to the disposal site. 

Subproject	Name of disposal site/area/capacity	Location	Existing status of the disposal site
			 Existing status of the disposal site

1.7. Construction method

1.7.1. Construction method applied for Subproject 1 and Subproject 2

Construction of vessels berth

- Site preparation: clear the construction area, carry out unexploded ordnance (UXO) clearance, and remove obstacles. Establish control points for the construction zone.
- Bored piles: conduct supplementary geological surveys; perform tests on the stability of the borehole walls; construct test piles and perform static load tests; inspect the integrity of concrete piles according to design specifications.
- Assemble reinforcement and pour concrete for pile head connection details.
- Install formwork and reinforcement, then pour concrete for the longitudinal and transverse beams of the wharf.
- Install precast slab: install reinforcement, and pour concrete for the deck slabs.
- Pour concrete wearing course and shape the slope of the wharf surface.
- Install anchor plates, fenders, and access ladders. Apply anti-corrosion coating to steel components and paint wheel stops.

Port yard leveling:

- Position and install survey stakes at control points within the designated leveling area.
- Materials used for leveling are those purchased or utilized from material dredged from the water area, providing it meets quality standards
- The yard ground is leveled in combination with the construction of drainage system.
- The construction will be carried out from the inner area outward, using equipment such as bulldozers, rollers, and compactors.

Embankment:

- Align the work.
- Dredge the revetment foundation.
- Place ripraps at the revetment toe by a crane mounted on a pontoon, with support of barges transporting stone.

- Lay a geotextile using a combination of machinery and manual labor.
- Place stone on the slope by a crane mounted on a pontoon, with support of barges transporting stone.
- Install revetment surface layer by using a crane mounted on a pontoon, with support of divers.
- Construct concrete road at the crest of the revetment.

 Dredging of navigation channels and water areas:

Preparation:

Before dredging, the site, control points will be handed over for the construction, complete procedures to obtain construction permits, and approve maritime safety measures.

Geodetic survey:

- + Re-survey the site, verify existing control points, and establish additional points if necessary.
- + Establish a construction control grid as the basis for all geodetic surveying work; on that basis, perform longitudinal and vertical surveying to control vertical deviations and elevation levels of structural components.
- + Position the project works according to the design, verify elevation deviations of structural elements.
- + Positioning to support the execution of all construction components.
- + Monitor settlement and deformation of the structures.
- + Perform as-built drawings and measurements upon completion of construction; comply with specific requirements set out in construction standards for surveying works.

Dredging method:

+ Subproject 1: use a grab bucket combined with barges to transport dredged material to the disposal site, with transportation distance of $L=3$ km; the disposal method: dredged materials are pumped from the barge to the disposal site at the inefficient salt fields in Van Loc commune.

+ Subproject 2: for dredging the storm shelter area, suction vessels are used with a pipeline system to spray dredged materials directly onto the disposal site, with an average pipeline length of $L=0.5$ km. The dredged materials mainly consists of clayey mud, containing organic matter, pumped directly into the storage area at the inefficient salt fields in Van Loc commune, located along the shore of storm shelter anchorage zone. The disposal site is surrounded by a dike system for containing sludge, equipped with filtration gates; the discharged water flows into existing drainage canal before entering the river.

+ Construction measures at the dredged material storage site: the dredged material storage site will be enclosed by sandbag embankment (sand may be sourced from the dredged materials, provided it meet quality standards), with the top elevation following the approved planning elevation (average height approximately 4 m). Construct primary settling pits and water collection pits during dredged material deposition. Water drained from the dredged material will flow through temporary drainage channel to the collection pits before being discharged into the receiving source.

 Construction of architectural works

- Construction of architectural works: administration building, specialized warehouses, transfer warehouses, seafood product sorting and collection buildings. The construction

sequence is carried out from foundation to walls, roof, plastering, painting, finishing walls, and installing doors.

- Excavation of foundation pits: excavate soil to the elevation indicated in the drawings; measures must be taken to support the foundation pits to ensure safety for workers and structures.
- After completing the foundation excavation, proceed to cast blinding concrete and foundation concrete or build the foundation masonry.
- Construction of reinforced concrete components cast in place must ensure the integrity and monolithic quality of the concrete.
- Construction of the beam frame system, roof frame system, and roof covering.
- Finishing works: plastering, painting, door installation, basic interior works...

Technical infrastructure system

- The technical infrastructure system includes works for electricity supply & lighting, water supply and drainage, wastewater drainage, and wastewater treatment areas. Construction methods for these works are as follows:

Electricity supply & lighting:

- Installation of transformer stations: construct transformer stations to supply electricity for the port, including equipment such as transformers, distribution cabinets, circuit breakers, and protective devices.
- Installation of electrical cables: dig trenches and install electrical cables from the transformer station to the areas requiring power, ensuring safety and durability.
- Installation of distribution cabinets: the cabinets will distribute electricity to different areas of the port.
- Installation of lighting: determine the positions and types of lights suitable for each area of the port (high-pressure lamps, LED lights, etc.). Calculate illumination and coverage to ensure safety in the area.
- Wiring and connections: install the electrical wiring system for the lighting, connecting them to the power source and control cabinets.
- Installation of grounding system: ensure electrical safety for the system by installing grounding, lightning protection, and devices to prevent electrical leakage.
- System inspection: check all connections and electrical equipment to ensure the system operates effectively and safely.
- Acceptance and commissioning: carry out inspection and acceptance of construction items, evaluate quality, and confirm the completion of the electrical and lighting system.

Stormwater drainage system:

- Trenching: Excavate trenches according to the design to install the stormwater drainage system. Trenches must have appropriate slopes to ensure rapid and efficient water drainage.
- Installation of stormwater culverts: Install pipe sections along the length of the trench, ensuring tight joints with no water leakage. Stormwater pipes are generally arranged with proper slopes to automatically direct water away from the area.
- Installation of manholes and valves: Manholes allow inspection, maintenance, and clearing of the pipe system, while valves enable regulation and shutdown of water flow when necessary.

Construction of the wastewater drainage system and 200 m³/day treatment Plant:

- Excavate trenches and pipe installation: the construction process is similar to the stormwater system but special attention about selection of pipe materials resistant to acids, alkalis, or chemicals present in the wastewater should be paid.
- Installation of manholes and connection points: manholes facilitate monitoring and maintenance of the wastewater system. Ensure that pipe joints are sealed to prevent leakage.
- Excavation of foundation pits: excavate foundation pits for treatment tanks, ensuring depth and area meet design specifications.
- Construction of tank foundations: Pour concrete foundations for treatment tanks and other underground structures.
- Construction of treatment tanks: build wastewater treatment tanks, including sedimentation tanks, biological tanks, and disinfection tanks (according to the selected technology).
- Installation of piping and equipment: install wastewater pipelines, pumping systems, valves, distribution equipment, and other treatment devices such as mixers and aeration pumps.
- Integration of wastewater into treatment tanks: connect the drainage system to the treatment tanks according to design requirements, including storage tanks, manholes, and connections.
- Electrical system installation: install electrical systems for pumps, mixers, aerators, and lighting within the facility.
- Control systems setup: set up control cabinets and monitoring systems to regulate the treatment process and control parameters such as pH, temperature, water flow, and other critical indicators.
- System testing: conduct tests for pumps, treatment equipment, and control systems to ensure efficient and stable operation.
- Completion and acceptance: after construction, carry out project acceptance following standards for quality, safety, and environmental compliance.

Water supply system:

- Trench excavation and site preparation: Excavate trenches according to the designed length and depth. Clear trenches thoroughly to facilitate pipe placement.
- Pipe installation: Install water supply pipes according to the design layout. Ensure joints are tight with no leaks. Pipes should be installed with proper slopes to maintain water flow and allow easy maintenance and repair.
- Pressure testing: Perform pressure tests across the entire pipeline system, check for leaks, and flush the pipes.
- Backfilling and site restoration: After installation and testing, backfill trenches, protect pipes, and reinstate the surface to its original condition.

1.7.2. Construction method applied for Subproject 3 to Subproject 9

 Construction diversion

Period of channel diversion in construction:

- Dry season: From November to June each year.
- Rainy season: From July to October each year.

Design frequency for channel diversion: Based on TCVN 9160:2012 “Hydraulic structures – Technical requirements for design of diversion channel in construction”, taking into account construction duration, water level frequency, and maximum flow, the design auxiliary structures such as cofferdams and diversion channels is carried out with $P = 10\%$.

Channel diversion during construction period:

****For dredging of irrigation and drainage canals:***

- Use Lassen III sheet piles to enclose the construction area of the right bank embankment, and divert the flow to allow construction of the remaining section of the drainage canal.
- For Bao Trieu Canal (Ong Ty Canal): During construction, a pontoon is used to support the excavator for dredging the canal according to the design cross-section, allowing flow diversion through the existing drainage canal.
- For Subprojects 4, 5, 6, 7 in Hoang Yen, Hoang Luu, Hoang Phong, and Hoang Chau communes: During construction, a pontoon is used to support the excavator for dredging the canal bed according to the design cross-section, so flow diversion is not required.
- Main drainage canal, segment from Ong Ninh sluice to Quay Co sluice, section from K0+429.14 – K0+488.90 m (right bank embankment, downstream of Ong Hong sluice): Use bamboo piles and woven bamboo screens to form twin-pile cofferdams for constructing the right bank embankment and divert the flow for the remaining section of the drainage canal.
- Dredging in-field canal branch: During dredging, a pontoon is used to support the excavator for dredging the canal according to the design cross-section, allowing flow diversion through the existing drainage canal
- Canal from Ong Thuoc sluice to Ong Vanh sluice: Flow diversion follows the existing canal.

 Main construction methods:

Due to the extended alignment of the main drainage components, construction activities are carried out based on a segmented approach. Branch roads are utilized for transporting soil, materials, and equipment to the site.

 Weathered soil removal:

- Before excavation, all roots of large and small trees must be manually removed. Grass, weathered soil, and poor-quality soil as specified in the design must be cleared using mechanical equipment. Excavated waste is to be transported to the designated disposal site using self-dumping trucks with a capacity ≤ 10 tons. Excavated waste is to be transported to the designated disposal site using self-dumping trucks with a capacity ≤ 10 tons. Excavated embankment soil is reused for filling.
- At positions where embankment slope excavation is carried out, the soil must be loosened, finely broken down, and moisture-conditioned uniformly before being reused for backfilling.
- If the contractor discovers underground technical systems, archaeological sites, etc. Within the construction area, the excavation must immediately halted and the area fenced off. Within 24 hours, the contractor must notify the project owner and relevant authorities for resolution.
- During construction, the contractor must minimize impacts beyond the excavation area.
- Excavation of foundation pits must be carried out in accordance with the specified method, boundary lines, and slope angles as shown in the design drawings.

Construction of Foundation pit:

Preparation work:

After being handed over, the site is divided into zones, transfer and mark reference points, set boundary stakes, and clear the entire area.

Install temporary camps and auxiliary areas, construct access roads, stormwater drainage routes, and implement safety measures such as guard stations, project gates, signage, and lighting systems.

Site layout and positioning:

Before construction, benchmark coordinates and control grid must be handed over between the project owner and construction contractor. Reference stakes must be made of concrete and placed in positions that do not interfere with the construction workers, and are protected throughout the construction period.

Based on the approved site planning, the structure is positioned. Use surveying equipment locate centralline axes, foundation pit boundaries, cross-sections, and reference markers beyond the construction area. Verify actual site dimensions before construction.

Soil excavation:

For excavation of foundation pit, both machinery and manual labor are used. Excavators, dump trucks, and bulldozers are mobilized for collection, loading and transportation of excavated materials.

For deep excavation areas, apply the construction method of stepwise top-down excavation according to the design cross-section, and transport the excavated material to the designated disposal site.

For soil/rock layers, excavation is performed directly with excavators, loading onto trucks for transport. Construction equipment includes excavators, bulldozers, and trucks.

After excavation, proceed with positioning reference points and determining the elevation of the structure to prepare for the next phase of construction.

Foundation pit drainage:

The foundation pit of the spillway is located on a hillside higher than surrounding areas, providing good drainage capacity. Therefore, it is sufficient to install surface and subsurface drainage channels discharging into the river and nearby streams.

During foundation excavation, create horizontal and longitudinal slopes of 2–3% toward rivers and streams; combine with longitudinal and transverse canals to ensure effective surface and groundwater drainage.

Earthwork and Embankment Construction

Dredging and Excavation:

- Step 1: Use the old canal bed to divert the flow during construction. Remove the weathered soil within the canal bank area. For sections on the existing canal bed, anti-bog mats are used to allow the excavator to operate while standing on the mats during construction.

- Dredging depth: Based on geological documents from the design phase, the average sludge layer is 0.50 m. Equipment is mobilized at both ends of the canal, and proceeds the dredging from the ends toward the center.

- Step 2: Drive bamboo piles to reinforce the foundation within the construction area of the toe beam for the riverbank revetment. Construct the toe beam, complete the cross-section

of the revetment and canal bank foundation, and simultaneously build the operation and maintenance road according to the design cross-section.

- Step 3: Dredging the main canal channel according to design. Excavators are positioned on both sides of the canal, shape the canal slopes as designed. Excavated material is loaded onto trucks and transported to designated disposal site.

- Step 4: Complete embankment foundation according to design cross-section. Finish the reinforcement of crushed stone layers and concrete on the canal bank.

❖ **Soil embankment:**

The embankment construction must strictly follow the approved design, TCVN 9165-2012, and other relevant regulations to ensure required quality.

- Embankment construction generally includes the following tasks: surface preparation, soil placement, leveling, watering, and compaction.

- Soil must be laid in layers and the construction must not be carried out during rainy season.

- The embankment construction must be only carried out after the foundation treatment has been finished and accepted.

- For the sections with thin manual embankment adjacent to the existing dike body, after clearing grass, steps must be proceeded. Each step should have a height equal to one layer of fill soil, a width of 0.2 m to 0.3 m, slightly inclined toward the existing dike body, and the surface should be roughened before placing the fill.

- Soil layers are placed both mechanically manually, compacted to achieve design density $\gamma \geq 1.65 \text{ T/m}^3$ with required compaction rate $K \geq 0.95$. Use 9–16T compactors to ensure suitability for mechanical work on steep and narrow existing dike slopes, while avoiding excessive excavation into the dike body. During embankment slope excavation and soil grading, steps must be formed to meet the requirements for filling and compaction at the contact interface.

- If heavy rain is forecast during soil spreading, work must be stopped immediately. The soil surface should be graded with a slope to allow rainwater drainage, then compacted to prevent the formation of mud puddles that would require post-rain treatment.

- After the rain, wait until the surface soil evaporates to reach the controlled moisture level before continuing with soil placement. If any part of the dike surface becomes excessively soft, it must be removed before further filling. For mud puddles, all mud must be excavated and replaced with compacted soil to level the surface before proceeding with the next layer of fill.

- On sunny days, if the surface dries before compaction, additional water must be sprayed to ensure controlled moisture content before proceeding with compaction. Watering must be done evenly, avoiding excessive concentration in one spot to prevent soil softening and mud formation.

- Backfill soil must be compacted to the required density.

- Compactors must operate in a direction parallel to the centerline of the dike and must not compact in a direction perpendicular to the centerline.

- When segmenting for compaction, the compacted strip at the boundary between two adjacent segments must overlap by at least 0.5 meters.

- Within the same segment, each subsequent compaction pass must overlap the previous pass by 0.1 to 0.15 meters. The compaction passes of the upper and lower soil layers must not coincide.

- Mechanical compaction can be performed with two methods: forward-reverse compaction and circular path compaction. For circular path compaction, the compactor's speed must be reduced in curved sections, and care must be taken to avoid missed spots and to thoroughly inspect curved areas, as the soil is more prone to damage.

- When using mechanical compactors, manual compaction is required to reinforce corners and the edges of the dike where machines cannot reach.

Pavement construction

❖ Formwork, Scaffolding, and Bracing:

- Formwork and bracing structure must follow the design and meet the following requirements:
 - + Ensure stability, structural integrity, and deformation within allowable limits under load.
 - + Ensure correct shape and dimensions as per the design drawings.
 - + Ensure tight sealing to prevent cement slurry leakage.
 - + Scaffolding and working platforms: Must be placed on firm ground to prevent slipping. If props are placed on soft soil, wooden pads must be used under the base to prevent settlement.
- Installation of formwork : Must be based on established survey benchmarks and follow the construction design drawings to ensure accurate dimensions, alignment between structural components, and correct spatial positioning of the structure.
 - + For critical components, additional control points must be established to facilitate inspection of formwork installation.
 - + After the formwork and bracing installation is complete, inspection and acceptance must be carried out based on the following criteria: :
 - + Accuracy of the formwork compared to the design.
 - + Accuracy of embedded components.
 - + Tightness between formwork panels and between the formwork and the foundation surface or previously poured concrete.

Stability of the formwork and bracing, with special attention to padding and supports points.

❖ Work Platforms:

- + Work platforms must be sturdy and level. Rotten or decayed wood must not be used. During concrete transportation, vibrations should be minimized.

- + Work platforms must not be directly connected or braced to the formwork or reinforcement to avoid displacement of formwork or steel and prevent concrete from being disturbed during setting period.

❖ Rebar bending:

- Rebar bending:

- + Rebar must be bent cold; hot bending is strictly prohibited. For deformed bars or welded steel mesh/frame, hook bending are not required.

- + The starting point of the bend must form a smooth, uniform curve. The bending radius must be 15 times the diameter of the bar, and the angle and position of the bend must comply with the design specifications.

- + The bent hooks at both ends of the rebar must face inward toward the structure. For stirrup rebar with diameters from 6mm to 9mm, the straight segment at the hook end must be no less than 60mm; for diameters from 10mm to 12mm, it must be no less than 80mm.

- **Transportation and Installation of Reinforcement steel:**

- + Rebar must be transported from the fabrication site to the installation site without damage or deformation. If deformation occurs, it must be corrected before installation.

- + Positioning, spacing, protective layer thickness, and dimensions of all reinforcement components must follow the pre-determined layout and comply with the design drawings.

- ❖ **Concrete construction works:**

The masonry volume is relatively small, and the structural components are minor, so the construction method is entirely manual. For mortar mixing, small mixers with capacity of 80–150 l should be used to ensure quality of masonry units. During construction, strict adherence to the industry standard 14 TCN 12-2002: *Hydraulic construction – Stone Masonry and Paving – Technical Requirements for Construction and Acceptance* is required.

- ❖ **Installation of precast concrete slab:**

Slab casting:

- The slope paving slabs are precast at the casting yard, and their geometric dimensions must strictly conform to the design specifications, with a tolerance not exceeding 2mm.



Formwork panel

- ❖ **Installation:**

- Installation of paving slabs is carried out manually. The construction direction proceeds from the toe upward to the crest, following a sequential method to prevent displacement or erosion of the filter gravel on the slope.
- The filter gravel layer must be constructed with the full design thickness; After installation, the concrete slabs must be level and conform to the designed slope coefficient. Slabs are installed in a staggered pattern as shown in the design drawings.

At gaps adjacent to longitudinal and transverse beams, or where full-size slabs cannot be placed, M200 concrete is used to fill in, matching the slab thickness.

❖ **Embankment construction:**

- Only after the precast concrete elements reach the required design strength and have passed inspection and acceptance may they be transported for slope reinforcement.
- Construction includes reinforced concrete toe beams, installation of the precast elements, longitudinal beams along the revetment, and the revetment crest.

❖ **Revetment crest construction:**

Install formwork and pour concrete for the revetment crest road;

After completion, proceed with dry stones to reinforce the crest slope on the inland side.

❖ **Grass coverage for slope protection:**

Grass for slope protection is sourced from areas near the project site. When planting, select species with strong, well-developed, and durable roots. Moreover, they must be drought-resistant and low-growing; tall-stemmed varieties are not permitted. Grass should be cut into sods, transported to the planting location, and securely pinned to the slope. After planting, regular watering is required, and any dead patches must be removed and replanted. The location, dimensions, and layout of the grass planting must follow the procedures specified in the design documents. Grass must be planted immediately after completing the finishing work of the structure.

1.7.3. Fishing port operation technology (for Subproject 1 and Subproject 2)

❖ **Fishing port operation process**

The fishing port operation process is as follows: Fishing vessels, seafood collection vessels → Service port → Market for various products; Supply market.

Fishing port operation equipment

Equipment used at the fishing port includes:

- Unloading/loading equipment from fishing vessels to the wharf and receiving/sorting facility, including:
 - Mini cranes, rubber-tired cranes: transport boxed seafoods from vessels to the wharf.
 - Conveyors: transport bagged seafood or torn packaging, etc.
- Equipment for transportation from the wharf to the receiving/sorting facilities and from the sorting facilities to processing plants: forklifts, conveyors, trucks, and refrigerated trucks.
- Equipment for transporting from processing plants to the consumption market: trucks, refrigerated trucks.
- Equipment for transporting from port services back to fishing vessels includes:
 - Fuel (gasoline/diesel): supplied via direct pipeline pumping.
 - Ice: conveyor systems.
 - Fresh water: supplied via direct pipeline pumping.

Lach Truong storm shelter technology

The main method of mooring vessels currently used at storm shelter areas nationwide involves grouping fishing vessels side-by-side in clusters of 2 to 6 boats, then anchoring using the following methods:

Method 1: Self-anchoring

Traditionally, in several localities, fishermen find areas with sufficient depth and shelter from waves and wind, then drop their vessel anchors. In some cases of severe storms, all fishing gear and other assets may need to be moved and the vessel intentionally sunk to avoid damage. This method is only applied to small vessels when the mooring infrastructure is limited.

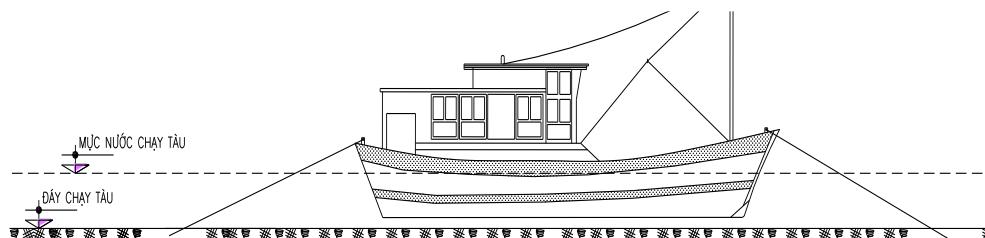


Figure 1-2: Mooring boats using the self anchoring method

Method 2: Double-anchor mooring

- The group of vessels are moored with the bow tied to a shore-based anchor post and the stern anchored to a buoy or underwater anchor post.
- Advantages: Keeps the vessel group stable, allows more vessels to be moored within the same area.
- Disadvantages: Subject to lateral wind and wave forces, increasing the risk of capsizing.
- Suitable for: anchorage areas that require extensive dredging and appropriate for large vessels.

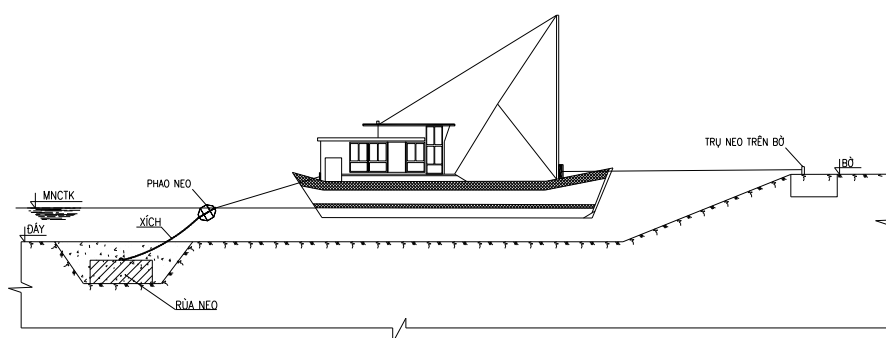


Figure 1-3: Mooring vessels using a combination of mooring buoys and shore-based anchor post

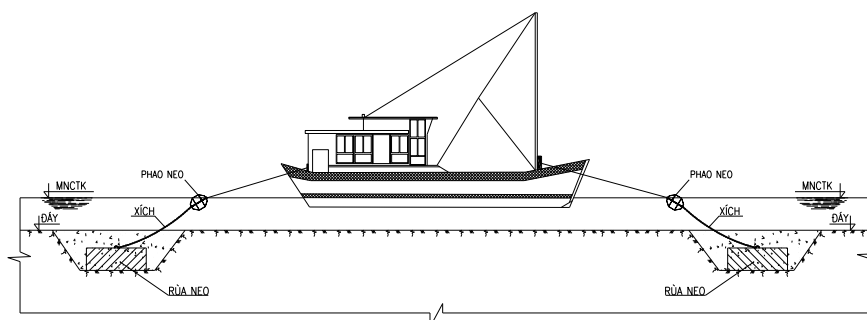


Figure 1-4: Mooring boats using bow and stern mooring buoys

Method 3: Vessel mooring combined both shore-based anchor posts and traditional anchors

- The vessel cluster is moored by tying to shore anchor posts while also dropping anchors.
- Only applicable for areas sheltered from waves and wind, or for mooring during minor storms. During severe storms, vessels are highly prone to collide with the breakwater, posing safety risks.

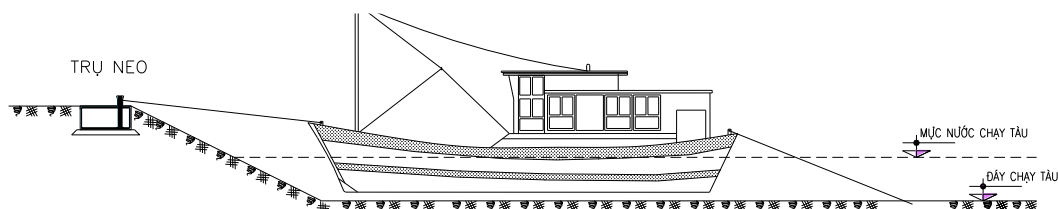


Figure 1-5: Mooring vessels using a combination of shore-based anchor posts and anchors

Method 4: Vessels moored with a single mooring buoy

- Vessel clusters are moored to a single buoy, allowing them to rotate around the buoy as wind direction changes during a storm.
- Advantages: This is the safest mooring method; as vessels always align with the wind direction, so there is no lateral force.
- Disadvantages: Requires a large mooring area, resulting in significant dredging volume for the anchorage zone.

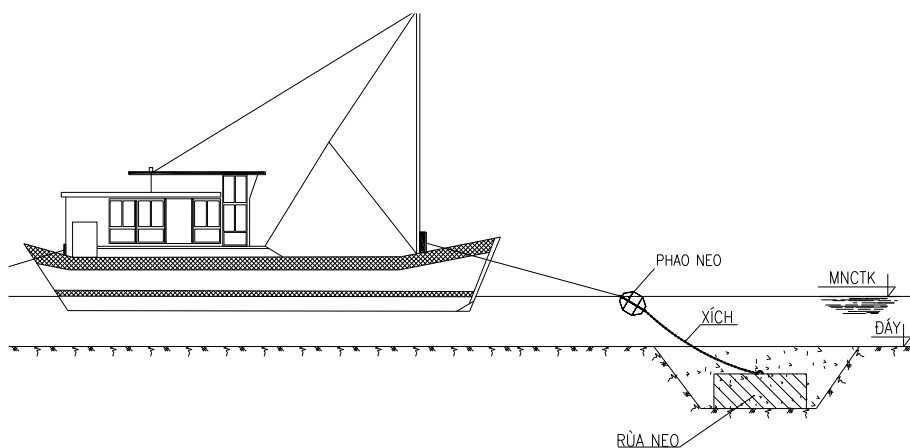


Figure 1-6: Vessel mooring with a single mooring buoy

1.7.4. Wastewater treatment system at Subproject 1 and Subproject 2

❖ Wastewater collection and treatment system

Flow chart of wastewater collection and treatment at Subproject 1 and subproject 2

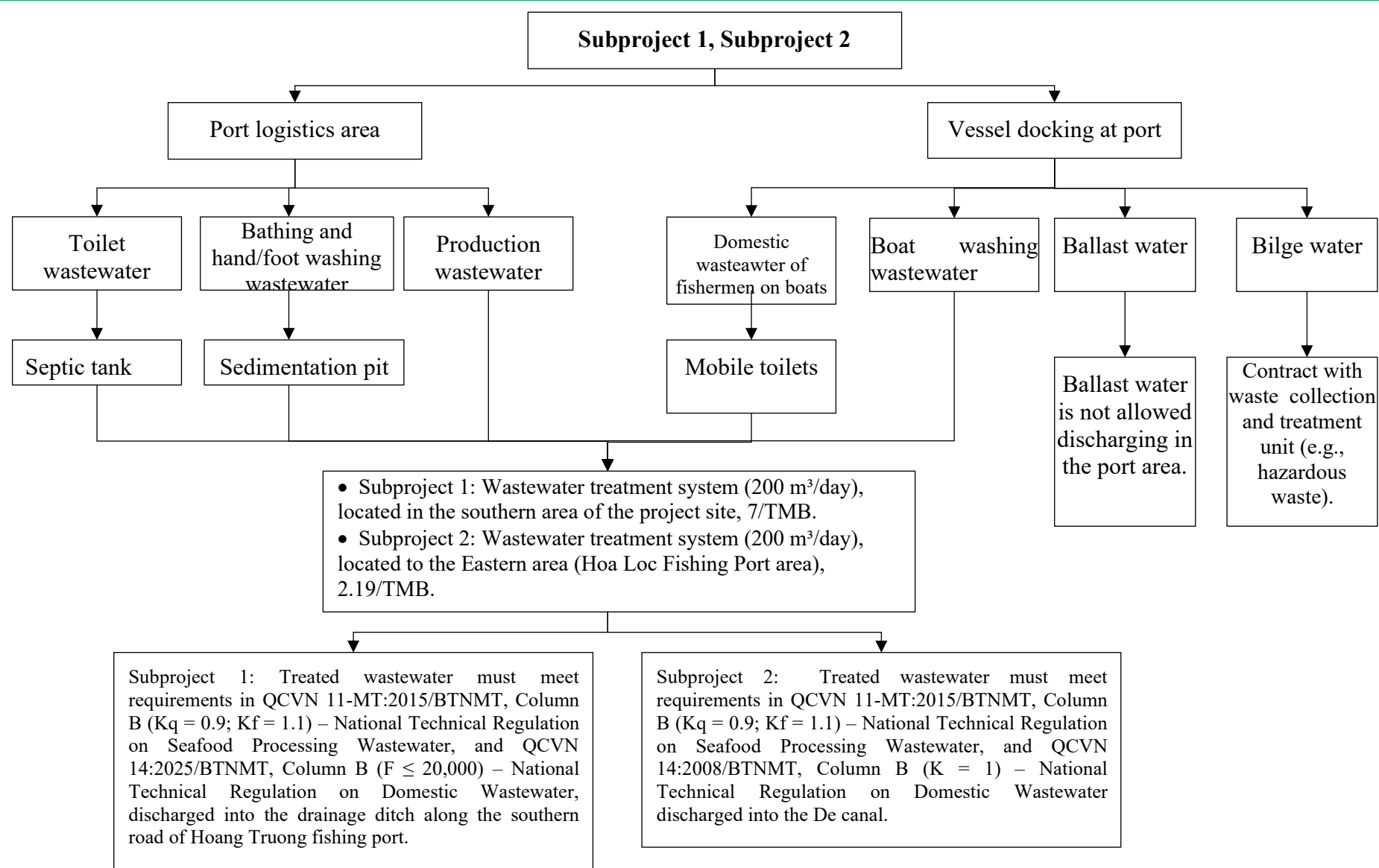


Figure 1-7: Diagram of wastewater collection and treatment at subproject 1 and subproject 2

Wastewater sources generated:

- *Domestic wastewater*

At subproject 1: Wastewater generated from the fishing port logistics area and from fishermen when vessels dock will be collected and preliminarily treated through two 3-compartment septic tanks of 10 m³ each (one at the operation building and one at the public restroom) before being conveyed to the centralized wastewater treatment system with a capacity of 200 m³/day.

At subproject 2: Domestic wastewater generated from the fishing port logistics area and fishing vessels docked will be collected separately and conveyed to the centralized wastewater treatment system with a capacity of 200 m³/day.

- *Industrial wastewater*

At subproject 1 and subproject 2: Wastewater from the seafood receiving–sorting area will be collected via pipes and conveyed to the centralized wastewater treatment system with a capacity of 200 m³/day.

❖ Centralized wastewater treatment facilities at subproject 1 and subproject 2:

The diagram of the centralized wastewater treatment system technology for subproject 1 and subproject 2 is shown in the figure below:

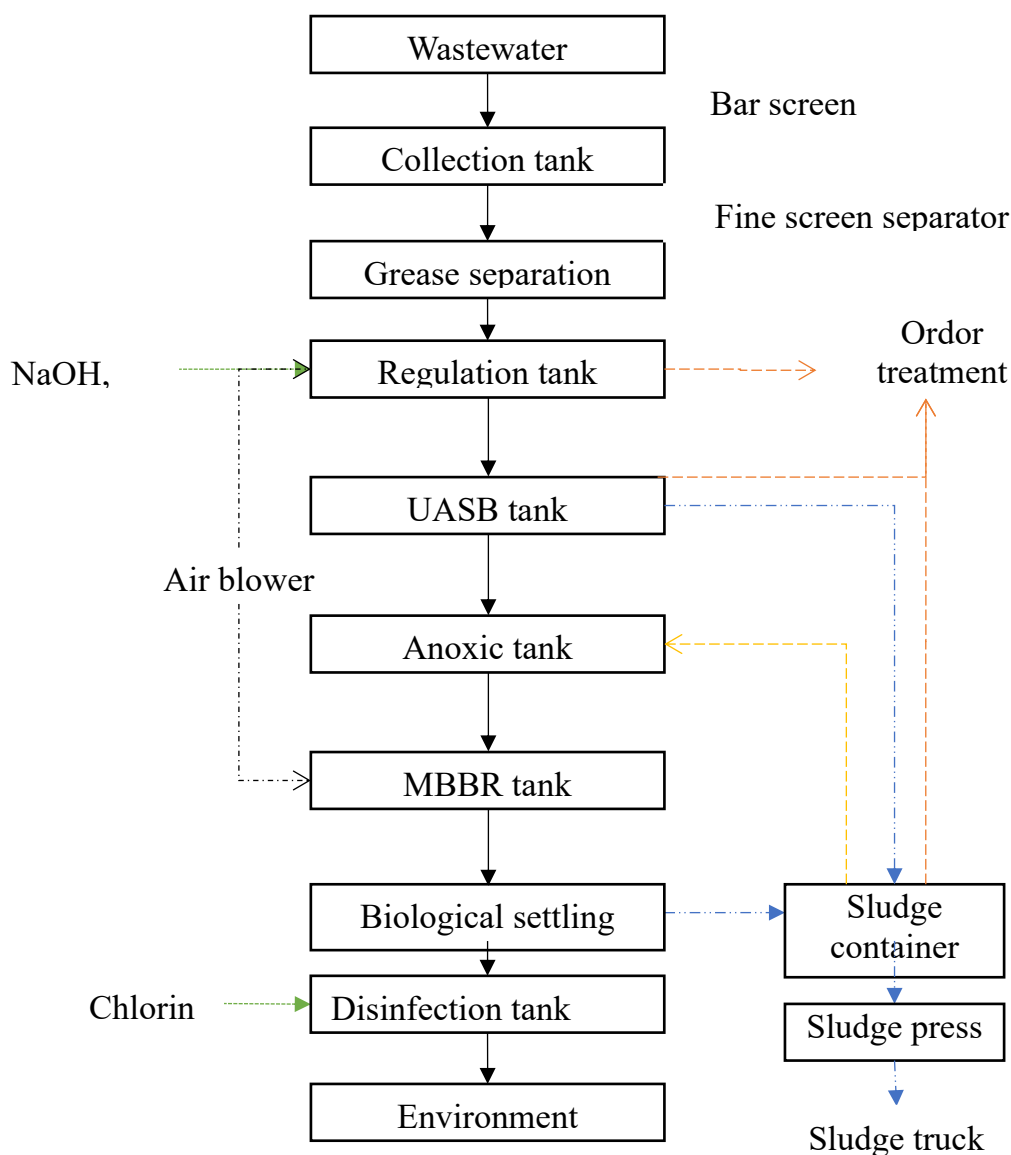


Figure 1-8: Wastewater treatment system flow chart

- Location of the wastewater treatment system:

- + Subproject 1: Located in the southern area of the project site.
- + Subproject 2: Located in the eastern area (Hoa Loc Fishing Port).

- Wastewater receiving sources:

Subproject 1: Treated wastewater meets the standards of QCVN 11-MT:2015/BTNMT, Column B ($K_q=0.9$; $K_f=1.1$) and QCVN 14:2025/BTNMT, Column B ($F \leq 20,000$) will be discharged into the drainage ditch along the southern road of Hoang Truong Fishing Port.

Subproject 2: Treated wastewater meets the standards of QCVN 11-MT:2015/BTNMT, Column B ($K_q=0.9$; $K_f=1.1$) and QCVN 14:2025/BTNMT, Column B ($F \leq 20,000$) will be discharged into De Canal.

- Wastewater discharge locations (VN2000 coordinates, central meridian $105^{\circ}00$, 3° projection zone):

Subproject 1: X = 220072; Y = 599480.

Subproject 2: X = 2200367; Y = 598166

1.8. Total investment and implementation schedule

❖ Total project investment:

Not exceeding VND 400,000,000,000, equivalent to USD 16.93 million. Project's financial mechanism:

- IBRD loan from the World Bank: Approximately VND 329.55 billion, equivalent to USD 13.95 million.
- Counterpart fund: Approximately VND 70.45 billion, equivalent to USD 2.98 million.

The total investment of each subproject is summarized in the following table:

Table 1-12: Total investment of subprojects

(Exchange rate: 1 USD = 26,090 VND according to VCB's exchange rate on 22.04.2025)

No.	Subprojects	Investment capital (VND)	USD
1	Subproject 1- Upgrading and expansion of Hoang Truong fishing port	117,107,182,331	4,488,585
2	Subproject 2- Upgrading and expansion of Lach Truong fishing port and storm shelter area in Hoa Loc commune, Hau Loc district	59,383,335,936	2,276,096
3	Subproject 3- Upgrading aquaculture area infrastructure in Nga Thuy, Nga Tan, and Nga Tien communes, Nga Son district	27,205,700,000	1,042,764
4	Subproject 4- Upgrading aquaculture area infrastructure in Hoang Yen commune, Hoang Hoa district	22,624,119,000	867,157
5	Subproject 5- Upgrading aquaculture area infrastructure in Hoang Phong commune, Hoang Hoa district	9,424,045,000	361,213

6	Subproject 6- Upgrading aquaculture area infrastructure in Hoang Luu commune, Hoang Hoa district.	11,935,722,000	457,483
7	Subproject 7- Upgrading aquaculture area infrastructure in Hoang Chau commune, Hoang Hoa district.	12,881,863,400	493,747
8	Subproject 8- Upgrading aquaculture area infrastructure in Da Loc commune, Hau Loc district.	10,880,060,225	417,020
9	Subproject 9- Construction, upgrading aquaculture area infrastructure Quang Trung commune, Quang Xuong district	17,097,000,000	655,309

❖ Project Implementation Schedule: Estimated 6 years (2023–2028)

- Project preparation: 2023 – 2025
- Construction: 2026 – 2028
- Acceptance and commissioning: 2027 – 2028

1.9. Project implementation arrangement

Project implementation arrangement:

- Thanh Hoa Provincial People's Committee is the governing body; the Thanh Hoa Project Management Unit of Construction investment works for Agricultural and Rural Development is the project owner.
- Project management method: The project owner organizes the implementation of the construction investment project in accordance with the Land Law, the Law on Environmental Protection, and the Construction Law. The project is carried out under the form of direct management by the project owner. The project owner will establish a Project Management Unit to administer the project implementation.
- Project implementation method: The project owner will invest in and construct the project in compliance with current investment and construction management regulations and other relevant regulations. The content of investment implementation, the schedule of construction items, and economic and technical targets shall be carried out according to the investment approval resolution of the competent authority.
- Construction management:
 - The project owner, Thanh Hoa Project Management Unit of Construction investment works for Agricultural and Rural Development, directly organizes and manages the project.
 - Consultants: Responsible for providing the project owner with consultancy service on surveys, design, engineering, and other services during construction, as well as supervising and managing construction quality.
 - Construction teams: Responsible for executing the construction under the management of the Project Management Unit and functional departments of the Company.

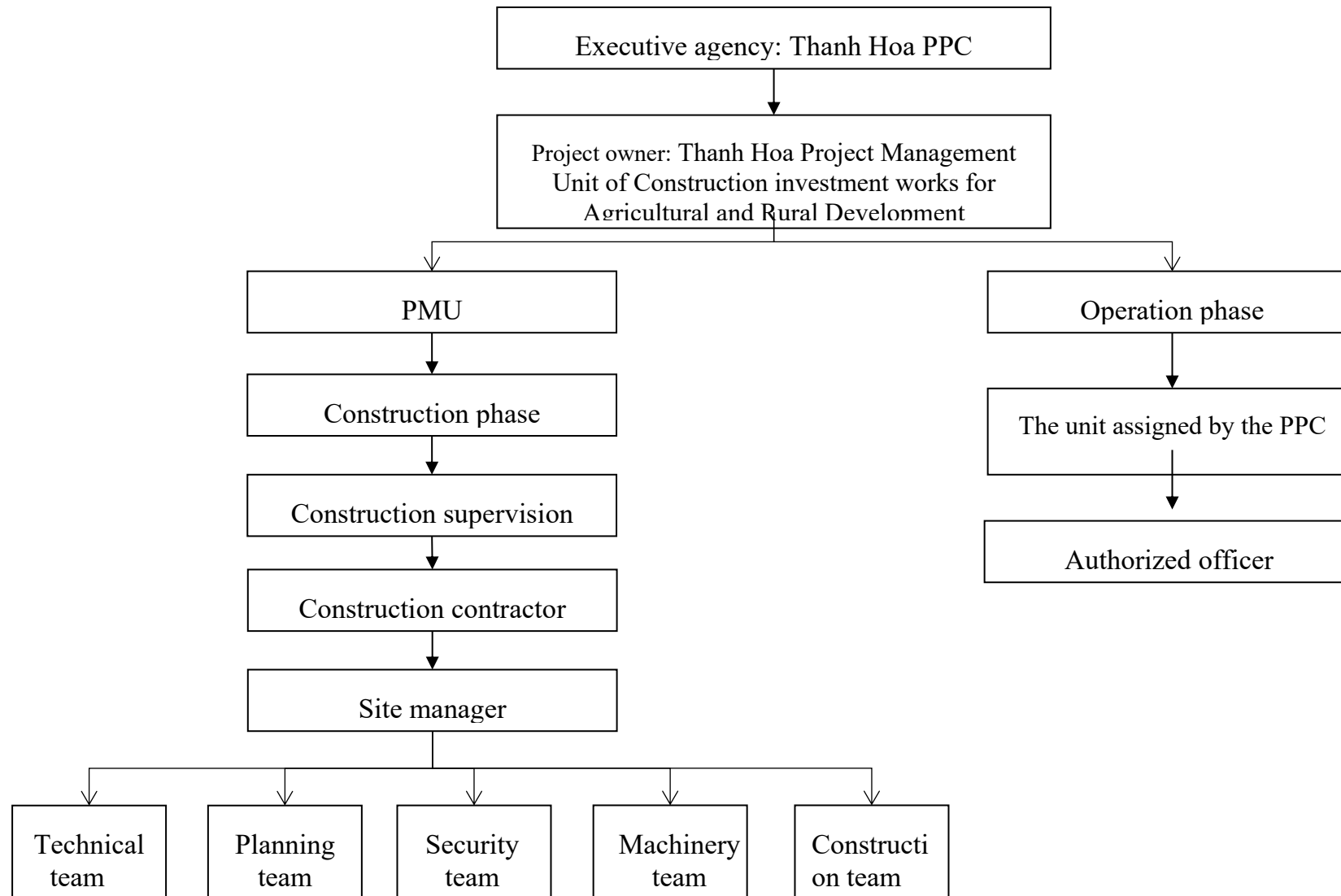


Figure 1-9: Project management organization chart

CHAPTER 2. NATURAL, ENVIRONMENTAL AND SOCIO-ECONOMIC CONDITIONS

2.1. NATURAL CONDITIONS

2.1.1. *Geographical location*

a. **Geographical conditions**

Project “Sustainable Fisheries Development in Thanh Hoa Province” comprises 9 subprojects, covering the territories of 7 communes: Hoang Tien, Hoang Chau, Nga Son, Tan Tien, Hoa Loc, Van Loc, and Quang Chinh in Thanh Hoa Province. Thanh Hoa Province is located at the northernmost part of the North Central Coast region of Vietnam, with geographical coordinates ranging from 19°18'–20°40' North latitude and 104°22'–106°05' East longitude. The administrative boundaries of Thanh Hoa are defined as follows:

- To the north: bordering Hoa Binh, Son La, and Ninh Binh provinces;
- To the south: bordering Nghe An province;
- To the west: bordering Houaphanh province of the Lao People’s Democratic Republic;
- To the east: bordering the East Sea.

The total natural area of Thanh Hoa is 1,113,193.81 hectares (accounting for 3.37% of Vietnam’s total area), including Agricultural land: 860,843 ha, Forestry land: 600,061 ha, Special-use land: 70,804.90 ha, Residential land: 52,004.32 ha, Unused land: 88,891 ha. Thanh Hoa plays a vital role in socio-economic development as well as national defense and security in both the North Central Coast region and nationwide.

Geographical features of the communes covered by the 9 subprojects are as follows:

- Hoang Tien and Hoang Chau communes (Eastern Thanh Hoa): Coastal communes characterized by low-lying coastal plains interspersed with estuaries and tidal flats, favorable for agriculture, aquaculture, and capture fisheries.
- Hoa Loc and Van Loc communes (Northeastern Thanh Hoa): Coastal communes with fishing ports and sandy beaches suitable for fishing and seafood processing. The flat terrain with wetland and low-lying areas, advantageous for agriculture and aquaculture development.
- Nga Son and Tan Tien communes (Northeastern Thanh Hoa): Lowland communes with extensive wetlands, swamps, and river mouths, favorable for aquaculture. These localities are also traditionally known for sedge mat weaving.
- Quang Chinh commune (Eastern Thanh Hoa): A coastal commune with flat terrain and fertile soil, suitable for agriculture and marine economic development. The coastal zone includes tidal flats, aquaculture areas, bathing beaches, and strong potential for marine tourism development.

2.1.2. *Climate and meteorological conditions*

Temperature: During the year, there are two distinct seasons: The cold season from November to April, with an average temperature of 19.2°C (in 2023). The coldest temperature was recorded in January 2023 (average 16.1°C); however, on some days the temperature dropped as low as 7–8°C. The hot season lasts from May to October, with an average temperature of 28°C. The hottest month was June 2023; the average temperature in the month was 29.5°C; however, peak daily temperatures reaching 38–39°C.

Air Humidity: Air humidity is one of the important factors affecting the process of dispersion and transformation of pollutants. According to statistics in 2023, the annual average humidity was 85.4%; with a maximum monthly average of 91%, and a minimum of 79%. Air humidity

varies by season, but is not significant: humidity is slightly lower in the dry season and moderately higher in the rainy season.

Rainfall: Rainfall plays a key role in purifying pollutants in the air and diluting pollutants in the water, therefore, the pollution level in the rainy season is often lower than in the dry season. The rainy season lasts for six months from May to October. The month with the highest rainfall was October (180.3 mm in 2022, 115.8 mm in 2023); the month with the lowest rainfall was February (12.8 mm in 2022, 5.2 mm in 2023); the average number of rainy days in the year was 137 days. Rainfall in the year is concentrated from June to the end of October each year and accounts for about 80% of the total annual rainfall.

Sunshine: On average, sunshine hours increase during the summer months (from May to October), reaching between 111–197 hours (in 2022) and 136–253 hours (in 2023), with peak in June, July, and August. Meanwhile, the winter months (from November to February of the following year) records the lowest sunshine duration, with as little as 4 hours (for example, in January 2022 there were only 4 sunshine hours).

Fog: Fog often occurs in winter and spring. The number of foggy days in the year is concentrated in November and December, ranging from 6–8 days, contributing to higher air and soil humidity.

2.1.3. Topographic and geological features

2.1.3.1. Topographical features

a. Topographical characteristics of subproject 1

Hoang Tien Commune (formerly Hoang Truong Commune, Hoang Hoa District) is a coastal alluvial plain commune; however, the terrain is highly dissected. Characteristically located on the coastal sandy barrier, the foreshore area consists of undulating sand dunes forming a natural barrier running parallel to the coastline, predominantly covered with perennial grasses and *Casuarina equisetifolia* (casuarina trees) serving as windbreaks and sand-fixing vegetation. Behind the dunes lies a low-lying, narrow depression, topographically lower than the dune belt, suitable for cultivation of crops such as sweet potatoes, sesame, peanuts, mulberries, and various vegetables. The area near the foothills of the Linh Truong mountain range has a significant groundwater reserve, with lower-lying terrain favorable for wet-rice cultivation. The pedogenesis in this area is primarily influenced by long-term marine sediment deposition processes: sand accumulation by littoral currents, combined with fluvial alluvium transported by the Red River and Ma River estuaries. Additionally, alluvium from the Lach Truong River (historically a tributary of the Ma River), together with estuarine tidal dynamics, has contributed to sediment accretion over thousands of years, forming the present geomorphological landscape. The Lach Truong River traverses the northern boundary of the commune with a length of approximately 2.1 km.

The results of the topographic survey of the project area show that the project site is located along the southern bank of the Lach Truong River (Lach Truong Estuary), within Hoang Truong Commune, and includes a portion of land currently being leveled. The terrain elevation across the study boundary, from the shoreline towards the outer limit of the surveyed area, ranges from +2.9m to -7.27m



Figure 2-1: Topographic plan of the subproject area

b. Topographical characteristics of subproject 2

Hoa Loc Commune (formerly Hoa Loc Commune, Hau Loc District) was formed through long-term fluvial–marine sediment accretion processes. The terrain is relatively flat, sloping gradually from the northwest to the southeast, which is favorable for the development of the fisheries and aquaculture economy.

The subproject area is located on the Lach Truong River sandbank and the Kenh De River sandbank, approximately 1 km from the Lach Truong Estuary. The Lach Truong River at the study area has a width ranging from 125 to 200 m, with a relatively steep gradient. At a distance of about 20 m from the riverbank, the average riverbed elevation reaches -4.30 m.

The navigational channel entering from the Lach Truong Estuary belongs to the inland waterway route managed by the Vietnam Inland Waterways Administration. The channel has a width of 40 m, with a 15 m protection corridor. The total width of the channel and its protection corridor is 70 m.

c. Topographical characteristics of subproject 3

The subproject area is located within the administrative boundaries of Nga Son Commune and Tan Tien Commune (formerly Nga Thuy, Nga Tan, and Nga Tien Communes of Nga Son District). The area exhibits the topographical characteristics of the coastal plain, with a relatively flat terrain dissected by drainage canals. The elevation difference between the riverbank and the riverbed ranges from 3 to 4 meters. Transportation along the riverbanks is relatively difficult, especially during the rainy season.

d. Topographical characteristics of subproject 4, 5, 6, 7

he areas of Subprojects 4, 5, 6, and 7 are located within Hoang Tien Commune and Hoang Chau Commune (formerly Hoang Yen, Hoang Phong, Hoang Luu, and Hoang Chau Communes of the former Hoang Hoa District). These areas exhibit the typical topographical characteristics of the coastal plain, with a relatively flat terrain dissected by drainage canals. The elevation difference between the riverbank and the riverbed ranges from 3 to 4 meters. Some topographical and geomorphological features in these areas are as follows:

- Elevation of dikes and internal roads: (+1.50) ÷ (+2.80).
- Elevation of river-side floodplain: (+1.30) ÷ (+1.50).

- Elevation of inland fields: $(+0.01) \div (+0.60)$.

e. Topographical characteristics of subproject 9

The topography of Quang Chinh Commune (formerly Quang Trung Commune, Quang Xuong District) belongs to the delta region, characterized by terrain fragmented by a network of rivers and canals. The Yen River flows along the western and southern boundaries of the commune with a length of approximately 9.0 km, while the Hoang River passes through the central area of the commune with a length of about 2.0 km.

2.1.3.2. Geological Characteristics

a. Geological Characteristics of Subproject 1

Based on the results of the geotechnical investigation for Subproject 1 – Upgrading and Expanding Hoang Truong Port, conducted by the Consortium of Agricultural and Rural Infrastructure Construction Consulting Co., Ltd., Minh Khai Holdings Co., Ltd., and VINASENA Construction Consulting JSC in September 2024. At the construction site, 11 boreholes were drilled. Based on the results of field investigations and laboratory testing, the stratigraphy of the surveyed area is divided into soil and rock layers from top to bottom as follows:

Geological Conditions of the Berth and Operation House Area:

- Layer 1: Topsoil – Greyish green to dark grey silty mud containing organic matter. Flowing state. Average thickness: 0.45 m. To be removed.
- Layer 2: Greyish green to dark grey clayey silt containing organic matter. Plastic–flowing to flowing state. Thickness varies from 0.8–1.8 m. Average thickness: 1.18 m.
- Layer 3: Consists of sub-layers 3a and 3b.
 - o Layer 3a: Silty sand interbedded with thin layers of clayey silt containing organic matter, greyish green to dark grey in color. Plastic–flowing state. Thickness varies from 0.7–1.4 m. Average thickness: 0.98 m. Bearing capacity $R_0 = 58$ kPa; Deformation modulus $E_0 = 3,333$ kPa.
 - o Layer 3b: Fine to medium sand containing shell fragments (clams, oysters), greyish green to dark grey in color. Loose to medium-dense state, water-saturated. Thickness varies from 0.4–1.3 m. Average thickness: 0.85 m. Bearing capacity $R_0 = 170$ kPa; Deformation modulus $E_0 = 12,000$ kPa.
- Layer 4: Gravel mixed with small pebbles and clayey sand, yellowish grey, brownish yellow, greyish green to dark grey in color. Medium dense to dense state. Encountered only in borehole BCC3. Thickness: 1.70 m.
- Layer 5: Strongly weathered siltstone and sandstone, decomposed into sandy silt with fine gravel, fragments, few small pebbles, mottled yellowish grey, purplish brown, greyish green. Semi-hard state. Thickness varies from 1.5–4.5 m. Average thickness: 2.50 m.
- Layer 6: Moderately to slightly weathered siltstone and sandstone, yellowish grey, greyish green, mottled purplish.
 - o Upper part: Fairly hard, brittle, producing fragmented core samples (slam structure).
 - o Lower part: Hard, brittle, producing blocky core samples. Thickness varies from 3.2–4.5 m. Average thickness: 3.72 m.

Geological Conditions of the Foreport Basin:

- Layer 1: Topsoil – Greyish green to dark grey silty mud containing organic matter. Flowing state. Average thickness: 0.60 m.
- Layer 2: Greyish green to dark grey clayey silt containing organic matter. Flowing to plastic–flowing state. Thickness varies from 1.5–2.3 m. Average thickness: 1.96 m.
- This is a very weak soil layer with large deformation potential but very low permeability. It can support only small structures, and proper ground improvement measures are required before placing foundations on this layer.
- Layer 3a: Silty sand interbedded with thin layers of clayey silt containing organic matter, greyish green to dark grey. Plastic–flowing state. Thickness varies from 2.0–2.4 m. Average thickness: 2.20 m.
- Layer 4: Gravel mixed with small pebbles and clayey sand, yellowish grey, brownish yellow, greyish green to dark grey. Average thickness: 0.43 m.
- Layer 5: Strongly weathered siltstone and sandstone, decomposed into sandy silt with fine gravel, fragments, few small pebbles, mottled yellowish grey, purplish brown, greyish green. Semi-hard state. Encountered at the bottom of boreholes LT1 and LT5.

b. Geological Characteristics of Subproject 2

Based on the results of the geotechnical site investigation, the stratigraphy of the surveyed project area is as follows:

Geology of the Port Construction Area:

- Layer 1: Clayey silt containing organic matter, brownish grey to dark grey in color. Flowing to plastic–flowing state. Encountered in two boreholes BCC1 and BCC2. Thickness varies from 1.2–2.7 m, with an average thickness of 1.95 m.
- Layer 2: Fine sand with a small amount of clam and oyster shells and organic matter, greyish green to dark grey in color. Loose, water-saturated state. Encountered in boreholes BCC1 and BCC2. Thickness is consistent at 2.3 m.
- Layer 3: Clayey silt containing organic matter with sand lenses, dark grey to greyish green in color. Plastic–flowing state. Encountered in boreholes BCC1 and BCC2. Thickness varies from 1.7–3.0 m, with an average thickness of 2.35 m.
- Layer 4: Silty clay containing organic matter, dark grey to greyish green in color. Plastic–flowing to soft plastic state. Encountered in boreholes BCC1 and BCC2. Thickness varies from 5.9–10.9 m, with an average thickness of 8.40 m.
- Layer 5: Silty clay with a small amount of gravel, mottled yellowish grey, whitish grey, and greyish green in color. Stiff plastic to soft plastic state. Encountered only in borehole BCC1. Thickness is 3.00 m.
- Layer 6: Strongly weathered shale and siltstone, decomposed into silty clay with gravel, fragments, and small blocks, mottled yellowish grey, brownish yellow, greyish green, and reddish brown in color. Semi-hard state. Encountered in boreholes BCC1 and BCC2. Thickness varies from 4.4–4.6 m, with an average thickness of 4.50 m.
- Layer 7 (coded as No. 7 on the geological cross-section): Moderately to slightly weathered shale and siltstone, mottled yellowish grey, brownish yellow, and reddish brown in color. Upper part: Fairly soft, friable rock, producing fragmented core samples (slam structure). Lower part: Fairly hard rock, brittle, producing blocky core samples. The top and bottom depths of this layer were not fully penetrated in either borehole BCC1 or BCC2. Thickness ranges from 3.0–5.0 m, with an average thickness of 4.0 m.

Geology of the Foreport Basin:

Based on borehole exploration in the surveyed area with a maximum depth of 5.0 m, combined with Standard Penetration Test (SPT) results and laboratory soil testing. Single layer: Clayey silt containing organic matter, clam and oyster shells, interbedded with very thin layers of silty sand, brownish grey, dark grey, and greyish green in color. Flowing to plastic–flowing state. Thickness recorded is 5.0 m.

Geology of the Lach Truong Fishing Vessel Anchorage Area

Based on borehole exploration in the surveyed area with a maximum depth of 5.0 m, combined with laboratory soil testing, the stratigraphy consists of 4 layers from top to bottom:

- Layer 1 (coded as No. 1 on the geological cross-section): Clayey silt containing organic matter, brownish grey, dark grey, and greyish green in color. Flowing to plastic–flowing state (locally interbedded with thin silty sand layers). Encountered in all boreholes of both components. Thickness varies from 2.3–5.0 m, with an average thickness of 3.81 m.
- Layer 2a (coded as No. 2a): Fine sand with a small amount of clam and oyster shells and organic matter, greyish green to dark grey in color. Loose, water-saturated state. Encountered in boreholes KND1 and KND2. Thickness varies from 0.9–1.0 m, with an average thickness of 0.95 m.
- Layer 2b (coded as No. 2b): Fine sand with a high content of organic matter and clam/oyster shells, greyish green to dark grey in color. Loose, water-saturated state. Encountered in boreholes KND4 and KND5. Thickness varies from 1.2–2.3 m, with an average thickness of 1.75 m.
- Layer 3 (coded as No. 3): Clayey silt containing organic matter interbedded with thin silty sand layers, dark grey to greyish green in color. Plastic–flowing state. Encountered in boreholes KND1 and KND2 of both components. Thickness varies from 1.1–1.8 m, with an average thickness of 1.45 m.

c. Geological Characteristics of Subproject 3

Engineering Geology of Phu Son Sluice

Based on the borehole exploration data in the surveyed area, with a maximum exploration depth of 9.0m combined with soil sample testing results, the stratigraphy of Phu Son 2 Sluice consists of 4 layers distributed from top to bottom as follows:

- First layer: In the geological profile designated as No. 1. Alluvial channel bed deposit: Silty clay with organic matter, grayish green, dark gray in color. State: soft to very soft plastic (flow to soft plastic). Encountered in boreholes HKC2 and HKC3. Thickness varies from 0.3 – 0.4m, with an average thickness of 0.35m.
- Second layer: In the geological profile designated as Layer D. This layer is only found in borehole HKC1. Thickness: 4.2m.
- Third layer: In the geological profile designated as No. 2. Silty clay containing organic matter, dark gray to grayish green. State: very soft plastic. Encountered in all three boreholes HKC1, HKC2, and HKC3. Thickness ranges from 0.8 – 1.2m, with an average thickness of 0.93m.
- Fourth layer: In the geological profile designated as No. 3. Sandy clay (clayey silt) in brownish gray, pinkish brown, dark brown. State: very soft plastic. Encountered in all three boreholes HKC1, HKC2, and HKC3. Thickness ranges from 3.6 – 5.9m, with an average thickness of 5.10m.

Engineering Geology of Phu Son 2 Canal

Based on the borehole exploration data in the surveyed area, with a maximum exploration depth of 6.0m combined with soil sample testing results, the stratigraphy of Phu Son 2 Canal consists of 4 layers distributed from top to bottom as follows:

- First layer: In the geological profile designated as No. 1. Alluvial channel bed deposit: Silty clay containing organic matter, dark gray to grayish green. State: plastic to very soft plastic. Encountered in boreholes HKK1 and HKK2. Thickness is constant at 0.50m.
- Second layer: In the geological profile designated as Layer Đ. Encountered in boreholes HKK3 and HKK4. Thickness ranges from 1.2 – 1.6m, with an average thickness of 1.40m.
- Third layer: In the geological profile designated as No. 2. Silty clay containing organic matter, dark gray to grayish green. State: very soft plastic. Encountered in all four boreholes HKK1, HKK2, HKK3, and HKK4. Thickness ranges from 0.7 – 1.9m, with an average thickness of 1.43m.
- Fourth layer: In the geological profile designated as No. 3. Sandy clay (clayey silt), brownish gray, pinkish brown, dark brown. State: very soft plastic. Encountered in all four boreholes HKK1, HKK2, HKK3, and HKK4. Thickness ranges from 2.2 – 3.0m, with an average thickness of 2.63m.

Engineering Geology of Bao Trieu Canal

Based on the borehole exploration data in the surveyed area, with a maximum exploration depth of 6.0m combined with soil sample testing results, the stratigraphy of Bao Trieu Canal consists of 4 layers distributed from top to bottom as follows:

- First layer: In the geological profile designated as No. 1. Encountered in boreholes HKK1, HKK2, HKK3, HKK4, and HKK5. Thickness ranges from 0.5 – 0.8m, with an average thickness of 0.64m.
- Second layer: In the geological profile designated as Layer Đ. Encountered in boreholes HKK6 and HKK7. Thickness ranges from 0.9 – 1.1m, with an average thickness of 1.00m.
- Third layer: In the geological profile designated as No. 2. Encountered in all 7 boreholes HKK1, HKK2, HKK3, HKK4, HKK5, HKK6, and HKK7. Thickness ranges from 1.2 – 2.3m, with an average thickness of 1.64m.
- Fourth layer: In the geological profile designated as No. 3. Clay and silty clay, brownish gray, pinkish brown, light purple. State: very soft plastic. Encountered in all 7 boreholes HKK1–HKK7. The top and bottom depth of the layer was not fully penetrated in any of the boreholes. Thickness varies from 1.8 – 2.8m, with an average thickness of 2.19m.

d. Geological Characteristics of Subproject 4

According to the results of borehole investigations and laboratory testing, the stratigraphic profile of the area consists of the following layers:

- Layer B: Composition: Silty clay, gray-brown, grayish-green, grayish-black in color, containing organic humus. State: Soft plastic – fluid-plastic. Areal distribution: This layer occurs at the surface, mainly within the canal bed and adjacent paddy fields on both canal banks, with a thickness ranging from 0.3–0.4 m. Geotechnical characteristics: Due to its composition and unstable condition, being located immediately at the surface.
- Layer Đ1 – Road embankment fill: Composition: Clay to clayey silt with gravel fragments, yellow-gray to reddish-brown in color, semi-hard consistency. Origin: Man-

made embankment fill. Areal distribution: Distributed along the road embankment (left bank of the canal). Average thickness: ~1.5 m.

- Layer Đ – Canal embankment fill: Composition: Clay, yellow-brown in color, stiff-plastic, locally semi-hard. Origin: Man-made embankment fill. Areal distribution: Distributed along the canal embankment (right bank of the canal). Average thickness: ~2.2 m.
- Layer 1: Composition: Clay, grayish-green to grayish-black, containing organic inclusions. State: Soft-plastic – fluid-plastic. Origin: Fluvio-marine deposits (amQIV). Areal distribution: Extensively distributed throughout the surveyed canal alignment, underlying silt Layer B. Thickness: From K0 to K2, the average thickness is about 1.0 m; from K2 to the end of the alignment, thickness is >2.0 m.
- Layer 2: Composition: Clay, grayish-green to grayish-gray in color, State: Stiff-plastic, Origin: Fluvio-marine deposits (amQIV). Areal distribution: Occurs beneath Layer 1, at the initial section of the alignment from K0 to K0+300. Thickness: Thin (<0.5 m); the maximum thickness recorded at borehole HK2 is 0.5 m.
- Layer C: Composition: Fine-grained sand, grayish-green in color, intercalated with silty clay, loose structure. Origin: Fluvio-marine deposits (amQIV). Areal distribution: Found beneath Layer 1, distributed at the downstream section of the canal alignment, from K3+500 to the end. Maximum thickness: 1.5 m (recorded at borehole HK15).

e. Geological Characteristics of Subproject 5, 6, and 7

- Layer B: Silty clay, grayish-brown to dark gray in color, containing plant humus. Thickness ranges from 0.3–0.7 m.
- Layer Đ (Embankment fill): Fill soil composed of clay and clayey silt, yellowish-brown in color. Consistency: soft-plastic to stiff-plastic. This layer is distributed along the alignment of the dyke embankment, paddy field margins, and internal rural roads. Thickness varies from 0.7–2.5 m.
- Layer 1: Clay, grayish-green to dark gray, containing organic matter, locally intercalated with sand lenses. Consistency: soft-plastic to fluid-plastic. This layer occurs extensively across the surveyed area. Average thickness is approximately 2.2–3.0 m.
- Layer 2: Fine-grained sand, grayish-green to grayish-brown in color, locally intercalated with clay and clayey silt, medium-dense to loose structure. This layer occurs extensively across the surveyed area, with an average thickness of about 3.50 m.

The stratigraphy within the project construction area consists of soil layers with relatively uniform distribution; however, bearing capacity varies, particularly in Layer 1. Therefore, the following considerations should be taken into account during design and construction:

- Appropriate ground improvement measures should be adopted to treat weak soil layers. Specific treatment depth should be determined through design analysis and selection. During construction, attention should be paid to groundwater seepage into excavation pits.
- When constructing structural components, stockpiling of materials should be avoided at canal banks, weak points, or vulnerable slopes to prevent bank sliding or collapse.
- Heavy vehicles exceeding the allowable load should not be permitted to travel or operate on the dyke, to ensure safety for local residents and structural stability of the dyke alignment.

f. Geological Characteristics of Subproject 8.

The stratigraphic structure of the surveyed area from top to bottom is as follows:

- First layer: Alluvial channel fill deposit: Grayish-black silt containing organic humus. Consistency: soft plastic to flowing plastic. This layer was encountered in boreholes HKC2 and HKC3. The thickness of the layer is constant at 0.50 m.
- Second layer: Concrete pavement of the culvert made of aggregate 1x2 with a thickness of 0.20 m. The embankment soil consists of excavated waste soil: silty clay mixed with various types of brick and stone fragments, grayish-brown to yellowish-brown in color. Consistency: dense to medium dense, soft plastic. This layer was encountered only in borehole HKC1. The thickness of the layer is 1.0 m.
- Third layer: This layer was encountered in all three boreholes HKC1, HKC2, and HKC3. The thickness of the layer varies from 0.50 m to 1.50 m, with an average thickness of 0.87 m.
- Fourth layer: Silty clay containing organic humus and interbedded lenses of silty fine sand, grayish-black to bluish-gray in color. Consistency: flowing plastic. This layer was encountered in all three boreholes HKC1, HKC2, and HKC3. The thickness of the layer is constant at 1.50 m.
- Fifth layer: Silty clay, grayish-brown to dark brown in color. Consistency: flowing plastic. This layer was encountered in all three boreholes HKC1, HKC2, and HKC3. The thickness of the layer varies from 0.60 m to 0.80 m, with an average thickness of 0.70 m.
- Sixth layer: Medium-grained sand containing organic humus, bluish-gray to grayish-black in color. State: loose, saturated. This layer was encountered in all three boreholes HKC1, HKC2, and HKC3. The thickness of the layer varies from 0.60 m to 0.70 m.
- Seventh layer: Silty clay, grayish-black to bluish-gray in color. Consistency: soft plastic to flowing plastic. This layer was encountered in all three boreholes HKC1, HKC2, and HKC3. The thickness of the investigated layer varies from 1.00 m to 1.60 m, with an average investigated thickness of 1.23 m.

g. Geological Characteristics of Subproject 9

The stratigraphic structure of the survey area from top to bottom is as follows:

- First layer: Alluvial channel fill deposit: Bluish-gray to dark gray silt containing organic humus. Consistency: soft plastic to flowing plastic. This layer was encountered in boreholes HKC2 and HKC3. The thickness of the layer is constant at 0.30 m.
- Second layer: Embankment soil (dyke fill): Silty clay, grayish-brown, grayish, to yellowish-brown in color. Consistency: medium dense to dense, moist, soft plastic to stiff plastic (with desiccation cracks resembling bird-foot patterns, resulting in high drilling fluid loss). This layer was encountered only in borehole HKC1. The thickness of the layer is 1.80 m.
- Third layer: Silty clay containing organic humus, bluish-gray to dark gray in color. Consistency: flowing plastic. This layer was encountered in all three boreholes HKC1, HKC2, and HKC3. The thickness of the layer varies from 1.20 m to 2.80 m, with an average thickness of 1.77 m.
- Fourth layer: Sandy silt mixed with silt containing organic humus, bluish-gray to dark gray in color. Consistency: plastic to flowing plastic (intercalated with thin layers of silty clay containing organic humus, dark gray in color, consistency ranging from flowing plastic to soft plastic). This layer was encountered in all three boreholes HKC1, HKC2, and HKC3. The thickness of the layer is constant at 3.40 m.
- Fifth layer: Silty fine to very fine sand containing organic humus, bluish-gray to dark gray in color. Consistency: loose to medium dense, saturated. This layer was

encountered in all three boreholes HKC1, HKC2, and HKC3. The thickness of the investigated layer varies from 1.00 m to 2.00 m, with an average investigated thickness of 1.37 m.

2.1.4. Hydrological Conditions

The subprojects within the project scope are located in coastal and lowland areas across seven communes of Thanh Hoa Province, including Hoang Tien, Hoang Chau, Nga Son, Tan Tien, Hoa Loc, Van Loc, and Quang Chinh. These areas are influenced by major river basins such as the Ma River, Yen River, Lach Truong River, Len River, and Can River. Specifically:

- Subproject (Subp) 1, Subp 2, and Subp 4, 5, 6, 7 are situated within the Lach Truong River basin (a branch of the Ma River).
- Subp 3 is influenced by the Len River (a branch of the Ma River).
- Subp 8 is located near the lower reaches of the Can River.
- Subp 9 lies within the Yên River basin, one of the major rivers of Thanh Hoa Province.

The hydrological characteristics of the main rivers in the project area are described as follows:

❖ *Ma River*

The Ma River is 512 km long, originating from the Vietnam–Laos border area, in the southern part of Dien Bien Province, where it discharges into the sea at the Hoi estuary. Its drainage basin covers approximately 28,400 km², of which over 10,000 km² is within Vietnam. The river network density is 0.66 km/km², with 39 primary tributaries, among which the Chu River, Len River, and Lach Truong River are the main distributaries. The Ma River exhibits a flood season flow of approximately 650–750 m³/s and a dry season flow of around 50–90 m³/s. The river experiences irregular tidal influences, which are particularly pronounced during the dry season, contributing to droughts and saline intrusion in the lower reaches.

❖ *Can River*

The Can River is located along the border of Ninh Binh and Thanh Hoa provinces in Vietnam. It essentially represents the lower reach formed by the confluence of four upstream rivers: Tong River, Hoat River, Tam Diep River, and But River. The Can River serves as a flood drainage channel and acts as a natural boundary of the North Central region. Its flood season flow is approximately 100–120 m³/s, while the dry season flow is low, only about 10–25 m³/s, which can lead to localized droughts.

❖ *Yen River*

The Yen River (also known as Muc River or Chuoi River, with a branch called Nha Le River) is one of the rivers in Thanh Hoa Province. It originates in Binh Luong (Nhu Xuan), flows through Nhu Thanh, Nong Cong, Quang Xuong, Nghi Son, and empties into the East Sea at the Lach Ghep estuary. The river is 94.2 km long, with a drainage basin area of 1,996 km² (49.5% lowlands and semi-mountainous areas, 45.2% forested and mountainous areas). The total runoff of the Yen River is 961×10⁶ m³ during the flood season and 185×10⁶ m³ in the dry season. Its main tributaries include the Nhom River, Hoang River, ThiLong River, and Ly River, which help regulate floods and distribute water during the dry season.

❖ *Len River*

The Len River shares its water source with the Ma River at Bong and discharges into the sea at the Lach Sung estuary. The river is 40 km long, with a flood season flow of approximately 100–150 m³/s and a dry season flow of 30–50 m³/s derived from the Ma River to meet domestic and agricultural demands. The river plays a significant role in supplying irrigation water and flood drainage for coastal areas. Both banks are protected by dikes to safeguard local communities and agricultural production.

❖ **Lach Truong River**

The Lach Truong River branches off from the Ma River at Tuan Junction, flowing eastwards into the sea at the Lach Truong estuary. The main river is 22 km long, with wide riverbanks. Water from the Ma River only flows into Lach Truong during the flood season, while in the dry season, Lach Truong is affected by tidal influences from both the Ma River and the sea. Lach Truong serves as a key drainage channel for the Hoang Hoa and Hau Loc areas.

2.1.5. Current Status of Biological Resources in the project area

The subprojects are located in the communes of Hoang Tien, Hoang Chau, Nga Son, Tan Tien, Hoa Loc, Van Loc, and Quang Chinh – which are coastal communes of Thanh Hoa Province. The local economy is primarily based on agriculture and aquaculture. Specifically, the coastal areas (Hoang Tien, Hoang Chau, Hoa Loc, Van Loc) have well-developed aquaculture models including clam farming, tiger shrimp, and brackish water fish, while the inland lowland areas mainly cultivate rice, short-cycle crops, and fruit trees. Overall, the project area is predominantly an agricultural ecosystem, with no presence of rare or endangered species listed in the Red Book.

Terrestrial Ecosystems:

The vegetation surrounding the project area is primarily composed of agricultural ecosystems, including:

- Plants: Eucalyptus trees and various fruit trees such as jackfruit, longan, pomelo, and bananas; as well as wild grasses and single-season rice cultivated by local households.
- Animals: Terrestrial fauna include soil-dwelling species such as reptiles, amphibians (frogs), birds, and rodents.

Aquatic Ecosystems:

- Plants: The project area is associated with river and lake systems including Thach Luyen River, Thuong Hoa Lake, and Bang River. The dominant aquatic vegetation includes planktonic algae such as diatoms (Silic algae), cyanobacteria, green algae, and filamentous algae, as well as floating plants such as water hyacinth and cultivated single-season rice. Algal diversity is higher in natural water bodies compared to aquaculture ponds.
- Animals: The aquatic fauna in the project area includes groups such as Protozoa, Copepoda (copepods), Cladocera (water fleas), Rotatoria (rotifers), Ostracoda (seed shrimps), and insect larvae. Among these, rotifers are the most abundant group, followed by copepods. Additionally, the water bodies host a diversity of aquatic animals including shrimp, fish, snails, and freshwater mussels.

Mangrove Forests:

- Mangrove forests in Thanh Hoa Province play an important role in environmental protection, disaster prevention, and supporting livelihoods for coastal communities. The total mangrove forest area in Thanh Hoa is estimated at approximately 822 ha, mostly planted forests, distributed mainly along the coastal areas of Hoang Hoa, Hau Loc, and Nga Son. Mangrove forests mitigate the impacts of sea waves and tidal surges, protect dikes, and safeguard coastal settlements. Since 2017, Thanh Hoa Province has replanted and restored over 337 ha of mangroves, particularly in Da Loc Commune in Hau Loc District.
- Several clusters of mangrove forests located 2–5 km away from the project area, serving as wave barriers and protecting coastal dikes and residential areas. However, all subproject locations are situated more than 2 km away from these mangrove areas or their buffer zones.

In conclusion, the project area is characterized solely by conventional agricultural and aquaculture ecosystems; there are no rare or specially protected species, and the subprojects do not have negative impacts on mangrove ecosystems.

2.1.6. Natural Disasters and Climate Change

The coastal and lowland areas of Thanh Hoa Province frequently experience tropical storms, which can significantly affect the coastal districts of the province from July to November each year. Common natural disasters in the area include storms, storm surges, heavy rainfall causing flooding, and flash floods, typically concentrated in September. Severe droughts and cold spells usually occur from December to February. Additionally, tornadoes, whirlwinds, and hailstorms may occasionally occur, though with low frequency.

According to the annual summary reports on natural disaster prevention and control in Thanh Hoa Province, in recent years the province has experienced an average of 30 disaster events per year, including 3 tropical storms, 1 tropical depression, 8 heavy rainfall events, 5 tornadoes, thunderstorms with rain, 4 landslides, 6 heatwaves, and 3 cold spells. Typical events are described as follows:

- + *Heavy Rainfall*: Occurred on 05–06/5, 06–10/6, 25/6, 07–10/7, 26–28/8, 07–09/9, 13–15/9, and 24–27/9, resulting in 1 death; 23 houses damaged; 202 ha of rice fields, 398 ha of seasonal crops, 587 ha of annual plantations, and 13 ha of forest damaged; 9 livestock and 55 poultry killed; 247 sites of road embankment erosion with a total volume of approximately 59,000 m³; and other property losses.
- + *Thunderstorms, Tornadoes, and Lightning with Rain*: Occurred on 03/5, 09/5, 13/5, 29/7, and 05/9 in the districts of Nhu Xuan, Quan Hoa, Nhu Thanh, and Thuong Xuan, resulting in 2 deaths (due to lightning); damage included 5 houses, 43 ha of rice, 5 ha of forest, and 1 ha of seasonal crops, as well as other assets.
- + *Heatwaves*: From 20–22/4, 09–23/5, 26–31/5, 14–30/6, 01–04/7, and 25–31/7/2021, severe heatwaves occurred in many parts of the province with maximum temperatures ranging from 37–41°C and minimum relative humidity of 40–55%.
- + *Storm No. 2 (June 2021)*: From the night of 11/6 to the morning of 13/6/2021, Thanh Hoa Province experienced rain, moderate to heavy in some areas, with total rainfall ranging from 30–80 mm, peaking at 108 mm at Ngoc Tra Telemetry Station, Quang Xuong. Impacts included 9 houses, 2 ha of maize, 63 ha of vegetables, road embankment erosion at 224 locations with a total volume of approximately 17,280 m³, and other property losses.
- + *Storm No. 8 (October 2021)*: From 13–16/10/2021, the province experienced rainfall of 80–140 mm due to the combined effects of Storm No. 8, cold air influx, and tropical convergence over the North Central region. Some lowland districts recorded rainfall up to 190 mm, causing 1 house to be urgently relocated, 7 houses affected by landslides, 3 school sites impacted, 2 ha of rice, 90 ha of seasonal crops damaged, and road embankment erosion at 31 locations totaling approximately 6,530 m³, as well as other property losses.

Damage from Natural Disasters :

In 2021, natural disasters in Thanh Hoa Province caused 3 deaths and 1 injury; damaged 39 houses, required urgent relocation for 5 houses, 33 houses affected by landslides; destroyed 260 ha of rice, 2 ha of maize, 552 ha of seasonal crops and vegetables, 590 ha of annual plantations; killed 9 livestock and 55 poultry; caused road embankment erosion and sediment deposition at 651 locations with a total volume of approximately 182,610 m³, undercut slope erosion at 44 locations totaling 295 m in length, and other losses. The estimated total damage value was approximately 66.5 billion VND.

In 2023, Thanh Hoa Province experienced 25 natural disaster events, including 5 tornadoes, 7 heavy rainfall events, 1 tropical storm, and 12 heatwaves. In 2024, the province experienced 27 natural disaster events, including storms, heavy rainfall, floods, and landslides, causing significant human and property losses. Detailed damage reports have not yet been fully released.

2.2. CURRENT STATUS OF ENVIRONMENTAL COMPONENT QUALITY

In order to assess the baseline environmental quality in the subproject sites, the project owner coordinated with the environmental monitoring unit, KGZ Investment Joint Stock Company (holding VIMCERTS Certificate No. 320), to conduct surveys, measurements, and environmental sampling and analyses (including air, surface water, groundwater, wastewater, soil, and sediment) at each subproject site. The environmental sampling and analysis were conducted on October 23, 24, and 30, 2024. The information on the quality of environmental components in the project area is as follows:

Table 2-1: Quality results of environmental components in the project area

No.	Sample	Number of samples	Monitoring parameters	Result
1	Air sample	11 samples (Each Subproject (Subp) takes 1 sample, Subp 3 takes 3 samples)	Temperature, Humidity, Wind Taed, Noise (LAeq), Total Suspended Particulate Matter (TSP), SO ₂ , NO ₂ , CO, H ₂ S.	The results of monitoring the ambient air quality in the project area show that all indicators are within the allowable limits of QCVN 05:2023/BTNMT: National technical regulation on ambient air quality (average in one hour). Noise parameters of the project area are within the allowable limits according to 26:2010/BTNMT: National technical regulations on noise. This result shows that the ambient air quality in the project areas remains relatively good, with no signs of pollution.
2	Surface Water sample	22 samples (Each subproject takes 2 samples, Subp 3 takes 6 samples)	pH, Turbidity, Salinity, Total Dissolved Solids (TDS), Total Suspended Solids (TSS), COD, BOD ₅ , Chloride (Cl ⁻), Ammonium (NHC as N), Nitrite (NO ₂ ⁻ as N), Nitrate (NO ₃ ⁻ as N), Phosphate (PO ₄ ³⁻ as P), Total N, Iron (Fe), Total Oil, Grease, Coliform	According to the results of surface water quality monitoring, at all monitoring points, most of the values are lower than the allowable limit according to QCVN 08:2023/BTNMT, except for some indicators of COD, BOD ₅ , Ammonium, and Surfactants exceeding the allowable standards according to QCVN 08:2023/BTNMT. Specifically: + At sampling point NM1.1 - Subp1: COD exceeds 1.46 times; BOD ₅ exceeds 1.33 times, Ammonium exceeds 1.73 times; At sampling point NM1.2 - Subproject 1: BOD ₅ exceeds

No.	Sample	Number of samples	Monitoring parameters	Result
				1.01 times, Ammonium exceeds 1.53 times. The results show that the river water in the area shows signs of organic and nutrient pollution due to fishing and living activities. + At sampling point NM2.1 - Subp2: Chloride exceeds 5 times; at sampling point NM2.2 - Subp2: Chloride exceeds 4.68 times. The results show that the river water in the area shows signs of Chloride pollution, possibly due to the process of cleaning fishing boats, washing fish, and salting fish to preserve them, causing salt to leak into the environment. + At sampling point NM3.1.1 - Subp3: Fe exceeds 1.86 times; at sampling point NM3.2.1 - Subp3: Fe exceeds 2.7 times; At sampling point NM3.2.2 - Subp3: Ammonium exceeds 40 times; At sampling point NM3.3.1 - Subp3: Chloride exceeds 1.7 times; At sampling point NM3.3.2 - Subp3: Chloride exceeds 1.56 times. The results show that the surface water in the canal is quite seriously polluted with organic matter. + At sampling point NM4.1 – Subp4: Ammonium exceeded 2.2 times, Nitrite exceeded 2.4 times; At sampling point NM4.2 – Subp4: Ammonium exceeded 2.6 times, Nitrite exceeded 2.2 times. The results show that the surface water in the canal is organically polluted. + At point NM5.1 – Subp5, Ammonium is 2.16 times higher, sample NM5.2 – Subp5 has: Ammonium is 2.56 times higher. The results show signs of organic pollution. + At sampling point NM6.2 – Subp6: BOD5 exceeds 2.0 times. The results show that the surface water in the canal is organically polluted.

No.	Sample	Number of samples	Monitoring parameters	Result
				+ At sampling point NM7.1 – Subp7, Fe is 2.1 times higher. The results show that surface water in the canal is organically polluted.
3	Groundwater samples	11 samples (Each subproject takes 1 sample, Subp3 takes 3 samples)	pH, Total Dissolved Solids (TDS), Hardness, Sulfate, Chloride, Nitrite, Nitrate (NO ₃ ⁻ as N), Ammonium, Iron (Fe), Arsenic (As)	Analysis results indicate that the groundwater quality in Subprojects 1, 2, 3, 5, 6, 7, 8, and 9 is relatively good, with no signs of pollution detected. At the sampling locations, most of the analyzed parameters fall within the permissible limits of QCVN 09:2023/BTNMT. However, for the NN4 soaking water sample in Subproject 4, the ammonium concentration exceeds the QCVN 09:2023/BTNMT limit by 2.44 times. It was observed that additional water in Subproject 4 is being stored locally.
4	Wastewater Samples: Wastewater was collected from existing facilities (Subprojects 1 and 2) and from aquaculture areas	11 samples (one sample per Subproject, except Subproject 3, where 3 samples were taken).	pH, TDS, Total Suspended Solids (TSS), COD, BOD ₅ , Nitrite (NO ₂ ⁻ as N), Phosphate (PO ₄ ³⁻ as P), Chloride (Cl ⁻), Ammonium (NH ₄ ⁺ as N), Nitrate (NO ₃ ⁻ as N), Iron (Fe), Total Oil and Grease, Coliforms.	The measured wastewater parameters in the project area (from existing facilities – Subprojects 1 and 2 – and aquaculture zones) show that most discharge parameters are within the permissible limits of QCVN 40:2011/BTNMT, Column B. However, the NT9 sample (wastewater from Subproject 9) has TSS exceeding the standard by 1.52 times. Overall, wastewater quality is largely within allowable limits. Nevertheless, TSS levels in Subproject 9 require monitoring and control during construction..
5	Soil Samples	11 samples were collected (one sample per Subproject, except Subproject 3, where 3 samples were taken)	Total Phosphorus, Total Nitrogen, Total Chromium (Cr), Cadmium (Cd), Copper (Cu), Lead (Pb), Zinc (Zn), Arsenic (As).	The soil quality analysis shows that all heavy metal parameters are within the permissible limits according to QCVN 03:2023/BTNMT (Category 2). During the project construction, the topsoil layer will be removed. Depending on the soil characteristics, decisions will be made regarding its reuse or disposal. Therefore, quality soil excavated during construction

No.	Sample	Number of samples	Monitoring parameters	Result
				of the project components can be reused for foundations or other purposes, or disposed of as ordinary waste..
6	Sediment Samples	11 samples were collected (one sample per Subproject, except Subproject 3, where 3 samples were taken)	Arsenic (As), Cadmium (Cd), Lead (Pb), Mercury (Hg), Copper (Cu), Zinc (Zn), Total Nitrogen, Total Phosphorus, pH (H ₂ O), pH (KCl)	The analysis indicates that the concentrations of heavy metals in sediments within the project area are significantly lower than the permissible limits specified in the National Technical Regulation on Sediment Quality (QCVN 43:2017/BTNMT). Therefore, the sediment material classified under the subproject is non-hazardous and not contaminated with heavy metals. Consequently, the dredged sediment can be used in perennial crop cultivation, urban landscaping, or landfilling based on the practical needs of local residents. Otherwise, sediment materials from the subproject will be collected, transported, and disposed of at temporary storage areas approved by the local authorities.

Detailed tables of environmental quality monitoring results are provided in Appendix 2.

2.3. SOCIO-ECONOMIC CONDITIONS

The “Sustainable Fisheries Development Project in Thanh Hoa Province” comprises nine subprojects, spanning the administrative boundaries of seven communes: Hoang Tien, Hoang Chau, Nga Son, Tan Tien, Hoa Loc, Van Loc, and Quang Chinh in Thanh Hoa Province. These areas were formerly part of 11 communes across four districts, including: Hoang Truong, Hoang Yen, Hoang Phong, Hoang Luu, and Hoang Chau in the former Hoang Hoa District; Hoa Loc and Da Loc in the former Hau Loc District; Nga Thuy, Nga Tan, and Nga Tien in the former Nga Son District; and Quang Trung in the former Quang Xuong District.

Currently, there are no socio-economic statistics available for the seven newly merged communes following the administrative boundary reorganization effective from July 1, 2025. Therefore, this report uses the 2024 statistical data of the 11 former communes as baseline information for assessing the environmental and social impacts of the project.

2.3.1. Social conditions

Population: According to the 2024 statistical data provided by the People’s Committees of the 11 former communes (currently consolidated into 7 communes) within the project area, the total population is 86,228 people, equivalent to 20,462 households, accounting for approximately 2.33% of Thanh Hoa Province’s total population (3.7 million people).

Regarding gender structure, the male population in the project area is 43,220, representing 50.1%, while the female population is 39,880, representing 49.9%. Similarly, the male-to-female ratio for Thanh Hoa Province is comparable, with males accounting for approximately

50.2% and females 49.8%. Thus, the gender distribution within the project area is relatively balanced and consistent with the provincial average, although minor variations exist between communes. For example, Nga Tien Commune has a notable male predominance (5,571 males and 2,858 females), whereas Hoang Yen Commune has slightly more females than males (2,185 males and 2,257 females).

Population Density: The project area has a population density of 877 people/km², significantly higher than the provincial average of 315 people/km², meaning the project area's density is approximately 2.78 times higher than that of the province. Certain communes have densities above the average, such as Hoang Truong (1,921 people/km²), Hoa Loc (1,696 people/km²), and Quang Trung (910.9 people/km²), while communes like Nga Tan (450 people/km²) and Hoang Yen (448.2 people/km²) have lower densities.

Table 2-2: Population, population density of communes in the project area

Subproject	Commune	Natural area (Ha)	Total population			HH	Population Density (People/Km2)
			Total	Male (People)	Femal (People)		
SP 1	Hoang Truong	598.85	11,511	5,653	5,858	2,572	1,921
SP 2	Hoa Loc	717.73	12,175	6184	5991	3,087	1,696
SP 3	Nga Tan	1,513.96	6,819	3,568	3,251	1,749	450
	Nga Tien	582.06	8,429	5,571	2,858	1,387	1,148
	Nga Thuy	647,82	6,325	2,760	2,787	1,775	856
SP 4	Hoang Yen	990,91	4,442	2,185	2,257	1,108	448,2
SP 5	Hoang Phong	909.28	7,023	3,642	3694	1,735	772
SP 6	Hoang Luu	585.355	6,025	1,472	1425	1,145	1029
SP 7	Hoang Chau	1,235	9,640	4,796	4,844	2,233	780
SP 8	Da Loc	1401.37	8,155	4,169	3,986	2,123	582
SP 9	Quang Trung	675	6,149	3,220	2,929	1,634	910,9
Total		9,834.3	86,228	43,220	39,880	20,462	877

(Source: People's Committees of communes, November 2024)

Working-Age Population: The proportion of the working-age population varies significantly among the communes within the project area. Across the total population of each commune, the working-age group ranges from 18.3% to 75.7%. Hoang Yen Commune has the highest proportion of working-age residents at 75.7%, reflecting a young population structure and abundant human resources. Other communes with relatively high labor participation include Nga Tan (63.1%), Quang Trung (62.1%), Da Loc (62.1%), and Hoang Phong (61.5%). Conversely, Hoang Luu Commune has the lowest proportion of working-age population at only 18.3%, indicating a relatively limited labor force in this locality, which may be due to an aging population or high out-migration of workers.

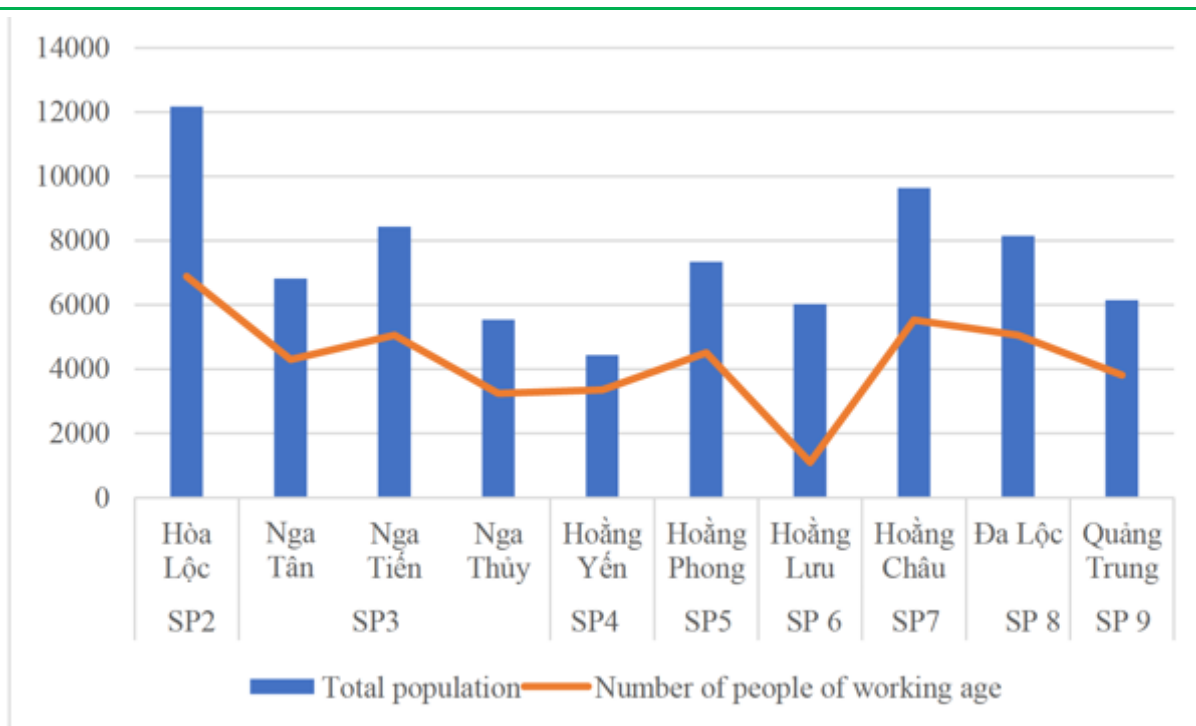


Figure 2-2: Number of people of working age in the project area

(Source: People's Committees of communes, November 2024)

Income: According to the per capita income data in 2024, the communes within the project area have income levels higher than the provincial average of Thanh Hoa (VND 55.2 million/person/year). Most communes in the project area exceed this provincial average, except for Da Loc Commune (VND 55.1 million/person/year), which is almost equivalent to the provincial average. Quang Trung Commune has the highest income, reaching VND 76.5 million/person/year, approximately VND 21.3 million (38.6%) higher than the provincial average. Other communes with relatively high income include Hoang Truong (VND 73.7 million), Hoang Luu (VND 68 million), Hoang Chau (VND 65.3 million), and Hoang Phong (VND 65 million). Conversely, communes with average income levels include Nga Tan, Nga Tien, Hoang Yen (all VND 59 million), Nga Thuy (VND 60 million), and Hoa Loc (VND 57 million). The income gap among communes is quite pronounced, with the highest-income commune (Quang Trung) exceeding the lowest-income commune (Da Loc) by VND 21.4 million/person/year, equivalent to 38.9%. This reflects differences in economic conditions, production and service activities, and the level of infrastructure investment among the communes. Overall, the project area has a per capita income higher than the Thanh Hoa provincial average, but significant disparities still exist between the communes.

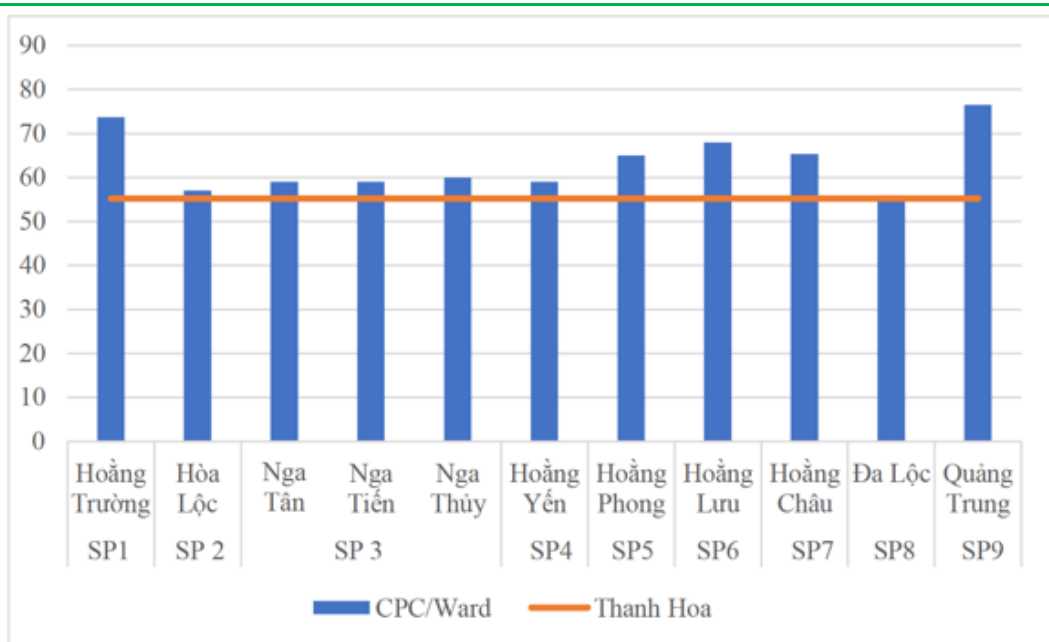


Figure 2-3: Average income per capita in communes in the project area

(Source: People's Committees of communes, November 2024))

Poverty Rate: Data from the People's Committees of the communes in the project area indicate that the multidimensional poverty rate in 2024 ranges from 0.46% to 3.19%, all of which are lower than the provincial average of 6.52%. Some communes have higher poverty rates compared to the regional average, including Nga Thủy (3.19%), Hoàng Yên (2.98%), and Nga Tiến (2.67%). Conversely, the communes with the lowest poverty rates are Hoàng Phong (0.46%), Hoàng Lưu (0.48%), and Hoàng Châu (0.62%). The gap between the commune with the highest poverty rate (Nga Thủy) and the lowest (Hoàng Phong) reaches 2.73%, reflecting significant differences in economic conditions and living standards among the communes in the project area.

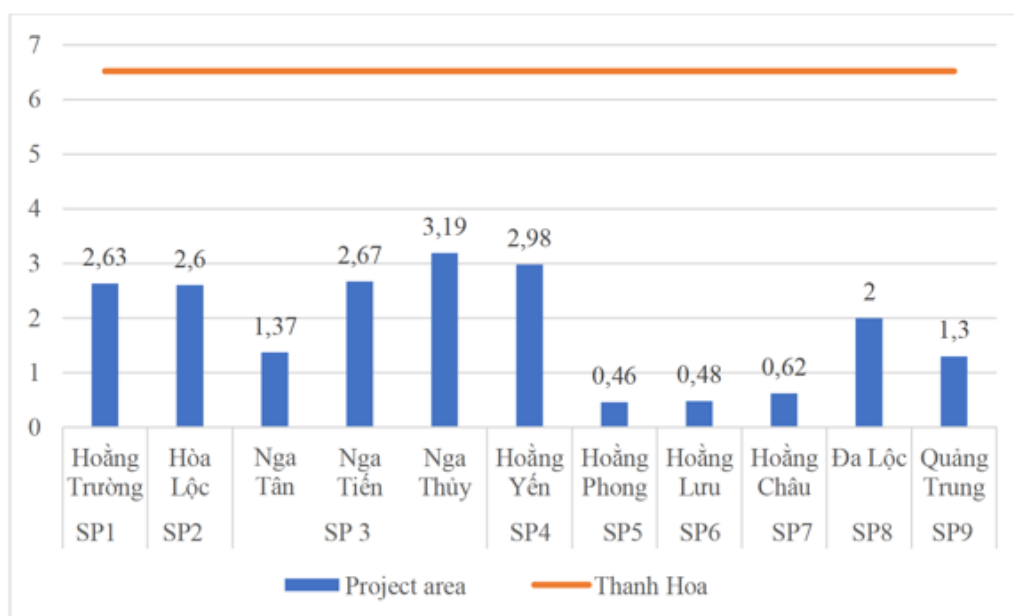


Figure 2-4: Multidimensional poverty rate of the communes in the project area in 2024

(Source: People's Committees of communes, November 2024))

2.3.2. Economic Structure

Economic Structure: The economic structure of the communes in the project area shows a clear differentiation among three sectors: agriculture, forestry and fisheries; industry and construction; and services and handicrafts. Some communes remain primarily agricultural, notably Nga Tien (59.6%), Hoang Truong (54%), Hoa Loc (52%), and Da Loc (49.5%). These communes have a high proportion of agricultural activities, reflecting dependence on crop production and aquaculture, while industry and services remain underdeveloped—for instance, Nga Tiến has only 19.4% in services and Hoang Truong only 21% in industry.

In contrast, some communes are experiencing a strong shift towards industry and construction, highlighted by Nga Tan (42.5%), Hoang Yen (39%), Hoang Luu and Hoang Chau (40%).

Meanwhile, certain communes show a well-developed service sector, such as Quang Trung (38.7%), Hoang Phong (36.9%), Hoang Luu (35%), and Hoang Chau (32%). These communes may have advantages in trade, consumer services, or tourism. However, Da Loc has the lowest service proportion (10.3%), indicating that its economy still relies predominantly on agriculture and industry.

Table 2-3: Economic structure of communes in the project area (Unit: %)

Subproject	Commune	Agriculture, forestry and fisheries	Industry and construction	Services and handicrafts
Subproject 1	Hoang Truong	54	21	25
Subproject 2	Hoa Loc	52	19	29
Subproject 3	Nga Tan	31,5	42,5	26
	Nga Tien	59,6	21	19,4
	Nga Thuy	40	30	30
Subproject 4	Hoang Yen	33	39	28
Subproject 5	Hoang Phong	31,6	31,5	36,9
Subproject 6	Hoang Luu	25	40	35
Subproject 7	Hoang Chau	28	40	32
Subproject 8	Da Loc	49,5	40,2	10,3
Subproject 9	Quang Trung	30,5	30,8	38,7

(Source: People's Committees of communes, November 2024)

❖ Fisheries Exploitation Conditions

Fishing activities are shifting from nearshore to offshore exploitation, accompanied by an increase in the capacity of larger vessels and the adoption of modern equipment. The annual catch has steadily increased, reaching approximately 130,200 tons in 2020, including: marine capture fisheries: ~120,860 tons, inland capture: ~4,140 tons. The offshore fleet (vessels ≥ 15 m) comprises 1,337 vessels. The estimated fishery resource stock is around 165,000 tons, of which offshore areas account for ~100,000 tons and nearshore & inshore areas ~65,000 tons. The offshore catch in 2020 reached 86,212 tons.

❖ Aquaculture Conditions

Aquaculture in the region has developed steadily, with a trend toward implementing best practice models (VietGAP), including certification and traceability systems. Both cultivated area and production volume have increased consistently, especially in rice-fish systems and freshwater and brackish water aquaculture. The primary farming methods are improved extensive systems, gradually transitioning to semi-intensive, intensive, and integrated farm operations. Productivity is approximately 2.2 tons/ha for improved extensive systems and 8–10 tons/ha for intensive systems.

2.4. CURRENT STATUS OF TECHNICAL INFRASTRUCTURE OF THE SUBPROJECT AREA

2.4.1. Transportation System

🚦 Current Transport Conditions – Subproject 1

❖ Road Transport:

The project site borders the existing external road connecting Hoang Yen – Hoang Truong and links to Provincial Road D.510. The section passing through the project area has a length of 850 m, with a concrete pavement structure. The carriageway is 5.5 m wide, and the total width including the pavement and shoulders averages 8 m. Along the southern side of the road is the existing residential area, while the northern side borders the waters of Lach Truong. There are currently no designated parking lots in the area; vehicles are mostly parked at private residences.

❖ Inland Waterway Channel

The inland waterway channel extends from the western side of Lach Truong River mouth to the sea. The channel has a width of 40 m, with a protected corridor of 15 m on each side, resulting in a total water surface width of 70 m (Source: Directorate for Inland Waterways). The edge of the protected corridor of the inland waterway passing through the study area is located approximately 15–55 m south of the existing embankment. There is currently no centralized clean water supply in the project area.

🚦 Current Transport Conditions – Subproject 2

❖ External Transport

The northern dike road of Hoa Loc Port and the western road of the Fishery Port Management Board (Cross-section 1-1) connect to Xuan Loc Commune to the west and Diem Pho Urban Area to the north. Within the planned area, the road length is approximately 436 m, with a roadbed width of 7.5–10.0 m, carriageway width of 6.5–7.0 m, shoulder width of 0.5–1.5 m, and a cement concrete pavement.

The western dike road along Kenh De (Cross-section 2-2) connects to Diem Pho Urban Area to the north and Xuan Loc Commune to the west. The road length within the planned area is approximately 1.3 km, with a roadbed width of 4.5–7.5 m, carriageway width of 3.0–4.0 m, shoulder width of 0.5–2.0 m, and a cement concrete pavement.

The eastern dike road along Kenh De (Cross-section 3-3) connects to Minh Loc Commune to the north and south, and Hai Loc Commune to the east. The road length within the planned area is approximately 2.0 km, with a roadbed width of 6.5–10.5 m, carriageway width of 4.5–5.5 m, shoulder width of 1.0–3.0 m, and a cement concrete pavement.

❖ Internal Transport:

Within the planned area, there is Vich ferry dock to the north and Lach Truong ferry dock to the south, connecting Hoa Loc Commune in the west with Hai Loc Commune in the east.

At Hoa Loc Port, there is a pier with a width of 11.5–13.5 m and a port yard with dimensions of 49.0–68.0 m. Both the pier and yard are constructed with cement concrete.

🚦 Current Transport Conditions – Subproject 3

The transportation routes leading to the project area include the main roads as follows: Inter-communal Road Nga Son – Tan Tien: Carriageway width of 4.5–5.5 m, shoulder width of 1.0–3.0 m, with cement concrete pavement. Provincial Road 527B: Length of approximately 12 km, asphalt concrete pavement, road width about 6.5–7.0 m. Provincial Road 524: Asphalt concrete

pavement, road width about 6.5–7.0 m. National Route 10: Length of 45 km, carriageway width 13–14 m, pavement structure made of asphalt concrete.

In addition, around the project area there are several other local roads, all of which have been reinforced with concrete and connected to the main roads in the area. The regional transport network is relatively convenient for transporting construction materials and carrying out construction activities.

Current Transport Conditions – Subproject 4

The transportation routes leading to the project area include the main roads as follows: Inter-communal Road Hoang Yen – Hoang Truong and Provincial Road 510: Current conditions are similar to the access roads to the Subproject 3 area mentioned above.

In addition, surrounding the project area there are several other local roads, all of which have been reinforced with concrete, with a width of 4.5–5.5 m, and connected to the main roads in the area. The regional transport network is relatively convenient for the transportation of construction materials and carrying out construction activities.

Current Transport Conditions – Subproject 5

Current Status of the Transportation Network and Facilities: The project is located near transportation routes such as National Highway 1A, inter-communal and inter-village roads, with widths ranging from 4 to 12 meters, featuring either concrete or asphalt pavement. In addition, there are several smaller internal roads within the fields.

Current Status of Rivers and Irrigation Canals for Agricultural Use: Within Hoang Phong Commune, there are internal irrigation canals that supply water for agricultural production and aquaculture. The main canal systems are primarily gravity-fed, following the natural terrain.

Current Transport Conditions – Subproject 6

Current Status of the Transportation Network and Facilities: The project is located near transportation routes such as National Highway 1A, inter-communal and inter-village roads, with widths ranging from 4 to 12 meters, featuring either concrete or asphalt pavement. In addition, there are several smaller internal field roads.

Current Status of Rivers and Irrigation Canals for Agricultural Use: Within Hoang Luu Commune, there are internal irrigation canals supplying water for agricultural production and aquaculture. The main canal systems are primarily gravity-fed, following the natural terrain.

Current Transport Conditions – Subproject 7

Current Status of the Transportation Network and Facilities: The project is located near transportation routes such as National Highway 1A, inter-communal and inter-village roads, with widths ranging from 4 to 12 meters, featuring either concrete or asphalt pavement. In addition, there are several smaller internal field roads.

Current Status of Rivers and Irrigation Canals for Agricultural Use: Within Hoang Chau Commune, there are internal irrigation canals supplying water for agricultural production and aquaculture. The main canal systems are primarily gravity-fed, following the natural terrain.

Current Transport Conditions – Subproject 8

Current Status of the Transportation Network and Facilities: The project is located near transportation routes such as National Highway 1A, National Highway 10, National Highway 217, as well as inter-communal and inter-village roads with widths ranging from 4 to 12 meters, featuring either concrete or asphalt pavement. In addition, several smaller internal field roads exist.

Current Status of Rivers and Irrigation Canals for Agricultural Use: Within Đa Lộc Commune, there are internal irrigation canals supplying water for agricultural production and aquaculture. The main canal systems are primarily gravity-fed, following the natural terrain.

Current Transport Conditions – Subproject 9

Current Status of the Transportation Network and Facilities: The project is located near National Highway 1A and local inter-communal/village roads (width 4–12 m, concrete or asphalt), along with smaller internal roads.

Current Status of Rivers and Irrigation Canals for Agricultural Use: Irrigation canals in Quảng Trung Commune supply water for agriculture and aquaculture, following natural terrain.

2.4.2. Electricity and Telecommunications

- Subproject 1: The national electricity grid passes through the area, ensuring power supply for local residents and the subproject.
- Subproject 2: There is a 10 kV medium-voltage power line and 3 transformer stations with a total capacity of 1,060 kVA, ensuring electricity supply for the port. The existing telecommunications infrastructure includes three operators (Vinaphone, Viettel, Mobifone), providing 3G, 4G, and 5G services.
- Subprojects 3 & 4: Electricity supply systems are already available for residential, production, and business purposes.
- Subprojects 5–9: The national electricity grid passes through these areas, ensuring power supply for local residents and the subprojects.

2.4.3. Water Supply

- Subproject 1: The existing water supply comes from the Hai Tien Tourist Area clean water system. Currently, water is supplied through a D160 pipeline along Đ.510 road leading to But Pagoda.
- Subproject 2 : The existing water supply comes from the Bai Trung clean water plant system. A D160 pipeline runs along the road to Hoa Loc Commune (the western road of Hoa Loc Fisheries Industrial Cluster).
- Subprojects 3–9: There is no centralized clean water supply for residential areas. Households near these subprojects currently rely on drilled wells. During the construction phase, arrangements will be made to connect to existing household water sources or purchase clean water (tank or container).

2.4.4. Drainage, Wastewater Treatment, and Environmental Sanitation

Subprojects 1 and 2

There is no separate drainage or wastewater treatment system. Domestic wastewater and rainwater flow together through roadside ditches and are discharged directly into the Lach Truong River, causing unsanitary conditions and environmental pollution.

A complete waste collection and treatment system is not in place. Some waste is buried, burned on-site, or dumped near riverbanks or the sea; the remainder is collected and transported to centralized treatment facilities (for SP 2). Waste mainly originates from port activities, residents, and seafood processing facilities. Wastewater discharge, oil, and grease from fishing vessels into rivers and the sea are common, polluting water and affecting the coastal landscape.

 **Subprojects 3–9:** There is no wastewater drainage system or solid waste collection system.

2.4.5. Current Status of Fishing Ports, Fishing Vessels, and Aquatic Resource Exploitation

Subproject 1

Current Status of Fishing Ports

Hoang Truong Fishing Port was built in 2008 and put into operation in 2009. Classified as a Class III fishing port, it can accommodate 50 vessels of 450 CV, with a seafood throughput of 5,500 tons/year.

Existing Infrastructure:

- The quay embankment for mooring spans approximately 400 m within the project boundary. The embankment is constructed of tightly packed rubble stone, with several degraded sections and sediment accumulation along the embankment. Illegal landfills by surrounding residents for spontaneous commercial activities over the years have reduced its operational efficiency.
- Private boat repair areas are scattered along the foot of Linh Truong Mountain, outside the project boundary, along with spontaneous fill areas and rail tracks for boat repairs within the project boundary.
- The navigation channel is shallow and not dredged, making it difficult for large-capacity vessels to load and unload.
- Port infrastructure (berths, access roads, lighting, canopies, etc.) has not yet been invested.

Currently, it is estimated that more than 300 fishing vessels from Hoang Truong Commune and neighboring communes unload cargo here, with an annual throughput of approximately 2,000–3,000 tons.

Table 2-4: Statistics on the number of vessels managed by Hoang Hoa district

No.	Ship length	Quantity (pieces)
1	<6m	770
2	6m ÷ <12m	15
3	12m ÷ <15m	23
4	15m ÷ <24m	121
5	> 24m	09
6	Total	938

(Source: Thanh Hoa Fisheries Department)

The volume of seafood processed at the port is approximately 2,000–3,000 tons per year, including: fermented fish (churp: fish, moi), frozen processing (fish, shrimp, squid), dried fish, dried squid, dried moi, etc.

With the current fleet mostly composed of small vessels (length <6 m accounting for a large proportion), the mooring and berthing arrangements are spontaneous and lack formal planning based on vessel size. This leads to prolonged unloading times, significant reduction in fish quality, and consequently unstable income for fishermen. The management system has not addressed critical issues such as: Environmental pollution at the shoreline and port areas due to low awareness among fishermen and local residents. Embankment erosion at multiple points, with rubble stones displaced over time by tides, compromising riverbank safety. Navigation channels not dredged, making it very difficult for large-capacity vessels to dock and unload.

Subproject 2

Current Status of Fishing Port:

Hoa Loc Fishing Port is a Class II port, covering approximately 3.5 ha, with a storm shelter area of 19.5 ha, capable of accommodating vessels up to 400 CV. The port is located in Hau Loc District, Thanh Hoa Province, and is one of the major fishing hubs in the province. Investment and Operation: The port was constructed and put into operation in 2007. It was

designed for 200–300 vessels with capacities ranging from 135–450 CV. Port Length: Approximately 270 m, of which: 120 m for vessels >400 CV and 150 m for vessels 90–400 CV. Currently, Hoa Loc Port regularly handles approximately 700 vessels (90–800 CV), with an annual cargo throughput of 30,000–40,000 tons, including 10,000–15,000 tons of seafood. The port can simultaneously accommodate unloading for 10 vessels

Trường Current Status of Lạch Truong Storm Shelter

The Lạch Truong storm shelter was invested in and put into operation in 2012, designed to accommodate 264 vessels.

- Area 1: Vessels 250–400 CV; from the entrance of De Canal along De Canal to 425 m from the canal entrance.
- Area 2: Vessels 90–250 CV; from the end of Area 1 to La La Temple, 725 m long. Vessels are moored on both sides.
- Area 3: Vessels <90 CV; from La La Temple along the De Canal dike northward past Vích ferry, 680 m long.

Areas 1 and 2, totaling approximately 1.1 km, were constructed and put into operation in 2014, including dredging of navigation channels, embankment construction, and vessel mooring systems. After nearly 10 years, sedimentation due to floods and lack of regular dredging has reduced the usable area. At low tide, mooring buoys sit on mud, narrowing the area while vessel traffic has increased. This makes navigation for storm sheltering difficult and dangerous. Vessels may need to wait hours for tide rise, with some grounding and obstructing other vessels. During storms or low tides, emergency response and vessel evacuation are delayed.

According to the current survey, two mooring areas have been severely silted, and at the entrance of the basin, when the tide is low, the water level is approximately **cos(-1)**, allowing only small vessels under 50 CV to enter. The siltation of the two mooring areas is detailed as follows:

- Area 1: 425 m long, accommodates vessels up to 400 CV. At low tide, the channel depth is only about 0.5 m, while at high tide, it reaches approximately 1.8 m.
- Area 2: 725 m long, accommodates vessels up to 250 CV. At low tide, the channel depth is about 0.2 m, and at high tide, it reaches 1.5 m.

Additionally, the Lạch Truong mooring area lacks many critical infrastructure items, including: Basin operations building, Community house, Access roads around the basin, Lighting system, Clean water supply system

During storms or low-pressure events, the access roads around the basin become muddy. Without an operations building, staff must manage vessel arrangements outdoors in rain or storm conditions, day and night, to ensure safe mooring and storm sheltering.

The right-side embankment of the mooring area serves both as flood protection and as a traffic route for local residents. However, the embankment has not been reinforced. During storms, road traffic is extremely difficult due to muddy surfaces, with water pooling in potholes and ruts, making passage very challenging.

2.5. SPECIFIC ENVIRONMENTAL AND SOCIAL CONDITIONS IN THE SUBPROJECT IMPLEMENTATION AREAS

In the area of Subproject 1

The SP 1 area is located adjacent to the Lach Truong estuary, approximately 1.5 km from the sea. The estuary within the project area has a width of about 1–1.5 km. Water quality in the

river is fairly good, and inland waterway traffic is relatively high, with many vessels seeking storm shelter during storms. Along both sides of the river, there are numerous aquaculture ponds owned by local residents, as well as some restaurants and hotels.

The residential area of Hoang Tien Commune is about 20 m from the port upgrade and expansion area, with a dense population of approximately 100 households. Within and around the Subproject implementation area (radius 300 m), there are no cultural or religious heritage sites (temples/shrines/communal houses, graves, churches) or other sensitive points.

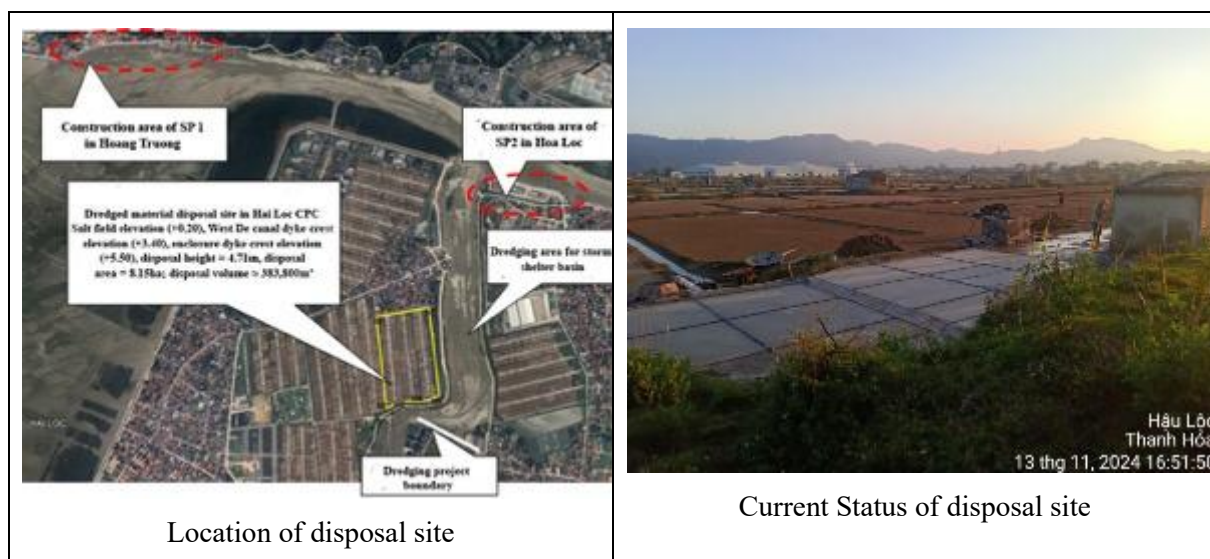
❖ **Dredged material disposal sites for SP 1 and SP 2**

The dredged material disposal sites for SP 1 and SP 2 are located in a low-efficiency salt field area in Hai Loc Commune, Hau Loc District (currently Van Loc Commune), with an area of approximately 8.15 ha and a storage capacity of up to 383,800 m³, sufficient to accommodate all dredged materials from both subprojects.

The disposal site is located about 2.5 km northwest of the SP 1 dredging area and about 0.5 km east of the SP 2 dredging area. This area is near the Lach Truong storm shelter, making it convenient for transport by barge (200–250 tons) along the Lach Truong River, and then pumping the material through pipelines to the disposal site.

Currently, the area has a dense population about 80 m from the disposal site; however, the pumping pipelines are appropriately arranged and do not affect surrounding residential activities. The disposal site location has been approved by the People's Committee of Thanh Hoa Province under Official Letter No. 9483/UBND-NNMT dated 20 June 2025.

The main transport route for dredged materials is as follows: SP area → Lach Truong River → Disposal site (distance 0.5–2.5 km). The location and current status images of the dredged material disposal site are shown in the figure below.



The area of Subproject 2

The Lach Truong River in the SP 2 area has a width of approximately 150–200 m (within the project area), located about 4 km from the sea. Near the river mouth, the river width increases to about 1,000–1,500 m. Water quality in the river is fairly good, and inland waterway traffic is relatively high, with many vessels seeking storm shelter during storms. Along both sides of the river, there are numerous aquaculture ponds owned by local residents, as well as some restaurants and hotels.

Current status of the Lach Truong storm shelter: Located approximately 500 m east of the existing fishery port, separated from residential areas, with a designed capacity for about 264 vessels. However, the storm shelter has been severely silted up. At the estuary entrance, when

the tide is low, the water level is approximately $\cos(-1)$, allowing only small vessels under 50 CV to enter. The current shelter does not meet the docking and storm-sheltering needs of vessels from Thanh Hoa province and other provinces, limiting the operational efficiency of the shelter.

The right-side dike system of the shelter functions both for flood protection and as a transportation route for surrounding residents. Currently, the dike surface is not reinforced, making transportation very difficult, especially during rainy or stormy days. The road surface is muddy and uneven, with puddles forming in potholes. The residential area of Hoa Loc Commune is about 120 m from the port upgrade and expansion area, with a dense population of approximately 40 households. Additionally, within 20–100 m from the existing port, there are several seafood processing enterprises, including: Chung Huong Frozen and Fresh Seafood Facility and Kich Hang Ice and Seafood Facility.

Within and around the SP implementation area (radius 400 m), there are cultural and religious heritage objects (temples/shrines/communal houses, graves, churches), including Truong Xa Parish Church and La Ha Palace. Details of PCR/sensitive sites will be presented in Section 2.6 below.

In the area of Subproject 3

Current status of Phu Son 2 sluice: The sluice is located under the right dike of the Can River and serves to take water from the Can River for aquaculture, combined with flood drainage. Currently, no sluice exists, and drainage still flows toward Xuan Mai 2 sluice. The sluice will be located on a relatively flat and open section at the beginning of the canal.

Current status of Phu Son 2 canal: The canal width ranges from 3 to 33 m, being widest at the head and narrowing toward the end. The canal's end section is silted, with eroded banks. Its function is to supply and drain water for aquaculture and to serve agricultural production drainage. Currently, water is taken in and drained to the Can River through Phu Son 1 sluice. There are four head sluices along the canal that have degraded and lack sufficient capacity; they need to be upgraded or replaced. A few households along the canal conduct aquaculture and fishing activities.

Current status of Bao Trieu canal: The canal width ranges from 8 to 15 m, widest at the head and narrowing toward the end. There are no inlet sluices, leading to siltation and bank erosion. The canal supplies and drains water for aquaculture and also supports local sedge cultivation, but the system lacks regulating sluices. At the canal's end, there is a transformer station and households conducting aquaculture (shrimp farming) located adjacent to the canal bank.

Current status of local population: The population density is high along the head of Phu Son 2 canal. A few aquaculture households live near the canal ends: approximately 100 m from Phu Son 2 canal and 20 m from Bao Trieu canal. Some households raise poultry, while others conduct aquaculture (shrimp farming) 20–100 m from the canals. Within and around the SP implementation area (radius 400 m), there are no cultural or religious heritage sites (temples/shrines/communal houses, graves, churches). PCR details will be presented in Section 2.6 below.

❖ *Dredged Material Storage Areas of Subproject 3*

The dredged material storage for SP 3 is arranged in 2 storage areas with a total area of 60 ha and a total capacity of 875,000 m³, sufficient to contain all dredged materials from the subproject. Storage Area 1: 15 ha, capacity 225,000 m³, Storage Area 2: 45 ha, capacity 650,000 m³

Current status of Storage Area 1 (located about 0.5 km east of the SP area): Currently an empty land owned by Mr. Mai Sy Tuan. There are no residential areas or buildings around the storage area. The storage site has an agreement for material dumping and has been approved by Mr. Mai Sy Tuan and the People's Committee of the commune.

Current status of Storage Area 2 (located about 1.0 km north of the SP area): Currently an empty land. There are no residential areas or buildings around the storage area. The storage site has an agreement for material dumping and has been approved by the People's Committee of the commune.

The main dumping route in this area is as follows: SP area → Storage Areas (distance 0.5–1.0 km).

The locations and current status images of the dredged material storage areas are shown in the figures below.

	
Location of Storage Area 1	Current Status of the Storage Area
	
Location of Storage Area 2	Current Status of the Storage Area

In the area of Subproject 4

Current Status of Son Trang 1 Culvert: Located on the small-capacity drainage embankment, currently severely damaged. The culvert gate, hinges, and concrete body are broken and collapsed, and the mouth of the culvert is buried, making it impossible to supply water for aquaculture or drainage in the area.

Current Status of Son Trang 2 Culvert: Small-capacity culvert, severely damaged. There is no control gate, and the concrete body is broken and collapsed. Water cannot be supplied for aquaculture or drained from the area.

Current Status of the Embankment: The current embankment crest is lower than the design level, averaging around +2.00 to +2.50 m. The embankment width is 2.5–4.0 m, and the slope is 1.0–1.2 m. Many embankment slopes are severely eroded. The surface has not been reinforced, making movement slippery and difficult during rainy and flood seasons, impacting aquaculture production.

Current Status of Son Trang 1 Canal: The canal serves to supply water for aquaculture, rice

cultivation, and irrigation in Hoang Tien commune through Son Trang 1 Culvert (BxH = 1.40 x 3.0 m) to the Lach Truong River. Currently, only a narrow section of the canal remains; the rest has been completely buried, causing frequent flooding.

Current Status of Son Trang 2 Canal: The canal supplies water for aquaculture, rice cultivation, and irrigation through Son Trang 2 Culvert (D80) into the earth canal and then to Lach Truong River. The canal is narrow, silted, and several banks are eroded, causing slow drainage and flooding.

Current Status of Hung Tien Canal: Supplies water for aquaculture, rice, and irrigation through a culvert under the dike (BxH = 1.60 x 2.40 m) to the Lach Truong River. The canal is narrow, silted, and banks are eroded, slowing drainage and reducing water supply for aquaculture. Existing structures: 2 combined irrigation-drainage culverts (ø80–ø100) are damaged and lack gates; 1 double D100 circular culvert is damaged.

Current Status of Nghia Thuc Canal: Supplies water for aquaculture, rice, and irrigation via a culvert under the dike (BxH = 1.80 x 2.30 m) to the Lach Truong River. The canal is narrow, silted, and banks are eroded, causing slow drainage and insufficient water for aquaculture. Existing structures: 2 culverts on the canal are damaged without gates; 6 combined irrigation-drainage culverts are damaged without gates.

Current Status of Residents: Hoang Tien commune residents are about 30 m from the construction area, sparsely populated (~10 households), mainly engaged in aquaculture and agriculture. PCR Objects: Within a 400 m radius, Thien Phuc Pagoda is nearby. Details will be provided in Section 2.6.

❖ *Dredged Material Storage for Subproject 4*

Located on vacant land in Son Trang Hamlet, Hoang Yen Commune (now Hoang Tien) with an area of 2 ha and a storage volume of 40,000 m³, sufficient for the entire dredged material of SP4. The storage site is 3 km from SP4 dredging area. No residential or public structures nearby. Approved by the local People's Committee. Disposal Route: SP area → Storage Area (0.5–3 km).

In the area of Subproject 5

Current Status of Dong Coi Canal: Supplies water for aquaculture, rice, and irrigation in Hoang Chau commune. The canal is narrow, silted, and mostly buried, causing frequent flooding.

Current Status of Hoi Trieu Canal: The Hoi Trieu Canal functions to supply water for aquaculture and rice cultivation in Hoang Chau commune through a culvert under the dike that discharges into the Ma River and subsequently flows to the sea. At present, the canal bed is silted, and many sections of the canal banks have eroded, resulting in slow drainage, waterlogging, and insufficient water supply for aquaculture activities..

Current Status of Tay Canal: The Tay Canal serves to supply water for aquaculture and rice cultivation in Hoang Chau commune through a water intake culvert under the dike that discharges into the Ma River and then to the sea. Currently, 400 meters of the canal have been reinforced with concrete; however, the culvert dimensions (30 x 40 cm) are too small to adequately fulfill the irrigation and drainage functions of the canal. The remaining sections are earthen canals with narrow, silted beds and eroded banks, resulting in slow drainage, waterlogging, and insufficient water supply for aquaculture activities.

Current Status of Residents: The residential area of Hoang Chau commune is located approximately 10 meters from the construction area, densely populated with around 100 households, mainly engaged in aquaculture and agricultural production. Within and around a 400-meter radius of the subproject area, there are no PCR (communal houses, temples, shrines, graves, or churches).

❖ ***Dredged Material Disposal Sites of Subproject 5***

The dredged material disposal sites of SP5 are arranged at two sites with a total area of 0.93 hectares and a total capacity of 16,519 m³, ensuring that the entire dredged material from SP5 can be accommodated. (Site 1: area 0.33 ha, capacity 4,519 m³; Site 2: area 0.6 ha, capacity 12,000 m³).

Current Status of Sites 1 and 2 (located approximately 2 km north of the subproject area): Currently, these areas are used as pond land managed by the commune People's Committee (PPC) and leased to local residents for production, although the lease agreements have expired. There are no residential areas or houses surrounding the disposal sites. The sites already have official agreements for dredged material disposal, which have been approved by the commune People's Committee.

Main Disposal Route: Subproject area → Disposal sites (approximately 2.0 km). The location and current status of the dredged material disposal sites are shown in the figures below.



Current Status of Disposal site



Current Status of Disposal site

In the area of Subproject 6

Current Status of Project Canals: The project area covers an aquaculture area of 170 ha. Currently, the main supply and drainage canals do not have intake and discharge structures at the canal heads, resulting in siltation and bank erosion. Besides their function of supplying and draining water for the aquaculture area, the main canals also serve to drain water for the local sedge cultivation area; however, the system still lacks structures for water regulation. Transportation to and from the project area for production, harvesting, and transporting products is relatively convenient. However, transportation within the project area is very difficult due to the use of eroded earthen canal banks as roads.

Current Status of Residential Areas: The residential area of Hoang Chau commune is located about 15 m from the construction area, with a dense population of approximately 50 households. At the end of the Subproject route, there are a few households of Hoang Chau commune engaged in aquaculture and agricultural production (in the construction area of Route No. 02 from Ngo Hao Laneto Thach culvert).

Within and around the subproject area (radius of 400 m), there are no cultural, religious, or sensitive sites (PCR), such as temples, pagodas, shrines, graves, or churches.

❖ ***Dredged Material Disposal Site of Subproject 6***

The dredged material disposal site of Subproject 6 is located on pond land managed by the commune People's Committee in Phuong Ngo 1 Hamlet, Hoang Luu commune (now Hoang Chau commune), with an area of approximately 1.2 ha and a capacity of 17,500 m³, ensuring that the entire dredged material from SP6 can be accommodated.

The disposal site is situated about 0.75 km from the SP6 dredging area. There are no residential areas or houses around the site. The site has an official agreement for dredged material disposal, which has been approved by the commune People's Committee.

Main Disposal Route: Subproject area → Disposal site (approximately 0.75–3 km). The location and current status of the dredged material disposal site are shown in the figures below.



In the area of Subproject 7

Current Status of Project Canals: The project area covers an aquaculture area of 60 ha. At present, the main supply and drainage canals in the aquaculture zone do not have intake and discharge structures at the canal heads, resulting in siltation and bank erosion. In addition to their function of supplying and draining water for the aquaculture area, the main canals also serve to drain water for the surrounding local area; however, the system still lacks structures for water regulation. Transportation to and from the project area for production, harvesting, and transporting goods is relatively convenient. However, transportation within the project area is very difficult due to the use of eroded earthen canal banks as roads.

Current Status of Residential Areas: The residential area of Hoang Chau commune is located approximately 30 meters from the construction area, with a dense population of around 60 households. These households mainly engage in aquaculture and agricultural production.

Within and around the subproject area (within a radius of 400 meters), there are no cultural, religious, or sensitive sites (PCR), such as temples, pagodas, shrines, graves, or churches.

❖ *Dredged Material Disposal Site of Subproject 7*

The dredged material disposal site of Subproject 7 is located on land used for crop cultivation, managed by the commune People's Committee in Chau Trieu Hamlet, Hoang Chau commune, Hoang Hoa district (currently Hoang Chau commune), with an area of approximately 1.5 ha and a capacity of 18,000 m³, ensuring that the entire dredged material from Subproject 7 can be accommodated.

The disposal site is situated about 1 km from the Subproject 7 dredging area. There are no residential areas or houses around the site. The site has an official agreement for dredged material disposal, which has been approved by the commune People's Committee.

Main Disposal Route: Subproject area → Disposal site (approximately 1 km). The location and current status of the dredged material disposal site are shown in the figures below.



In the area of Subproject 8

Current Status of Ong Ninh Culvert Construction Area: The culvert is located beneath the concrete road connecting the residential area of Van Loc commune with the rice cultivation fields. The culvert serves aquaculture purposes while also functioning for flood drainage. It is situated along a canal with a relatively flat and open terrain.

Current Status of Main Supply and Drainage Canal (Section from Ong Ninh Culvert to Quay Co Culvert): The canal width ranges from 6 m to 22 m. At the downstream end near Quay Co Culvert, the canal is at its widest and gradually narrows toward the upstream end. The narrowest section is in the middle of the canal due to bank erosion. The canal serves to supply and drain water for the aquaculture area and also drains water for local agricultural production. Water is currently taken and discharged into the Len River through Quay Co Culvert. Along the canal, there are several simple footbridges (“monkey bridges”) used by local residents to access rice fields and aquaculture ponds from the residential areas.

Current Status of Operation Management Road Construction Area: The starting point connects to the existing cement concrete road, which is approximately 5 m wide, and the end point connects to the Len River dike, which is 5.5 m wide. The construction area is located on the right side of the main drainage canal, currently an earthen canal bank. Along the route, a few households are scattered near the new road alignment. The nearest household is approximately 5 m from the road. The road passes several utility poles and ends near a shrimp farming area, about 5 m away.

Current Status of Two Internal Field Canals: These two canals have widths ranging from 0 to 4 m. At the upstream ends, the canals are widest and gradually narrow toward the downstream ends. The downstream ends are silted, and the banks are eroded. These canals serve to supply water for aquaculture and drain floodwater from the fields. Water is currently taken from and discharged into the main drainage canal. Along the canal banks, a few households engage in aquaculture.

Current Status of Two New Road Routes: The existing routes are earthen roads approximately 3 m wide, serving the transportation needs of Van Loc commune residents. A few households are scattered along the route. The nearest household is approximately 5 m from the road.

Current Status of Residential Areas: The residential area of Van Loc commune is approximately 40 m from the construction area, with a medium population density of around 50 households living along the canal. These households primarily engage in aquaculture and agricultural production. Near the main drainage canal, there is one household raising poultry and one household engaged in aquaculture (shrimp farming), located approximately 5–10 m from the project area.

Within and around the subproject area (within a radius of 400 m), there are no cultural, religious, or sensitive sites (PCR), such as temples, pagodas, shrines, graves, or churches. The

characteristics of PCRs will be detailed in Section 2.6 below.

❖ ***Dredged Material Disposal Site of SP 8***

The dredged material disposal site for SP8 is located on vacant land managed by the commune People's Committee in Hung Thanh Hamlet, Da Loc commune, Hau Loc district (currently Van Loc commune), covering an area of approximately 1.04 ha, with a capacity of 22,500 m³, sufficient to accommodate all dredged material from SP8.

The disposal site is approximately 1.5 km from the SP8 dredging area. There are no residential areas or houses in the surrounding area. The site has an official agreement for dredged material disposal, which has been approved by the commune People's Committee.

Main Disposal Route: Subproject area → Disposal site (approximately 1.5 km). The location and current status of the dredged material disposal site are shown in the figures below.



In the area of Subproject 9

Current Status of Ong Vanh Culvert Construction Area: The culvert is located at the downstream end of the canal and serves the function of preventing saltwater intrusion. At present, the culvert has severely deteriorated and is no longer operational.

Current Status of Ong Thuoc Culvert Construction Area: The culvert is located beneath the right dyke of the Hoang River and is designed to take water from the Hoang River to serve aquaculture, combined with flood drainage. Currently, the culvert has severely deteriorated and is no longer operational.

Current Status of Canal from Ong Thuoc Culvert to Ong Vanh Culvert: The canal width ranges from 2 to 4 meters, with the narrowest section at the upstream end and widening toward the downstream end. The upstream section is silted. The canal serves to supply and drain water for the aquaculture area as well as to drain water for local agricultural production. Water is currently taken from the Hoang River through Ong Thuoc Culvert and discharged into the Yen River via Ong Vanh Culvert. Along the canal, there are two head drainage culverts that have deteriorated and are no longer capable of providing sufficient flow; these need to be upgraded or replaced. Several simple footbridges (“monkey bridges”) have been constructed by local residents to access rice fields and aquaculture ponds from residential areas.

Current Status of Residential Areas: The residential area of Quang Chinh commune is approximately 10–20 meters from the construction area, with a medium population density of around 50 households living along the canal. A few households near the downstream end (near Ong Vanh Culvert) engage in aquaculture and agricultural production.

Within and around the subproject area (within a 400 m radius), there are no cultural, religious, or sensitive sites (PCR), such as temples, pagodas, shrines, graves, or churches.

❖ ***Dredged Material Disposal Site of SP 9***

The dredged material disposal site for SP9 is located on land temporarily used for surplus material managed by the commune People's Committee in Dung Hamlet, Quang Trung commune, Quang Xuong district (currently Quang Chinh commune). The site covers an area of approximately 0.5 ha, with a capacity of 10,000 m³, sufficient to accommodate all dredged material from SP9.

The disposal site is approximately 2.1 km from the SP9 dredging area. There are no residential areas or houses in the surrounding area. The site has an official agreement for dredged material disposal, approved by the commune People's Committee.

Main Disposal Route: Subproject area → Disposal site (approximately 2.1 km). The location and current status of the dredged material disposal site are shown in the figures below.



2.6. SENSITIVE OBJECTS

Sensitive objects in the project area include churches, schools, hospitals, traditional markets, etc. that may be affected by the construction and operation activities of the project as presented in Table 2-5.

Table 2-5: Sensitive objects in the project area

No.	Sensitive subjects	Distance (m)	Characteristic
I	Subproject 1		
1	Ship repair yard 	20	- Area about 1,000 m² - Workers: 10 workers. - Service: repair minor damage to fishing boats in port. - Operating hours: 7:00 a.m. to 9:00 p.m. when ships arrive at the factory
II	Subproject 2		
1	 Truong Xa Parish Church	200	- Location: The church is about 200m from the existing fishing port but is located on the main shipping route. - Total number of parishioners is about 500 people. - Crowded time: every Saturday and Sunday.

No.	Sensitive subjects	Distance (m)	Characteristic
2	 Factory in fishing port	0	- Area of about 400m², located in the existing fishing port; - Workers: about 20 workers are working daily. - Services: processing, trading, exporting frozen seafood (shrimp, squid, etc.). - Opening hours: 7:00 a.m. to 7:00 p.m.
3	Hoa Loc Fishing Port Central Market 	250	- Location: The central market is 250m from the existing fishing port but serves port activities. - Services: trading in seafood, meat, vegetables, fruits,... - Opening hours: 7:00 am to 9:00 pm daily.
4	La La Palace 	50	- Location: Phu La is about 50m from the storm shelter. - Total population: about 100 people. - Visiting time: on the 1st or 15th of the lunar month, and annual holidays.
5	Aquaculture area 	200	- The existing aquaculture area is located on the other side of the Lach Truong river., about 200m from SP2 - There are 08 households raising seafood in the area (mainly raising white-leg shrimp, tiger prawns, clams...). - Using water from Lach Truong river for aquaculture.
	 Lach Truong Ferry Terminal	0	- This is a waterway to transport people and goods from Hoa Loc and Hai Loc communes to Hoang Yen commune via Lach Truong river. - Location: ferry terminal right next to the existing Lach Truong fishing port - Each ferry trip on the river takes about 15-20 minutes to travel; the ferry operates from 6am to 7pm every day and there are dozens of trips per day.
III	Subproject 3		

No.	Sensitive subjects	Distance (m)	Characteristic
1	 Aquaculture households	350	- Location: The aquaculture area is about 350m from the end of Phu Son 2 canal and Bao Trieu canal. - Type: household scale, aquaculture in the area (mainly shrimp farming). - Use water from canal for aquaculture.
2	 Nga Tien Market	20	- Location: The market is located near the canal of the Subproject, which is 20m away. - Services: Trading of various seafood, meat, vegetables, and fruits, etc. - Operating Hours: The market operates twice daily (morning: –6 a.m; afternoon: 4–7 p.m).
3	 Nga Tien Kindergarten Playground	200	- Location: The school is located approximately 200 meters from SP 3, but it is situated along the main route for transporting materials to the Subproject. - Campus Area: Approximately 2,200 m², with around 20 to over 60 students. - Study Hours: Students attend classes from Monday to Friday. Peak arrival and departure times are between 7:00–8:00 a.m and 5:00–5:30 p.m daily.
4	 Nga Tien Primary School	180	- Location: The kindergarten is located approximately 180 meters from SP 3, but it lies along the main route for transporting materials to the Subproject. - Campus Area: Approximately 5,000 m², with around 30 to over 200 students. - Study Hours: Students attend classes from Monday to Friday. Peak arrival and departure times are 6.30–7.30 a.m, 11.00 a.m–12.00 p.m, 1.00–2.00 p.m, and 4.30–5.30 p.m daily.

No.	Sensitive subjects	Distance (m)	Characteristic
5	 Poultry farm on the canal	0	- Location: Poultry farming area of a household along the Phu Son 2 canal. - Type: Duck farming (informal/spontaneous). - Water Source: Uses canal water for duck farming activities.
IV	Subproject 4		
1	 Thien Phuc Pagoda	280	- Location: The pagoda is located approximately 50 meters from Son Trang 2 culvert. - Population: Approximately 200 people - Visiting Times: On the 1st and 15th of the lunar month, as well as during annual holidays and festivals. -
2	Aquaculture area 	10-20	Existing Aquaculture Area near SP 4: Located approximately 10–20 meters from SP 4. There are over 10 households that are engaged in aquaculture in the area, primarily shrimp farming. Water Source: Uses canal water for aquaculture activities.
V	Subproject 5: No Sensitive object		
VI	Subproject 6		
1	 Hoang Phong Kindergarten	250	- Location: The school is located approximately 250 meters from SP 6, but lies along the main route for transporting materials to the Subproject. - Campus Area: Approximately 2,400 m², with around 20 teachers and over 70 students. - Study Hours: Students attend classes from Monday to Friday. Peak arrival and departure times are 7:00–8:00 a.m and 5:00–5:30 p.m daily.

No.	Sensitive subjects	Distance (m)	Characteristic
2	Hoang Phong Primary School 	220	- Location: The school is located approximately 220 meters from SP 6, but lies along the main route for transporting materials to the Subproject. - Campus Area: Approximately 7,000 m², with around 30 teachers and over 180 students. - Study Hours: Students attend classes from Monday to Friday. Peak arrival and departure times are 6:30–7:30 a.m, 11:00 a.m–12:00 p.m, 1:00–2:00 p.m, and 4:30–5:30 p.m daily
3	 Hoang Phong Secondary School	220	- Location: The school is located approximately 220 meters from SP 6, but lies along the main route for transporting materials to the Subproject. - Campus Area: Approximately 2,600 m², with around 30 teachers and over 200 students. - Study Hours: Students attend classes from Monday to Saturday. Peak arrival and departure times are 6.30–7.30 a.m, 11.00 a.m–12.00 PM, 1:00–2:00 p.m, and 4.30–5.30 p.m daily.
VII	Subproject 7		
1	 Aquaculture pond area	10	- Existing Aquaculture Area is located near SP 7: approximately 10 meters from SP 7. - There are over ten households that are engaged in aquaculture in the area, primarily shrimp farming. - Water Source: Uses canal water for aquaculture activities.
VIII	Subproject 8		

No.	Sensitive subjects	Distance (m)	Characteristic
1	Aquaculture area 	10	- Aquaculture Areas near Aquaculture Areas is located near SP 8 (Van Loc Commune): - There are a few households engaged in aquaculture in the area, primarily shrimp farming. - The existing aquaculture area is located approximately 10 meters from SP 8. - There are about 20 households that are engaged in aquaculture in the area, primarily shrimp farming. - Water Source: Uses canal water for aquaculture activities.
XI	Subproject 9: No Sensitive object		

2.7. THE PMU'S EXPERIENCE IN E&S MANAGEMENT

Project owner - Thanh Hoa PMU of Construction Investment Works for Agriculture and Rural Development has considerable experience in terms of managing projects in Thanh Hoa (especially funded ones). Over the past ten years, the Unit has implemented more than twenty projects regarding irrigation, aquaculture, agriculture and rural development or similar.

Table 2-6: List of projects executed by the PMU over the past five years

No.	Project name	Period	Total investment (million VND)	No. of PMU participants
A	Projects managed by ministry of agriculture and environment		246,469	
1	Project: Drainage Improvement in Zone III, Nong Cong district, Thanh Hoa province (Phase 1) <i>The Thanh Hoa PMU of Construction Investment Works for Agriculture and Rural Development plays a role as the project owner</i>	2017-2021	246,469	15
2	Drainage Improvement in Zone III of Nong Cong (Phase 2), Thanh Hoa province	2023 - 2025	450,500	15
3	Hoang Khanh Pump Station, Thanh Hoa province	2023 - 2025	249,633	14
4	Enhancement of Flood Drainage Capacity in Northern Thanh Hoa	2023 - 2026	698,000	16
5	Project component No. 9: Reinforcement and Rehabilitation of the Dyke System in Thanh Hoa Province, Period 2021–2025	2022 - 2025	244,863	13

No.	Project name	Period	Total investment (million VND)	No. of PMU participants
6	Project component No. 12: Urgent Rehabilitation of Culverts under Dykes in Thanh Hoa Province	2022 - 2025	66,508	11
7	Project component No. 13: Urgent Repairs to Ensure the Safety of Several Reservoirs in Thanh Hoa Province	2023 - 2025	47,125	10
B	Projects managed by the province		1,227,970	
1	Project: Dam rehabilitation and safety (WB8)	2016-2023	426,454	15
2	Project: Upgrading and Repairing to Ensure the Safety of Reservoirs and Dams in Thanh Hoa Province	2018-2021	59,886	12
3	Project: Planting and Restoration of Coastal Forests in Hau Loc and Quang Xuong districts, Thanh Hoa province	2018-2022	93,000	11
4	Project: Coastal embankment in Quang Nham commune, Quang Xuong district, Thanh Hoa province	2018-2021	91,317	12
5	Construction of water supply system for urban areas along NH47, Thanh Hoa city and surrounding areas (funded by Hungary)		9,599	9
6	Emergency Treatment of Erosion on the Left Bank of the Ma River, section from K49+950 - K50+950, Hoang Dai commune, Thanh Hoa city	2023	32,000	9
7	Project: Rehabilitation and upgrading of sea dikes and embankments in Hai Binh ward, Nghi Son town	2023-2024	18,000	8
8	Project: Embankment of the left and the right banks of the Chu River in the Van Ha bridge area, Thieu Hoa district, and on the left dike of the Len River, Ha Trung district	2023-2024	250,000	14
9	Project: Dredging and removing the rock reefs in the navigation channel, fishing port area, and storm shelter for fishing vessels at Lach Bang, Nghi Son towns	2023-2025	69,874	10
10	Project: New construction of Yen Tam pump station system, Vinh Quang commune, Vinh Loc district (replacing	2022-2025	109,950	13

No.	Project name	Period	Total investment (million VND)	No. of PMU participants
	the Yen Ton pump station, Vinh Yen commune, Vinh Loc district)			
III	Projects involving the implementation of site clearance management		67,890	
1	The Len river irrigation system project is part of the Len River and Hoang Mai River Irrigation System Upgrading Project, aiming to enhance salinity control, improve ecological environment conditions, and strengthen climate change adaptation (KEXIM).	2020-2024	67,890	7
IV	Projects in preparation for investment during 2020-2025			
1	Treatment of coastal erosion near the dike section from K24+581 - K24+831 in the right bank of Len river, Hung Loc commune, Hau Loc district	2025	8,100	8
2	Erosion control of the Yen river's left bank, section from K1+200 - K1+800, Quang Phuc commune, Quang Xuong district	2025	14,416	9
3	Project: Sustainable Fishery Development Project in Thanh Hoa province	2023-2028	400,000	18

Typically, the PMU has been and is currently managing: (i) the Dam Rehabilitation and Safety Improvement Project (WB8); (ii) the Project of construction of water supply system for urban areas along NH47, Thanh Hoa city and surrounding areas (funded by Hungary); and (iii) The Len river irrigation system project is part of the Len River and Hoang Mai River Irrigation System Upgrading Project, aiming to enhance salinity control, improve ecological environment conditions, and strengthen climate change adaptation (KEXIM). These are ODA projects funded by World Bank, Hungary, and KEXIM. The Sustainable Fisheries Development Project in Thanh Hoa Province is the first project implemented and managed by the PMU to apply the World Bank's Environmental and Social Framework (ESF).

There are approximately 60 staff the PMU participated in projects of similar scale and nature as those mentioned above. Among them, 10 are environmental and social specialists, including 3 resettlement and social officers who have worked on at least five comparable projects, three of which were ODA-funded projects related to canals, embankments, fisheries, and dredging. These environmental and social specialists have attended training courses organized by donors such as the World Bank, aligned with the relevant safeguard policies at the time of project implementation, and have gained certain experience in environmental and social management in investment projects. However, the Environmental and Social Framework (ESF) remains a new concept for the PMU. While some staff are familiar with donor requirements for compliance with environmental and social safeguard policies during the preparation of

Environmental and Social (ES) instruments, they have not yet received comprehensive training on ESF. Consequently, there is a risk that capacity gaps in Environment and society (ES) management may affect the project's environmental and social performance and compliance. Such gaps can be addressed through on-the-job and formal training programs on ESF applications throughout the implementation of the Sustainable Fisheries Development Project in Thanh Hoa Province.

CHAPTER 3. ANALYSIS OF ALTERNATIVES

As part of the Environmental and Social Impact Assessment, the analysis of alternatives is essential in determining the proposed level of investment, defining the scope of works, or considering design and construction options in order to avoid or minimize potential adverse impacts while enhancing the positive impacts and benefits of the Project.

This analysis includes both the “with-project” and “without-project” scenarios. It describes, identifies, and compares design options, which are crucial to support decision-making regarding the selection of construction activities within the Project Area. The selected option is expected to have the least and lowest adverse impacts while meeting technically feasible solutions and cost–benefit considerations applicable to the Project. Furthermore, the practice of analyzing alternatives helps minimize adverse impacts and maximize positive environmental and social outcomes. The results of the analysis are presented below.

3.1. “With-Project” and “Without-Project” Scenarios

The Project, once implemented, will generate multiple positive economic, social, environmental, and climate-related benefits, as follows:

The proposed Project offers long-term benefits. If successful, these benefits will extend beyond the direct number of capture fishers, aquaculture farmers, and service providers engaged in fishing, seed supply, and aquaculture production. The Project will contribute significantly to the sustainable development of the fisheries sector, specifically:

- The Project design, particularly the fish landing ports and storm shelter ports, has integrated climate change considerations and extreme weather events, thereby extending the lifespan of infrastructure and reducing operation and maintenance costs.
- The upgrading/construction of fish landing ports and storm shelter ports will facilitate safe anchorage for fishing vessels from Thanh Hoa province and neighboring provinces. This will reduce fishing costs, increase product value by shortening the distance between fishing grounds and ports, and consequently improve incomes while preserving the nutritional quality of post-harvest fisheries products.
- Fishers will have opportunities to work in fishing, aquaculture, and processing environments under improved sanitation and environmental conditions, thereby reducing occupational health and safety risks. At the same time, the quality and value of fisheries products will be enhanced, and post-harvest losses reduced through improved landing and preservation practices.
- Improved waste management at port areas as well as aquaculture farms will contribute to reducing water pollution and sedimentation in the catchment area. In the long term, the Project will help improve the quality of surface water resources within the Project area.
- The adoption of Good Aquaculture Practices (GAP), Integrated Pest and Pathogen Management (IPPM), and the introduction of biosecurity measures and disease-free seed production will create a more efficient production and farming environment that is unfavorable to pests and pathogens. This will reduce the use of hazardous chemicals and antibiotics, protect the environment, mitigate economic losses caused by disease outbreaks, and ensure food safety and occupational health and safety for the fisheries workforce.
- Improved quality of aquaculture seed and enhanced production in aquaculture zones will enable fishers/farmers to expand brackish-water shrimp/fish farming, better adapting to the increasing challenges of sea level rise caused by climate change.

- The Project will also generate environmental and social benefits through the application of safeguard policies, including: (i) raising awareness and attention on environmental and social issues among beneficiaries and local communities; (ii) strengthening the presence of environmental and social officers/experts through training programs organized by MAE and provincial DAEs, as well as their fisheries extension officers, to enhance capacity in environmental and social screening and management; and (iii) raising awareness among senior government officials regarding the application of environmental and social safeguard principles in sustainable project development, thereby mainstreaming E&S considerations into project planning and implementation.

Table 3-1: Analysis of “With-Project” and “Without-Project” Scenarios

Affected Factors	Analysis and Comparison of Alternatives		Remarks
	Without-Project Scenario	With-Project Scenario	
Socio-Economic Aspects	Losses of fishing vessels and risks to fishers’ lives due to the absence of safe anchorage during storm and typhoon seasons.	Fishing vessels and fishers’ lives are guaranteed due to safe shelter during the stormy season.	
	Economic losses to the locality as large fishing vessels cannot access fish landing ports/anchorage areas due to shallow navigation channels and the lack of essential logistics services. The local socio-economic development remains slow due to the absence of integrated infrastructure investment. Fishing activities are mostly carried out in a spontaneous and unsustainable manner, resulting in low efficiency while still generating adverse environmental impacts.	Establishment of an integrated port complex for anchorage, vessel services, and fish processing, thereby transforming offshore fisheries into a key economic sector of the province, in line with the Government’s Marine Strategy. Generation of additional employment opportunities through services and processing activities. Local communities benefit from the development of integrated infrastructure, thereby improving their quality of life.	
Natural Environment	Some water surface areas and shrimp/fish/other aquaculture farms would be abandoned.	Storm shelter port with completed components, including breakwater, vessel mooring piles, service areas, etc.	
	Hydrological regimes and sediment transport would not be significantly altered, as human interventions (such as vessel movements, dredging, etc.) remain limited.	Hydrological regimes and sediment transport may be altered, creating risks of sedimentation, erosion, and impacts on aquatic ecosystems. However, these impacts are minor and can be mitigated (see detailed impact assessment in Chapter 4).	
	Water quality would not be substantially affected.	High risk of water pollution from wastewater and solid waste generated by vessels and port activities. Nevertheless, the port design has incorporated a	

		comprehensive wastewater collection and treatment system; therefore, these impacts will be controlled and will improve conditions compared to the previous situation, where most discharges were spontaneous and dispersed.	
	Fisheries resources remain abundant; however, they are increasingly being depleted as fishers lack the means to engage in offshore fishing.	Nearshore fisheries resources are regenerated due to reduced pressure on coastal fishing.	

Remarks: ☐ Key positive impacts of the Project

☐ Key negative impacts of the Project

The investment in project construction will generate environmental and socio-economic impacts within the Project area. However, these impacts are short-term and can be mitigated through specific measures. In the absence of the Project, such impacts will not occur in the immediate term; nevertheless, ensuring safe anchorage for fishing vessels during storm and typhoon seasons will face significant difficulties, and long-term losses of lives and assets among fishers will inevitably occur. By contrast, with the Project, the selected sites are highly feasible due to favorable natural conditions and low investment costs. In particular, with scientifically designed scale, technology, and operation, in addition to ensuring safety for fishers and fishing vessels, the Project will generate other positive impacts such as improved local infrastructure, enhanced community benefits from project facilities, reduced production costs, and the creation of new employment opportunities, etc

Potential environmental impacts can be controlled through the application of mitigation measures during the construction and operation phases. The Environmental Management and Monitoring Program will provide supplementary information that forms the basis for better forecasting of certain environmental issues, thereby enabling the application of appropriate measures to manage adverse environmental and social impacts, as well as to prevent and respond to environmental risks/incidents that may occur during the implementation of all nine subprojects under the Project.

3.2. Consideration of Alternatives

3.2.1. Analysis of Options on Scale and Technology

Regarding the scale, technology of fish port exploitation/operation, waste management technology, and project implementation sites, only one option was identified. This option has been proposed on the following bases: (i) Compliance with the approved Master Plan; (ii) Consideration of technical factors ensuring operational requirements; (iii) Consideration of cost, environmental and social impacts, and feasibility of project implementation; and (iv) Assurance that environmental impacts remain within permissible limits.

3.2.2. Analysis of Dredging Alternatives

Within the Thanh Hoa Province SFDP, only Subproject 2 – Lach Truong Fishing Port involves large-scale dredging works for the navigation channel, turning basin, and storm shelter anchorage area, with a dredged volume of approximately 365,000 m³. Therefore, dredging alternatives were analyzed and compared, as presented below.

The remaining subprojects (Subproject 1 and Subprojects 3 to 9) also include dredging activities; however, these are mainly limited to small areas in front of the port basins or inland

canals/ditches supplying water for aquaculture activities. These dredging volumes are relatively small and dispersed across multiple locations; hence, only one dredging method was selected in accordance with existing conditions of the fishing ports and canal networks. Specifically:

- For Subproject 1: The dredging method involves a cable-bucket excavator combined with barges transporting dredged materials to a designated disposal site, with a transport distance of approximately 3 km. The disposal method consists of pumping dredged material from barges to the disposal site located in the underutilized salt field area of Van Loc commune (shared disposal site with Subproject 2).
- For Subprojects 3 to 8: The dredging method involves placing an excavator on a pontoon to conduct dredging of canal beds according to the designed cross-section.

For Subproject 2, based on an analysis of current river/sea dredging practices in Viet Nam, three main methods are commonly applied, including:

- Option 1: Use of a clamshell grab bucket mounted on a barge (bucket dredger). Dredging is carried out using a bucket dredger (long-arm backhoe or hydraulic grab dredger mounted on a 500T pontoon). Dredged materials are loaded onto 400T barges and transported an average distance of 12–30 km to the disposal site. At the disposal site, dredged sand is pumped ashore using a pump installed on the barge, with a pumping distance of less than 500 m.



- Option 2: Use of a trailing suction hopper dredger (TSHD). The vessel employs a cutter head to agitate the seabed and then sucks the slurry of soil and water into the hopper. The water is discharged from the vessel, while the sediment is retained on board.



- Option 3: Use of a cutter suction dredger (CSD). This method has the advantage of high dredging productivity. The vessel employs a cutter head to agitate the seabed, after

which the sediment-water mixture is suctioned and pumped through a pipeline system directly to the designated disposal site.



Table 3-2: Comparison of Advantages and Disadvantages of River/Marine Dredging Alternatives

Criteria	Option 1 (Grab dredger)	Option 2 (Hopper dredger)	Option 3 (Cutter suction dredger) – Selected option
Technical	Easy to maneuver in narrow areas; Slower construction progress compared with hopper dredgers and cutter suction dredgers; Lower construction efficiency.	Higher construction efficiency. Difficulties in construction in narrow areas and with long transport distances for dredged materials.	Higher construction efficiency. The distance to the disposal sites is favorable as the selected disposal areas are all located near the dredging sites (the pipeline system can pump only up to approximately 2 km).
Environmental and social	Lowest turbidity as it causes minimal disturbance of bottom sediments.	Increased turbidity, with potential impacts on aquatic organisms and aquaculture. Difficult to implement in confined areas.	Similar to Option 2, increased turbidity with potential impacts on aquatic organisms.
Cost	Lowest cost.	Highest cost.	Moderate to high cost.

Based on conditions including: (1) dredging will be carried out within an actively used navigation channel, (2) the existing channel is narrow and shallow, and (3) the distance to the dredged-material disposal sites; it is necessary to ensure safe working conditions for dredging vessels and to protect navigation safety for both commercial vessels and dredgers, and to organize an appropriate fleet of dredgers in order to achieve the highest dredging productivity. Therefore, Option 3 (cutter suction dredger) is the selected dredging method for Subproject 2.

3.2.3. Analysis of Wastewater Treatment Technology Selection

Each of Subproject 1 and Subproject 2 will invest in a single wastewater treatment plant with a capacity of 200 m³/day, using aerobic technology and enclosed treatment tanks. This single-option technology proposal is based on an analysis of the operational characteristics of the two existing fish ports, taking into account: (i) their relatively small area; (ii) the need to meet current sanitary safety distance requirements; (iii) the general aesthetics of the ports; and (iv)

the characteristics of influent wastewater and the required effluent quality. Consequently, the feasibility study does not present multiple alternative wastewater treatment technologies but proposes one most-appropriate treatment technology, as described below.

Process flow: Wastewater → Collection tank → Grease trap → Equalization tank → UASB reactor → Anoxic tank → MBBR → Biological clarifier → Disinfection tank → Receiving environment.

Treated effluent from the centralized wastewater treatment system, with a capacity of 200 m³/day, is designed to comply with national standards QCVN 11-MT:2015/BTNMT, Column B ($K_q = 0.9$; $K_f = 1.1$) — National Technical Regulation on Wastewater from Fishery Product Processing — and QCVN 14:2008/BTNMT, Column B ($K = 1$) — National Technical Regulation on Domestic Wastewater — prior to discharge to the environment.

Designated effluent receiving bodies: For Subproject 1: roadside drainage canal along the southern axis of Hoang Truong fishing port; For Subproject 2: De Canal.

CHAPTER 4. ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

The assessment on environmental and social impacts and risks for the Project is carried out in three phases: pre-construction, construction and operation.

This chapter is presented in the following order: (1) Positive impacts; (2) Classification of negative impacts and risks; (3) Negative impacts and risks in the pre-construction phase; (4) Negative impacts and risks in the construction phase; (5) Negative impacts and risks in the operational phase; (6) Indirect impacts; (7) Cumulative impacts and risks; (8) Impacts caused by climate change.

The assessment considers the impacts and risks outlined in ESS1 of the World Bank Environmental and Social Framework (WB ESF), including aspects listed in the Environmental, Health, and Safety Guidelines (EHSG), as well as issues related to community safety, climate change, and socio-economic impacts. Cumulative impacts and risks, as required under ESS1, are also addressed. Impacts and risks related to workers and their working conditions, as specified in ESS2, have been discussed. Aspects covered under ESS3, including pollution risks and energy use, have been reviewed. Aquatic species, fish, aquaculture, and other living natural resources, as referenced in ESS6, have been considered in the Environmental and Social Impact Assessment (ESIA) and Environmental and Social Management Plan (ESMP). The potential adverse environmental impacts and risks are presented below.

4.1. POSITIVE IMPACTS

The project aims to concretize the strategic orientations outlined in the National Development Strategy for the 2021–2030 period; the Strategy for Sustainable Development of Vietnam’s Marine Economy to 2030, with a vision to 2045; the National Strategy on Green Growth and Sustainable Development; the National Socio-Economic Development Plan for the 2021–2025 period; the Strategy for the development of Vietnam’s Fisheries by 2030, with vision towards 2045; and the Master Plan for Fishery Port System and Storm Shelter Areas by 2020, with orientation to 2030. The project ensures continuity, inheritance, stability, and orders within the National Planning System.

The project comprises 09 subprojects located in 7 communes of Thanh Hoa Province. It belongs to infrastructure investment projects which aim at constructing and upgrading facilities to support marine fisheries and provide regional storm shelters for fishing vessels. The project’s objectives are to: (i) Accelerate socio-economic development in the project communes in particular and Thanh Hoa Province in general; concretizing the master plan for fishing port system and storm shelter areas for fishing vessels along the coast and on islands; meeting the demand for mooring and logistical services for fishing vessels; gradually advancing toward industrialization and modernization; establishing key interprovincial exchange hubs to drive the development of seafood industrial zones, coastal economic zones, and fisheries centers (at Hoang Truong and Lach Truong seaports) linked to major fishing grounds; and creating momentum for the fisheries sector to develop efficiently and sustainably. (ii) Contribute to the reduction of water pollution and protection of aquatic ecosystems through the collection and treatment of wastewater from seafood preliminary processing and domestic activities before being discharged into receiving bodies (the sea areas of Hoang Truong and Hoa Loc communes); improving the quality of receiving water sources; managing solid waste by reducing the amount of waste released into rivers and seas; preventing marine litter pollution and protecting marine fauna; reducing waterborne diseases; and creating favorable conditions for tourism and aquaculture. (iii) Contribute to sustainable development along with the promotion of cultural and human development; ensuring national defense, security, political stability, and social order and safety; guaranteeing social welfare, narrowing the gap between rich and poor, and improving living standards; protecting the ecological environment; and enhancing climate change resilience.

4.2. CLASSIFICATION OF NEGATIVE IMPACTS AND RISKS

There will be potential negative environmental and social impacts and risks in pre-construction, construction and operation of the investments under the nine subprojects.

These potential negative impacts and risks are classified based on criteria as below:

Significant Impacts (S)

- Impacts on large land area, important areas, or changes in environmental conditions in a period of more than two years;
- Impacts exceeding permitted standards and regulations. Long-term and large-scale impacts;
- Changes in ecological systems, impacts on ecological systems of large areas, or medium impacts (lasting for more than two years) yet required recovery period of the affected ecological systems is ten years;
- Impacts on health of people;
- Economic losses and damages to the subproject nearby people and communities;
- Potential significant social and environmental impacts which can only be controlled and mitigated if proper mitigation measures are implemented.

Medium Impacts (M)

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

Low Impacts (L)

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

No Impacts (N)

- Impacts that are not observable or cannot be distinctly attributed may arise from daily operational activities;
- No social and environmental impacts.

Based on the analysis of baseline data, field survey and discussions with officials and stakeholders, the project's potential negative impacts on the physical, biological and economic environments have been identified and assessed. Level of potential negative environmental impacts and risks are classified as substantial and specified in Table 4-1.

Table 4-1: Potential negative impacts of the project

Description	Environment			Biodiversity		Social				Others		
	<i>Emission, noise, vibration</i>	<i>Soil, water</i>	<i>Waste, dredged materials</i>	<i>Local biodiversity</i>	<i>Fish, aquatic species</i>	<i>Land acquisition, resettlement</i>	<i>Labor influx, community disturbance</i>	<i>Physical cultural resources</i>	<i>Livelihood of local residents</i>	<i>Erosion, sedimentation and local flooding, traffic safety</i>	<i>Damaged infrastructures</i>	<i>Risks of occupational accidents, natural disasters</i>
Subproject 1: Upgrading and expansion of Hoang Truong fishing port, Hoang Truong commune, Hoang Hoa district												
Pre-construction	L	L	L	N	L	L	L	L	L	L	L	L
Construction	M	M	L	N	M	L	L	N	M	L	L	L
Operation	L	N	L	N	N	N	N	N	N	N	N	L
Subproject 2: Upgrading and expansion of fishing port and storm shelter area in Lach Truong, Hoa Loc commune, Hau Loc district												
Pre-construction	L	L	L	L	L	L	L	L	L	L	L	L
Construction	M	M	M	L	L	N	L	L	M	L	L	L
Operation	L	L	L	N	N	N	N	L	L	N	N	L
Subproject 3: Construction of infrastructure in aquaculture area in Nga Thuy, Nga Tan, Nga Tien communes, Nga Son district												
Pre-construction	L	L	L	N	M	L	L	L	L	L	L	L
Construction	L	M	L	N	M	L	L	N	M	M	L	L
Operation	N	N	L	N	N	N	N	N	L	N	N	L
Subproject 4: Upgrading of infrastructure in aquaculture area in Hoang Yen commune, Hoang Hoa district												
Pre-construction	L	L	L	N	L	L	L	L	L	L	N	L
Construction	L	M	M	N	L	N	L	L	M	L	L	L
Operation	N	N	N	N	N	N	N	L	L	N	N	L

Description	Environment			Biodiversity		Social				Others		
	Emission, noise, vibration	Soil, water	Waste, dredged materials	Local biodiversity	Fish, aquatic species	Land acquisition, resettlement	Labor influx, community disturbance	Physical cultural resources	Livelihood of local residents	Erosion, sedimentation and local flooding, traffic safety	Damaged infrastructures	Risks of occupational accidents, natural disasters
Subproject 5: Upgrading of infrastructure in aquaculture area in Hoang Phong commune, Hoang Hoa district												
Pre-construction	L	L	L	N	L	L	L	L	L	L	N	L
Construction	L	M	M	N	L	N	L	L	M	L	L	L
Operation	N	N	N	N	N	N	N	L	L	N	N	L
Subproject 6: Upgrading of infrastructure in aquaculture area in Hoang Luu commune, Hoang Hoa district												
Pre-construction	L	L	L	N	L	L	L	L	L	L	N	L
Construction	L	M	M	N	L	N	L	L	M	L	L	L
Operation	N	N	N	N	N	N	N	L	L	N	N	L
Subproject 7: Upgrading of infrastructure in aquaculture area in Hoang Chau commune, Hoang Hoa district.												
Pre-construction	L	L	L	N	L	L	L	L	L	L	N	L
Construction	L	M	M	N	L	N	L	L	M	L	L	L
Operation	N	N	N	N	N	N	N	L	L	N	N	L
Subproject 8: Upgrading of infrastructure in aquaculture area in Da Loc commune, Hau Loc district.												
Pre-construction	L	L	L	N	M	L	L	L	L	L	L	L
Construction	L	L	L	N	M	L	L	N	M	M	L	L
Operation	N	N	L	N	N	N	N	N	L	N	N	L
Subproject 9 : Construction, upgrading of aquaculture area infrastructure in Quang Trung commune, Quang Xuong district.												
Pre-construction	L	L	L	N	M	L	L	L	L	L	L	L

Description	Environment			Biodiversity		Social				Others		
	<i>Emission, noise, vibration</i>	<i>Soil, water</i>	<i>Waste, dredged materials</i>	<i>Local biodiversity</i>	<i>Fish, aquatic species</i>	<i>Land acquisition, resettlement</i>	<i>Labor influx, community disturbance</i>	<i>Physical cultural resources</i>	<i>Livelihood of local residents</i>	<i>Erosion, sedimentation and local flooding, traffic safety</i>	<i>Damaged infrastructures</i>	<i>Risks of occupational accidents, natural disasters</i>
Construction	L	L	L	N	M	L	L	N	M	M	L	L
Operation	N	N	L	N	N	N	N	N	L	N	N	L

The structured assessment presented below will be proportionate to the level of potential impacts and risks during Pre-Construction, Construction and Operation phases. Where there are similar types of impacts and risks between types of works, more thorough assessment and analysis would be carried out for the items that the potential impacts and risks are more likely and significant and a brief discussion on the same topic will be provided for other work items.

During the project preparation phase (9 subprojects), the primary impacts and risks stem from land acquisition, livelihood activities, land use purpose conversion, and unexploded ordnance (UXO) clearance within the subproject areas.

During the construction phase, activities with potential environmental impacts include: (i) Site clearance: Demolition and vegetation removal for site preparation (ii) Earthworks, construction of roads and project components (iii) Transportation and storage: Movement and stockpiling of construction materials, machinery, equipment, and waste (iv) Activities workers involved in construction tasks (v) Construction works: Construction of project infrastructure components (vi) Installation of machinery and equipment for the operational phase (vii) Dredged material handling: Transporting dredged materials to temporary disposal sites and restoring construction areas, etc.

Construction activities are expected to cause general environmental impacts, including: (i) Emissions of dust and gases, noise, and vibration (ii) Generation of wastewater (iii) Generation of solid waste (iv) Degradation of water quality (v) Impacts on aquatic life (vi) Effects from erosion, sedimentation, and local flooding (vii) Disturbance to traffic and increased safety risks (viii) Potential damage to existing public infrastructure and interruption of related services (ix) Community safety concerns (x) Occupational health and safety issues (xi) Social impacts due to labor influx. In addition, the project's construction activities may pose site-specific impacts depending on the scale of infrastructure components and subproject location.

The project's operation phase includes: (i) Activities of vessels entering and exiting fishing ports/storm shelter areas (ii) Operations of fisheries-related services (including the operation of domestic and seafood processing wastewater treatment plants) (iii) Periodic maintenance and dredging of navigation channels (for Subproject 1 and 2); for the remaining seven subprojects (from subproject 3 to subproject 9), periodic dredging of canals/drainage channels is expected to depend on the local maintenance and repair plans.

Activities of vessels entering and exiting the project's fishing ports/storm shelter areas will result in the following impacts and risks:

- Impacts on air quality due to emission from vessels, ships;
- Degradation of surface water quality due to increased concentrations of oil and grease from vessels and boats;
- Impacts on the aquatic ecosystem in the area;

Activities of fisheries-related services (including the operation of wastewater treatment plants) under the project will cause the following impacts and risks:

- Deterioration of air quality due to unpleasant odors, including fishy smells, from seafood caught and the operation of wastewater treatment plants.
- Increased water pollution caused by wastewater generated from fisheries-related services.
- Increased generation of solid waste from fisheries related services.

Periodic dredging activities for the maintenance of navigation channels/turning basins under the project will lead to the following impacts and risks:

- Deterioration of air quality caused by the activities of vehicles and machinery involved in dredging activities.
- Degradation of water quality due to dredging activities (increased turbidity, total suspended solids - TSS, oil and grease, etc.).
- Impacts on the aquatic ecosystem in the area.

- Increased salt intrusion.

In addition, site-specific impacts associated with construction activities at each individual subproject will also be considered and assessed in this chapter.

4.3. IMPACTS AND RISKS IN PREPARATION PHASE

4.3.1. Impacts due to land acquisition and livelihood

The total area of permanently acquired land for the construction of project components is approximately 201,881 m², affecting 269 households. Among them, 262 households are impacted by land acquisition with less than 30% (accounting for 78%) and between 30–70% (accounting for 22%). In addition, 11 organizations (now reduced to 07 due to merging of communes) are affected, primarily commune-level People's Committees (PC). Across the entire project implementation area, no households or organizations are subject to relocation or resettlement. Specifically:

Table 4-2: Area of permanently acquired land

Subprojects	Total land acquisition, m ²	Land use right held by organizations, m ²	Land use right held by households, m ²	No. of affected households	No. of affected organization	Types of land
Subproject 1	23,536	23,536	0	0	01	Unused land and specialized water surface land area
Subproject 2	720	720	0	0	1	Specialized water surface land area
Subproject 3	19,491	14,392	5,099	23	1	Annual crop land, irrigation land, aquaculture land, unused land
Subproject 4	23,617	17,696	5,921	19	1	Annual crop land, aquaculture land
Subproject 5	17,687	9,975	7,712	54	1	Annual crop land, irrigation land, aquaculture land, transportation land
Subproject 6	19,079	5,033	14,046	52	1	Annual crop land, irrigation land, transportation land

Subprojects	Total land acquisition, m ²	Land use right held by organizations, m ²	Land use right held by households, m ²	No. of affected households	No. of affected organization	Types of land
Subproject 7	10,636	5,601	5,026	46	1	Annual crop land, irrigation land, aquaculture land, transportation land
Subproject 8	11,386	10,095	1,291	12	1	Aquaculture land, transportation land
Subproject 9	4,319	4,319	0	0	1	Aquaculture land, irrigation land
Disposal site of subproject 1,2	79,399	0	79,399	56	1	Salt land has been abandoned and not cultivated for years.
Total	201,881	92,950	118,931	262	7	

The project's site clearance for construction of sustainable fisheries development permanently acquires land of 7 organizations and production land of 262 households. Among them, annual crop land – 171 households, aquaculture land -35 households, salt land – 56 households. No household is ethnic minority; 07 organizations lose their annual crop land (03 organizations), irrigation land (07 organizations), aquaculture land (04 organizations), transportation land (05 organizations), specialized water surface land (2 organizations) and unused land (04 organizations).

Land acquisition for subproject implementation is inevitably, but the affected areas are not large compared to the total existing area (78% of households are affected with less than 30% and 22% of households are affected by 30-70% of the total area). However, the affected areas are located along the existing canals/ditches, which do not significantly affect the remaining total area of the land plots, thus, local people's income from the remaining areas will not be affected. Therefore, the impact from acquisition of this land is considered not large.

The project does not require land acquisition for temporary storage site for dredged materials or precast component yards. The construction materials, wastes are gathered within the land acquired by the project components and those of works along ditches/canals are stockpiled in these ditch/canal areas. The administrative area and workers' camps with a total area of about 9,000 m² are temporarily provided by local residents and the Commune People's Committee during the construction phase; These areas with about 1,000 m²/per subproject are stadium (subproject 3), vacant land, vegetation area with main grassland and wild shrub along canal sides or at the foot of dike (subproject 1, 2, 4, 5, 6, 7, 9), football field in Yen Loc village (Subproject 8). There are no residential houses and other structures surrounding these subprojects. The gathering of construction material may affect the environment due to increased sedimentation and dust emission due to loading/unloading and stockpiling. For the vacant land for subproject 9, it is near the market 1A, which currently is informal market where 3-4 households selling products in about 1-2 hours in the morning/afternoon. The subproject activities will not

significantly affect their business in this area. Therefore, the impact of material and waste stockpiling in this area is considered not significant as no residents reside in, short-term during gathering period, and can be mitigated through appropriate mitigation measures.

According to the inventory, about 420 trees belong to 81 households will be affected due to land acquisition, including: 372 fruit trees (banana, coconut, mango, jackfruit, star apple trees, fig trees, 35 timber trees (including white cedar and chinaberry), 13 ornamental plants (such as bougainvillea, flamboyant, ficus, and almond trees), and 5,155.3 m² of affected crops (including rice and canna). These trees are primarily from household gardens and do not generate economic profit, thus they do not significantly impact the livelihood of the families if being removed. Specifically:

- Fruit trees (including banana, coconut, mango, jackfruit, and star apple): 36 households affected, with a total of 372 trees impacted.
- Crops: 5,170 plants, with 28 affected households.
- Perennial and ornamental trees (including almond, banyan, flamboyant, fig, chinaberry, white cedar, and bougainvillea): 8 affected households.

The preliminary inventory results indicate that 8 out of 9 subproject areas (excluding Subproject 2) will affect residential structures or architectural assets within the project area. A total of 72 households will be affected due to impacts on structures. However, no households will be affected in terms of their main residential house; only auxiliary structures will be impacted, specifically: 110.5 m² of livestock shelters belonging to 7 households; 616.5 m² of temporary houses belonging to 13 households (temporary structures built on pond land for aquaculture production); 84.5 m² of temporary huts belonging to 4 households; and 6.25 m³ of unused rainwater storage tanks belonging to 1 household. In addition, the project will also affect other household assets such as marine railway systems, concrete yards, stone embankments, fences, gate pillars, brick walls, and low-voltage electric poles serving aquaculture areas. The overall impact on residential structures and architectural assets of households and organizations is considered minimal, with no significant effect on main dwellings. The areas subject to land acquisition mainly involve temporary houses, guard huts, livestock shelters, water tanks, yards, walls, and electric poles of a limited number of households. These affected structures can be repaired or adjusted to suit current conditions. Therefore, these impacts can be mitigated through technical measures and compensation and support mechanisms outlined in the project's Resettlement Plan (RP).

Therefore, the level of impact from land acquisition on the subproject areas is considered Low and unavoidable. The impact on household income is minor, resulting from the acquisition of land, residential structures, and the removal of crops. However, the affected households are currently only losing a small portion of their agricultural production land, and most are engaged in other income-generating activities such as business, fishing, processing, service provision, and transportation. As a result, the land acquisition and associated losses may cause only a slight reduction in household income. This impact is manageable and can be mitigated through income restoration support measures, as outlined in the project's Resettlement Plan (RP).

** Impacts on livelihood, income and jobs of local residents:*

The acquisition of agricultural land primarily affects the areas used for annual crop cultivation and aquaculture, resulting in short-term impacts on employment and livelihoods. Residents may experience a temporary reduction in income from agricultural and aquaculture products, with minor effects on daily food consumption. However, most of the acquired land accounts for a small proportion (less than 10%) of total cultivated land, so the reduction in income is considered negligible. In addition, many households earn income from other sources such as trading, coastal fishing, and wage labor, which may not be significantly affected by the land acquisition. Some aquaculture ponds may be temporarily impacted during construction, but this

can be mitigated by adjusting the timing of stocking and harvesting. Overall, the impacts on livelihoods are assessed to be short-term, localized, and manageable through measures such as adjusting aquaculture schedules to avoid critical periods of stocking and harvesting.

4.3.2. Impacts due to changes of land use purposes

Land acquisition for construction site clearance has led to a change in land use purposes. All households whose agricultural land is being acquired have less than 30% of their total agricultural production area affected, except for 36 households whose affected area exceeds 30%. Specifically, 28 households are affected by less than 30%, including 4 households in Hoang Yen commune – Subproject 4, 2 households in Hoang Phong – Subproject 5, 2 households in Hoang Luu – Subproject 6, 3 households in Hoang Chau – Subproject 7, and 15 households in Van Loc – Subproject 1,2. Additionally, 8 households in Van Loc – Subproject 1,2 are affected by 30–70%. The conversion of current land use into other purposes (such as transportation land, and irrigation land) affects areas of annual crop cultivation, aquaculture, irrigation, and transportation land. This impact is considered long-term. Regarding positive aspects: (i) Improve irrigation and internal transportation infrastructure, enhancing water supply and drainage efficiency, reducing natural disaster risks, and supporting more effective agricultural production (ii) Enhance the accessibility and operational management of infrastructure systems, ensuring regular maintenance of canals and reducing long-term maintenance costs (iii) Contribute to sustainable agricultural economic development, increasing crop productivity, facilitating the transportation of agricultural products, and reducing travel time and costs.

The land acquisition and conversion of land use purposes under the project primarily generate positive impacts, especially in the long term, by promoting infrastructure development and supporting efficient, sustainable agricultural production. Negative impacts are mostly localized and manageable, provided that appropriate livelihood support and fair compensation measures are implemented.

4.3.3. Unexploded ordnance (UXO) and residual explosive materials

Vietnam in general, and the project area in particular, experienced a civil war that ended in 1975. Although the land has been in use for over four decades since the end of the war, there remains a possibility that unexploded ordnance (UXO) may still be buried underground. UXO poses potential risks to workers and may cause damage to project infrastructure and nearby households if disturbed by construction activities such as site clearance, land leveling, and excavation. Most project components require clearance by licensed UXO removal units, except for certain areas that were already cleared by previous projects and are located within designated safety corridors. New construction works are considered to have a higher risk of UXO exposure than existing culverts, due to excavation activities that may reach depths of 0.3 to 3 meters on land and approximately 0.5 to 3 meters underwater in agricultural fields, canal beds, embankments, dredging zones, and port areas.

The subprojects under the Sustainable Fishery Development Project in Thanh Hoa Province will be upgraded and expanded across fishing ports and aquaculture zones, with unexploded ordnance (UXO) clearance activities conducted on both land and underwater areas at Hoang Truong Fishing Port, Lach Truong Fishing Port, and existing canal systems. According to the Circular No. 59/2022/TT-BQP dated August 30, 2022, for Class IV agricultural and rural development works, the safety corridor is defined as follows: 10 meters outward from each side of the embankment edge for dredging works under Subproject 2, where dredging depth does not exceed 3 m, and 3 m outward from each side of the structure edge for all other works. Requirements for UXO clearance depth are as follows: (i) Up to 3 m for dredging works and their safety corridors under Subproject 2; (ii) Up to 0.5 meters for underwater safety corridor areas; (iii) Up to 0.3 m for land-based safety corridor areas; And (iv) No UXO clearance is

required for existing concrete roads and residential buildings. UXO clearance activities will be carried out over a total area of 547,700 m² (54.77 ha), including 47.39 ha of land-based clearance and 7.38 ha of underwater clearance.

If unexploded ordnance (UXO) is not cleared, it may pose risks during construction, potentially affecting workers, local residents, and nearby infrastructure. According to consultations with the People's Committees of the communes within the project area, no incidents involving bombs, mines, or explosive materials or related casualties have been reported in the past ten years. Therefore, the risk of UXO in the project's construction area is considered low to medium in the long term, except for renovation and upgrading activities within the safety corridor, which has already undergone UXO clearance. However, this risk can be mitigated through UXO clearance activities that will be completed prior to construction, and construction activities should be confined to areas confirmed to be free of UXO.

4.4. ENVIRONMENTAL AND SOCIAL IMPACTS AND RISKS IN CONSTRUCTION PHASE

4.4.1. General impacts and risks

4.4.1.1. Impacts on ambient air quality

The sources of impact on ambient air quality during the construction phase primarily stem from dust and emissions generated by construction activities, including: (i) Demolition/clearing for site preparation; (ii) Earthworks, and construction of project components; (iii) Dust generated during the transportation of construction materials; (iv) Dust generated during waste transportation; (v) Dust emitted from the gathering and loading/unloading of construction materials; (vi) Emissions from vehicles transporting materials and waste; (vii) Emissions from construction equipment and machinery. Assessment for each source of impact related to the subprojects is detailed below.

❖ Dust generated from site preparation

The primary source of dust emissions during site preparation activities originates from the demolition of existing structures and debris resulting from the dismantling of deteriorated embankments, shoreline roads, and temporary buildings. These activities do not involve vegetation clearance.

Determine the volume of dust generated from demolishing existing houses and structures using the following formula:

$$W = E \times Q \times d \quad [CT1]$$

Where: W: Average amount of dust generated (kg);

E: Pollution coefficient (kg dust/ton);

Q: Emission amount (m³);

d: Debris d = 1.8 tons/m³ (According to Official Dispatch No. 1784/BXD-VP of the Ministry of Construction on promulgating material norms in construction).

The amount of diffused dust is calculated based on the pollution coefficient and the volume of excavated and embanked soil. According to the World Health Organization's guidance document, the pollution coefficient E is calculated using the following formula:

$$E = k * 0,0016 * \frac{\left(\frac{u}{2,2}\right)^{1,4}}{\left(\frac{M}{2}\right)^{1,3}} \quad [\text{CT2}]$$

Where:

- E: Pollution coefficient (kg dust/ton).
- k: Particle structure, with average value (k = 0.2 for dust with size <10µm - Particle structure table (k) page 13.2.4-4 AP 42, Fifth Edition Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources).
- u: Wind speed (Average wind speed in relevant subproject area).
- M: Debris's average moisture (14% - Table 13.2.4-1 AP 42, Fifth Edition Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources).

Determination of the dust pollution coefficient from demolition activities of existing structures, the dust emission load generated from the demolition of houses and existing structures is calculated using formulas [CT1] and [CT2], and compared to the standards QCVN 05:2023/BTNMT (0.3 mg/m³) and QCVN 02:2019/BYT (8 mg/m³) as follows:

Table 4-3: Dust load generated from site preparation

Subprojects	Demolition/clearance (ton)	Wind speed (m/s)	Pollution coefficient (kg/ton)	Dust load (mg/m ³)
Subproject 2	1,51.70	0.9	0.00290	0.205885
Subproject 4	49.16	0.8	0.00246	0.205446
Subproject 5	135.13	0.8	0.00246	0.201852
Subproject 6	145.93	0.8	0.00246	0.217596
Subproject 7	18.10	0.8	0.00246	0.199187
Subproject 8	296.95	0.8	0.00246	0.219658
Subproject 9	420.07	0.8	0.00246	0.219983

The affected group involves site workers, local residents surrounding the subproject area and others, specifically:

Table 4-4: Affected groups at subproject areas

Subproject	Affected residents surrounding the subproject
Subproject 1	- Households living near the foot of Linh Truong Mountain, and fishermen operating near the port - Individuals engaged in business and service activities at Hoang Truong fishing port.
Subproject 2	- Fishermen operating at the existing Hoa Loc fishing port and surrounding households, as well as workers at the industrial zone near Hoa Loc port.

Subproject	Affected residents surrounding the subproject
Subproject 3	- Households living scatteredly along the Phu Son 2 canal, Bao Trieu canal (Ong Ty), - Aquaculture households in the Tran Lam aquaculture area and the Northern aquaculture seed farm, - Business household in Nga Tien Market - Residents living along the main road and Ong Ty canal in Tan Tien commune
Subproject 4	- Aquaculture residents in the villages of Hung Tien, Nghia Thuc, and Son Trang - Linh Trang seafood farm - Son Trang village cultural house.
Subproject 5	- Residents of Hoi Trieu village, Hoang Chau commune, along the Cau Dua canal area, - Aquaculture households within the project area.
Subproject 6	- Residents in the Ngo Hao area, Phuong Ngo 2 village, Hoang Chau commune.
Subproject 7	- Aquaculture areas adjacent to the demolition and vegetation clearing site near Song Khe canal, Song Khe sluice, and branch canals No. 1, 2, and 3 in Hoang Chau commun. - No residents within the implementation area of Subproject 7
Subproject 8	- Workers involved in demolition activities, - Some residents at aquaculture farms/ponds within the area of Subproject 8 in Van Loc commune.
Subproject 9	- Workers involved in demolition activities, - Households living near Ong Thuoc sluice and Ong Vanh sluice.

The concentration of dust dispersion from the demolition of existing structures ranges from 0.2019 to 0.2199 mg/m³. This dust concentration shows minimal variation between the lowest and highest wind speeds, and remains below the permissible limits set by QCVN 05:2023/BTNMT and QCVN 02:2019/BYT. The impact level is assessed as Low due to the following reasons: (i) The dust concentration generated is lower than the permissible threshold; (ii) The demolition activities are short-term, lasting approximately 1 to 3 months; (iii) The affected group is limited, primarily consisting of construction workers, nearby residents, and other groups (*as mentioned in Table 4-3*); (iv) This impact can be mitigated.

❖ *Dust from earthwork and ground leveling*

The dust generated from earthworks and ground leveling activities is considered the most significant source of dust emissions during the construction phase, which typically lasts between 3 to 6 months. The extent of dust dispersion during excavation and ground leveling depends on the volume of soil excavated, transported, and backfilled. The amount of diffused dust is calculated based on the pollution coefficient and the volume of excavated and backfilled soil. Similarly, using the formula [CT2] mentioned above, the dust pollution coefficient and dust load from earthwork and ground leveling activities for construction projects can be determined as follows:

Table 4-5: Dust Load Generated by Excavation and Leveling Activities

Subproject	Earthwork and ground leveling volume (ton)	Dust load (mg/m ³)
Subproject 1	114,347.8	0.231297
Subproject 2	442,697	0.223130

Subproject	Earthwork and ground leveling volume (ton)	Dust load (mg/m ³)
Subproject 3	21,765	0.1910401
Subproject 4	119,199	0.2163880
Subproject 5	33,275	0.212652
Subproject 6	28,239	0.233156
Subproject 7	37,883	0.215184
Subproject 8	28,389	0.239741
Subproject 9	38,122	0.256293

In fact, the amount of dust dispersed from excavation and ground leveling activities is not as significant as estimated, due to varying construction timelines of each component (mainly concentrated in the first 1–2 months of the construction phase), relatively small volumes of earthwork, and the fact that subprojects are located in different areas with construction activities not occurring simultaneously or continuously. Dust dispersion from these activities is therefore estimated to be low in concentration, localized, and short-term—below the threshold set by QCVN 05:2023/BTNMT and significantly lower than the standard QCVN 02:2019-BYT. Moreover, dust concentration decreases rapidly with distance from the source. Dust mitigation measures will be implemented to minimize environmental impact and protect workers and nearby residents around the subprojects.

❖ *Dust generated from road surfaces during the transportation of construction materials and waste out of the construction site.*

The transportation of raw materials, fuel, and construction supplies from supply areas to project sites, as well as the transportation of excess solid waste from construction sites to temporary storage areas, generates dust and emissions from vehicles (mainly engine exhaust gases such as CO, SO₂, and NO₂). Dust and emissions directly affect transport workers and residents living along the transportation routes in each project area. The impacts caused by the transportation of materials and waste include:

- Dust and emissions generated can obstruct visibility and negatively affect the health of workers, commuters, and residents living along the transportation routes.
- The transportation process may cause traffic congestion and pose risks to traffic safety, affecting the daily travel activities of local residents.
- It may also disrupt commercial activities and daily activities of people living along the transportation routes.
- Uncovered or spilled materials during transportation can cause loss of urban beauty and negatively impact environmental sanitation conditions along the transportation routes.

Dust from road surfaces during the transportation of construction materials originates from the transported materials themselves and is stirred up by vehicle tires. This occurs during transport using diesel-powered vehicles (10-ton trucks) traveling on rural roads over an average distance of 15 kilometers to the construction site at:

The dust load generated during the transportation of construction materials is determined according to the formula of Air Chief, U.S. Environmental Administration, 1995:

$$L = 1,7 \times k \cdot \left[\frac{s}{12} \right] \times \left[\frac{S}{48} \right] \times \left[\frac{W}{2,7} \right]^{0,7} \times \left[\frac{w}{4} \right]^{0,5} \times [(365-p)/365], \text{ kg/(xe.km)} \quad [\text{CT3}]$$

Where: L - Dust emission coefficient (kg/km/Turnaround);

k - Particle size, k = 0.8 with dust with size less than 30μm;

s - the amount of soil on the road, s = 2%;

S - Average speed of the vehicle, S = 30km/h;

W - Loaded weight of the vehicle, W = 10 tons;

w - Number of wheels, w = 10 wheels.

p – The average number of rainy days in the year, p = 137 rainy days.

$$\rightarrow L = 0.255 \text{ kg/km/turn.}$$

Applying the SUTTON model, the average concentration of pollutants at any time with linear sources is determined according to the following formula:

$$C = \frac{0,8E \left\{ \exp \left[\frac{-(z+h)^2}{2\sigma_z^2} \right] + \exp \left[\frac{-(z-h)^2}{2\sigma_z^2} \right] \right\}}{\sigma_z \times u} \quad (\text{mg/m}^3) \quad [\text{CT4}]$$

In the [CT4], we have:

- C - Concentration of pollutants in the air (mg/m³)
- E - Load of pollutants from the waste source (mg/m.s)
- z - Height of the calculation point (m)
- h - Height of the road surface relative to the surrounding ground (m)
- u - Average wind speed in the area (m/s)

The vertical pollutant diffusion coefficient σ_z (z) with atmospheric stability class B is calculated based on the following formula:

$$\sigma_z = 0.53 \times 25^{0.73} \quad (\text{m})$$

In this calculation, x represents the distance from the calculation point to the exhaust source in the wind direction. The calculation method divides the point coordinates into horizontal axis (x) and vertical axis (z). The atmospheric stability is classified as type B.

The diffusion coefficient depends on the level of atmospheric diffusion, and the vertical coefficient σ_z is calculated according to Slade for atmospheric stability type B at a distance x = 25 meters from the center of the road to the sides.

The volume of construction materials will be supplied from material storage yards and local suppliers near the project area, with an average transportation distance of 15 kilometers, using 10-ton trucks.

Based on formulas [CT3] and [CT4], along with input parameters such as the volume of construction materials for Subproject 1 – Hoang Truong Fishing Port, during the transportation

period of 12–24 months, with a daily vehicle frequency ranging from 6 to 140 trips, the dust load generated from the construction components of the subprojects is determined as follows:

Table 4-6: Dust load generated from transportation of construction materials

Subproject	Volume of materials, waste (tons)	Transportation duration (month)	Number of vehicles (trip/day)	Dust load generated (*) (mg/m/s)	Dust load at 5m from the source (mg/m ³)
Subproject 1	154,165.07	12	43	0.008426	0.0031
Subproject 2	504,742.02	12	140	0.027587	0.0098
Subproject 3	48,376.06	24	7	0.001322	0.0031
Subproject 4	96,824.93	24	13	0.002646	0.0023
Subproject 5	42,613.66	24	6	0.001165	0.00309
Subproject 6	44,675.68	24	6	0.001221	0.00311
Subproject 7	54,051.95	24	8	0.001477	0.00323
Subproject 8	40,013.67	24	6	0.001093	0.00207
Subproject 9	45,496.26	24	6	0.001243	0.00315

According to the above calculations, the concentration of dust generated from road surfaces due to the transportation of construction materials within a 5m radius from the subproject areas is significantly lower than the permissible limit set by QCVN 05:2023/BTNMT (1-hour average). The impacts are assessed as low, with limited, localized, and intermittent effects on certain affected groups within a 500m radius of the subproject implementation areas. The impact level is considered Low because: (i) Dust concentration at a 5m distance is significantly lower than the regulatory standard; (ii) The construction period for the affected works is short-term; (iii) The number of affected individuals—workers and nearby residents—is relatively small (as presented in Table 4-3); (iv) These impacts can be mitigated through appropriate technical and management measures.

❖ *Dust from material gathering, loading/unloading*

The primary source of dust emissions from material gathering and loading/unloading activities originates mainly at the main material storage area serving the construction works of Subproject 1.

Based on the dust pollution coefficient generated during the loading and unloading of materials, referred to in AP 42, Fifth Edition Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, for example:

- For crushed stone: 0,0035 kg of dust/ton
- For sand: 0,0011 kg of dust/ton
- For cement: 0,36 kg of dust/ton, etc.

Calculation of dust concentration arising from the loading and unloading of construction materials according to the method of Tran Ngoc Chan, 1999, *Air pollution and treatment emissions (Volume I)*, Hanoi Science and Technology Publishing House.

Think of the air mass at the construction site area as a box with the dimensions of length L (m), width W (m), and height H (m), one side of the bottom of the air box is parallel to the wind

direction. Assuming that the air blowing into the box is polluted air and the air at the construction site at the time of construction is quite fresh, the average concentration of dust generated in 1 hour is calculated according to the formula.

$$C = \frac{E_s \cdot L}{u \cdot H} (1 - e^{-ut/L}) \quad [\text{CT5}]$$

Where: C – Dust concentration generated on average one hour (mg/m^3);
 E_s - Emission load calculated per unit area;
 $E_s = M/(L \times W)$ ($\text{mg}/\text{m}^2 \cdot \text{s}$)
M- Population load (mg/s);
u - Average wind speed in the wind direction at the top of the box (m/s);
H - Height of the diffusion box (m);
L, W - Length and width of the diffusion box (m).

The calculated concentration of dust generated from material loading and unloading activities, averaged over one hour (mg/m^3), takes into account the baseline concentration of ambient air quality (baseline environment). The dust concentration resulting from material loading/unloading activities is as follows:

Table 4-7: Dust load during material loading/unloading

Subprojects	Total volume of main materials (tons)	Construction period (days)	Total dust load from construction material loading/unloading (g)		Max dust load generated E_s (mg/s)	Dust load (mg/m^3)
			Min	Max		
Subproject 1	154,165.07	360	15,416.51	154,165.1	0.1606	0.24693
Subproject 2	504,742.02	360	50,474.20	504,742.0	0.5258	0.3949902
Subproject 3	48,376.06	480	4,837.61	48,376.1	0.0378	0.215788
Subproject 4	96,824.93	480	9,682.49	96,824.9	0.0756	0.242631
Subproject 5	42,613.66	480	4,261.37	42,613.7	0.0333	0.212652
Subproject 6	44,675.68	480	4,467.57	44,675.7	0.0349	0.233156
Subproject 7	54,051.95	480	5,405.19	54,051.9	0.0422	0.215184
Subproject 8	40,013.67	480	4,001.37	40,013.7	0.0313	0.239741
Subproject 9	45,496.26	480	4,549.63	45,496.3	0.0355	0.256293

The impact level of dust generated from construction material loading and unloading activities across all subprojects is generally low. However, for Subproject 2, the dust concentration from these activities exceeds the standard by 1.3 times. Nevertheless, the overall impact is considered low because: (i) The concentrations of dust and emissions are still significantly below the limits

set by QCVN 05:2023/BTNMT; (ii) The impact is intermittent and short-term (approximately 12–24 non-continuous months); (iii) The number of affected individuals is limited, as households are sparsely distributed along the transportation route; (iv) The impact from dust emissions during material loading/unloading can be effectively mitigated through appropriate technical and management measures.

❖ *Dust and exhaust gases emitted from transportation of materials and waste*

The transportation vehicles and construction machinery/equipment primarily use diesel oil (DO), thereby emitting pollutants from internal combustion, such as NO_x, SO₂, and CO. As mobile sources, these emissions directly affect road users along the transportation routes and disperse into the surrounding air, impacting workers and residents living near the subproject areas. The affected receptors include: (i) workers and residents in the areas listed in Table 4-3; and (ii) the material and waste transportation routes such as Provincial Road 510, Provincial Road 6 (Subproject A1), National Highway 10 (Subproject A2– Subproject 9), as presented in Table 1-7 above. The calculated concentrations of dust and exhaust gases generated by transporting materials and waste are based on World Health Organization statistics (1993), with emission factors/1 ton of diesel fuel for internal combustion engines as follows: 4.3 kg dust; 20 × S kg SO₂; 28 kg CO; 55 kg NO₂. Based on the operation frequency of machinery, pollutant concentrations depend on each construction area and are calculated using formula [CT6]. The construction period is estimated at approximately 8 hours per day.

$$\text{Pollution load (g/s)} = \frac{\text{Emission coefficient} \left(\frac{\text{g}}{\text{kg}} \right) \times \text{Fuel demand (kg DO/day)}}{3600 \times 8} \quad [\text{CT6}]$$

The pollution load and concentration of emissions from diesel combustion are calculated using formula [CT6], while the concentration of dispersed dust and exhaust gases is determined based on formula [CT4], as follows:

Table 4-8: Load of dust and emissions from waste transportation

Subprojects	DO volume (ton)	Parameters	Pollution load (mg/m.s)	Dust load at 5 m from the source (mg/m ³)
Subproject 1	23.74	Dust	0.0985	0.3028
		CO	0.6411	0.4486
		SO ₂	0.0229	0.0160
		NO ₂	1.2594	0.8812
Subproject 2	362.81	Dust	1.1285	0.30834
		CO	7.3486	0.00011
		SO ₂	0.2624	0.00006
		NO ₂	14.4347	0.00006
Subproject 3	20.5	Dust	0.0638	0.20234
		CO	0.4152	0.11726
		SO ₂	0.01483	0.00419
		NO ₂	0.8156	0.23034
Subproject 4	27.4	Dust	0.0852	0.22016
		CO	0.5546	0.15673
		SO ₂	0.01981	0.00560
		NO ₂	1.0893	0.30787

Subprojects	DO volume (ton)	Parameters	Pollution load (mg/m.s)	Dust load at 5 m from the source (mg/m ³)
Subproject 5	2.59	Dust	0.00005	0.09077
		CO	0.00035	0.00028
		SO ₂	0.00001	0.000010
		NO ₂	0.00069	0.00054
Subproject 6	3.59	Dust	0.00007	0.09100
		CO	0.00048	0.00038
		SO ₂	0.00002	0.000014
		NO ₂	0.00095	0.00075
Subproject 7	15.04	Dust	0.00031	0.14858
		CO	0.00203	0.00160
		SO ₂	0.00007	0.000057
		NO ₂	0.00399	0.00314
Subproject 8	4.49	Dust	0.00009	0.08643
		CO	0.00061	0.00048
		SO ₂	0.00002	0.000017
		NO ₂	0.00119	0.00094
Subproject 9	5.52	Dust	0.00011	0.08643
		CO	0.00075	0.00048
		SO ₂	0.00003	0.000017
		NO ₂	0.00146	0.00094

The impact level of dust and emissions from construction material and waste transportation is assessed as Low because: (i) A comparison between the concentrations of exhaust gases from transportation vehicles (*under unfavorable conditions with low wind speed and maximum pollutant concentrations*) and the QCVN 05:2023/BTNMT shows that at a distance of ≥ 5 m from the emission source, most pollutant concentrations remain within permissible limits. Therefore, the impact from dust and emissions is considered negligible. For Subproject specifically, the dust concentration exceeds the standard by 1.03 times; however, the dust concentration remains below the regulatory threshold at a wind speed of $u = 0.9$ m/s within a distance of < 25 m, and at $u = 1.4$ m/s within < 20 m; (ii) The duration of impact is short-term and intermittent (approximately 12–24 months); (iii) The affected group is limited because the construction is carried out in a large open area. Along the transportation route to the project site, some sensitive receptors are identified, including: Hoa Loc Commune Health Station (located along the asphalt road with a base width of 8m), Hoa Loc Commune People's Committee (35m from the road), Hoa Loc Commune Stadium (83m from the road), and schools such as Hoa Loc Primary School and Hoa Loc Secondary School (located on branch roads,

approximately 218 m and 145 m from the transportation route, respectively). Additionally, scattered households reside along both sides of the road at the intersection of Bui Dat and Pham Banh streets (Muoi Ba village, Xuan Loc Commune) and along the inter-village road in Xuan Tien, Hoa Loc Commune (with distances from the road to main houses ranging from 5 to 27m). As a result, dust from transport vehicles may settle on residential buildings and public structures, affecting urban beautiful landscape and potentially impacting the health of residents and road users. (iv) This impact can be mitigated through appropriate technical and management measures, which the project owner is required to implement and are detailed in the following sections of the report.

❖ *Dust and emissions due to operation of construction machinery*

Emissions are generated from the operation of construction machinery and equipment using diesel oil for internal combustion engines such as: excavators, graders, welding machines, clamshell dredger, generators, pile drivers, concrete mixers, etc. Pollutants emitted contain products from the fuel combustion process of internal combustion engines such as NO_x, SO₂, CO.

Similarly, to calculate the amount of emissions (CO, NO₂, SO₂) from machinery and equipment operating during construction such as ground leveling, mixers, pile drivers, etc. (using one ton of diesel fuel for internal combustion), This Environmental Impact Assessment (EIA) report is based on statistical data from the World Health Organization (WHO – 1993). The emission factors for internal combustion engines using 1 ton of diesel fuel are as follows: dust – 4.3 kg; SO₂ – 20 × S kg; CO – 28 kg; NO₂ – 55 kg.

The calculation process is estimated based on the operation frequency of machinery, with pollutant concentrations depending on the specific construction area. The construction duration is estimated at approximately 8 hours per day. The emission volume and pollutant concentration load from diesel combustion are calculated using formula [CT6].

Applying Formula [CT5] - the method of Tran Ngoc Chan, 1999, *Air pollution and treatment emissions (Volume 1)*, Hanoi Science and Technology Publishing House With wind speeds ranging from 0.8 to 1.6 m/s and a working shift duration of 8 hours, the concentration of exhaust emissions generated from construction machinery and equipment is as follows:

Table 4-9: Concentration of dust and emissions from construction machinery, equipment

Subproject	DO volume (ton)	Parameters	Pollution load (mg/m.s)	Dust load at 5 m from the source (mg/m ³)
Subproject 1	331.82	Dust	137.6	0.2341
		CO	896.1	8.0864
		SO ₂	32.0	0.0872
		NO ₂	1,760.2	0.1289
Subproject 2	490.73	Dust	203.5	0.2341
		CO	1,325.3	9.3193
		SO ₂	47.3	0.0756
		NO ₂	2,603.2	0.1760
Subproject 3	43.45	Dust	13.5	0.2121
		CO	88.0	6.4250
		SO ₂	3.1	0.0758
		NO ₂	172.9	0.1146

Subproject	DO volume (ton)	Parameters	Pollution load (mg/m.s)	Dust load at 5 m from the source (mg/m ³)
Subproject 4	45.43	Dust	14.1	0.2388
		CO	92.0	7.2340
		SO ₂	3.3	0.0854
		NO ₂	180.7	0.1404
Subproject 5	5.44	Dust	1.69	0.2514
		CO	11.02	9.1763
		SO ₂	0.39	0.0825
		NO ₂	21.64	0.0811
Subproject 6	5.03	Dust	1.56	0.2703
		CO	10.19	8.1013
		SO ₂	0.36	0.0975
		NO ₂	20.01	0.0975
Subproject 7	6.41	Dust	1.99	0.2491
		CO	12.98	7.9028
		SO ₂	0.46	0.0851
		NO ₂	25.50	0.1279
Subproject 8	4.49	Dust	1.46	0.2690
		CO	9.50	6.9268
		SO ₂	0.34	0.0838
		NO ₂	18.66	0.1009
Subproject 9	6.17	Dust	1.92	0.2645
		CO	12.50	10.4421
		SO ₂	0.45	0.0801
		NO ₂	24.55	0.0866

Therefore, the impact level is assessed as Low because: (i) Most concentrations of dust and exhaust gases are below the permissible limits, including QCVN 02:2019/BYT – dust: 8 mg/m³; QCVN 03:2019/BYT – CO: 9,000 mg/m³, NO₂: 5 mg/m³, SO₂: 5 mg/m³; and QCVN 05:2023/BTNMT – dust: 0.3 mg/m³, SO₂: 0.35 mg/m³, CO: 30 mg/m³, NO₂: 0.2 mg/m³, beyond a 5m from the emission source. For Subproject 2 specifically, dust concentrations remain below the permissible limits at a distance of 25 meters from the source. (ii) The duration of impact is short-term and intermittent, estimated at around 12–24 months. (iii) The affected group is limited due to the sparse residential density along the main transportation route (as referenced in Table 1-11). Some fishing households operating at the current port may be affected, but the impact is minimal, since most fishing activities conclude around 11:00 AM or 3:00 PM - outside the typical hours of material and waste transportation. (iv) This impact can be effectively mitigated through appropriate technical and management measures.

❖ *Dust and emissions due to welding activities at the site*

During the construction phase, welding activities will be carried out, which are sources of welding fumes and hazardous emissions such as CO and NO_x - particularly during the joining of structural steel frames and steel formwork. During welding, the chemicals contained in welding rod combust and release fumes that contain toxic substances, which may pollute the environment and pose health risks to construction workers. The emission load of pollutants generated from electric welding of structural components depends on the type of welding rod used, as follows:

Table 4-10: Coefficient by welding rod diameter

Pollutants	Welding rod diameter (mm)				
	2.5	3.25	4	5	6
Welding fumes (<i>containing other pollutants, mg/lqh</i>)	285	508	706	1.100	1.578
CO (<i>mg/l rod</i>)	10	15	25	35	50
NO _x (<i>mg/l rod</i>)	12	20	30	45	70

(Source: Pham Ngoc Dang, 2000, *Air quality, Science and Technics Publishing House*)

The volume of welding fumes and exhaust emissions generated during the construction period for each subproject is estimated based on the material usage norms issued by the Ministry of Construction (*specifically for 4 mm diameter welding rod - 25 rods/kg*). The concentration of pollutant parameters emitted at the construction site is calculated using formula [CT5], with a average height (H) of 5m, as follows:

Table 4-11: Volume of fumes and pollutants due to welding

Subprojects	Volume of welding rod (kg)	Parameters	Volume (g)	Volume (mg/s)	Pollutant volume (mg/m ³)
Subproject 1	12,702.41	Welding fume	224.197	28.832	0.2086
		CO	7.939	1.021	7.2600
		NO _x	9,527	1.225	0.0810
Subproject 2	3,091.49	Welding fume	54,565	7.017	0.2974
		CO	1,932	0.248	12.9889
		NO _x	2,319	0.298	0.1322
Subproject 3	799.83	Welding fume	14,117	1.634	0.3002
		CO	500	0.058	9.6278
		NO _x	601	0.069	0.1545

The concentrations of dust and hazardous gases generated from welding activities at subprojects 1, 2 and 3 when compared with the standards QCVN 02:2019/BYT, QCVN 03:2019/BYT, and QCVN 05:2023/BTNMT remain within permissible limits, even under unfavorable weather conditions and during continuous 8-hour construction shifts. The affected groups include construction workers directly involved in welding and nearby residents within distances of 110 m, 50 m, and 3 m from the construction sites of subproject 1, 2, and 3 respectively (as detailed in Table 4-3). The subproject areas are spacious, with no residential households located within the construction zones, and construction activities are intermittent rather than continuous. However, to ensure optimal working conditions and protect the health of workers, the project owner should take appropriate mitigation measures to reduce the impact of welding fumes and toxic emissions on affected individuals.

4.4.1.2. Impacts due to noise and vibration

❖ Impact due to noise

During the construction of the subproject components, noise arises mainly from: (i) the operation of trucks transporting construction materials and waste; (ii) the operation of construction machinery and equipment; (iii) dismantling/completing the construction items; and (iv) the activities of staffs and workers involved in the construction. Among them, noise is primarily generated from operation of construction machinery.

The forecasted noise levels generated by key construction machinery and equipment are presented in the table below.

Table 4-12: Levels of noise generated from construction machinery

No.	Machinery, equipment	Noise (dBA) by 1.5m
1	Bulldozer	93
2	Compactor (roller)	72 – 74
3	Excavator	72 – 84
4	Bucket excavator (Clamshell dredger)	72 – 93
5	Scraper and grader	80 – 93
6	Concrete mixer	75 – 88
7	Concrete pump	80 – 83
8	Concrete vibrator	85
9	Generator	72 – 83
10	Pile-driving barge	80 – 83
11	Truck	85

(Source: U.S. Environmental Protection Agency. *Noise from construction equipment and construction machinery* NJID, 300.1, 31 – 12 – 1971)

However, noise levels will gradually decrease by distance and are determined using the formula presented by *Pham Ngoc Dang in the book Ambient Air Environment, Science and Technics Publishing House, 2003*, as follows:

$$L_i = L_p - \Delta L_d - \Delta L_c (dBA) \quad [\text{CT7}]$$

In which:

L_i - Noise level at the calculated area at a distance d (m) from the source

L_p - Noise level measured at the source of noise (1.5 m away);

ΔL_d - Noise level decrease by distance d at frequency i ;

$$\Delta L_d = 20 \lg \left[\left(\frac{r_1}{r_2} \right)^{1+a} \right] \quad [\text{CT8}]$$

Where:

r_1 - Distance to the noise source with L_p (m);

r_2 - The distance to calculate the noise level reduction according to the distance corresponding to L_i (m);

a - The specific absorption coefficient of noise with the ground terrain ($a = 0.1$);

ΔL_c - Reduction of noise level through obstructions. The construction area is surrounded by buildings and brick walls, so $\Delta L_c = 1.2$;

The maximum noise levels at various distances generated by construction equipment operations are presented in the table below:

Table 4-13: Maximum noise by distance

No.	Machinery, equipment	Noise level at distance of 1.5 m from the source (dBA)	Noise level at distance of 15 m from the source (dBA)		Noise level at distance of 30 m from the source (dBA)		Noise level at distance of 50 m from the source (dBA)		Noise level at distance of 100 m from the source (dBA)		Noise level at distance of 200 m from the source (dBA)	
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
1	Bulldozer	93	73.0		67.0		62.5		56.5		50.5	
2	Compactor (roller)	72-74	52.0	54.0	46.0	48.0	41.5	43.5	35.5	37.5	29.5	31.5
3	Excavator	72-84	52.0	64.0	46.0	58.0	41.5	53.5	35.5	47.5	29.5	41.5
4	Bucket excavator (Clamshell dredger)	72-93	52.0	73.0	46.0	67.0	41.5	62.5	35.5	56.5	29.5	50.5
5	Scraper and grader	80-93	60.0	73.0	54.0	67.0	49.5	62.5	43.5	56.5	37.5	50.5
6	Concrete mixer	75-88	55.0	68.0	49.0	62.0	44.5	57.5	38.5	51.5	32.5	45.5
7	Concrete pump	80-83	60.0	63.0	54.0	57.0	49.5	52.5	43.5	46.5	37.5	40.5
8	Concrete vibrator	85	65.0		59.0		54.5		48.5		42.5	
9	Generator	72-83	52.0	62.5	46.0	56.5	41.5	52.0	35.5	46.0	29.5	40.0
10	Pile-driving barge	80-83	60.0	63.0	54.0	57.0	49.5	52.5	43.5	46.5	37.5	40.5
11	Truck	85	65.0		59.0		54.5		48.5		42.5	
QCVN 26:2010/BTNMT (6-21h)			70 dBA									

Moreover, the construction site contains multiple noise sources, which may result in higher actual noise levels due to cumulation and resonance among them. The additional noise level is presented below:

Table 4-14: Additional noise level due to multiple activities occurring at a location

Noise level (dB)	Additional noise (dB)	Noise level (dB)	Additional noise (dB)
0	3.0	7	0.8
1	2.6	8	0.6
2	2.1	10	0.4
3	1.8	12	0.3
4	1.5	14	0.2
5	1.2	16	0.1
6	1	18	0.05

(Source: *Le Trinh – Environmental Impact Assessment: Methods and Applications – Science and Technics Publishing House*)

According to the calculation results, the noise levels at a distance of 30m from construction vehicles and equipment remain within the permissible limit (<70 dB). Noise levels decrease further as the distance from the construction site to the affected area increases. Among the noise sources mentioned above, the most significant is the mobile noise generated by trucks carrying construction materials through residential areas.

The receptors affected by noise from each subproject experience no significant impact within a 30m radius from the construction site. Therefore, noise impacts primarily affect workers who directly operate machinery and equipment within the 30m construction zone. For the surrounding area, the impact on local residents is considered minimal. Specific affected groups are detailed in Table 4-3.

The level of noise impact at construction sites is considered low because: (i) The construction period is relatively short (12–24 months) and not continuous. (ii) Equipment does not operate simultaneously but rather in phases or shifts, depending on the progress and workload of each construction item. Different types of machinery are used at different times, resulting in minimal cumulative noise impact at any single location. (iii) All vehicles and equipment are subject to regular maintenance, and noise emissions will cease once construction activities are completed. (iv) Noise primarily affects workers operating machinery and working on-site; there is no significant effect on surrounding residential areas or the broader space. (v) Noise impacts can be effectively mitigated through appropriate technical and management measures.

❖ *Impact due to vibration*

Vibration is primarily generated by high-powered and frequently operated equipment on the construction site, such as bulldozers, excavators, and air compressors—mainly during activities like ground leveling and pile driving for embankment/port reinforcement in subprojects 1 and 2. The remaining subprojects do not experience vibration impacts from construction machinery.

Table 4-15: Vibration of some typical construction equipment

No.	Type of means and equipment used	Reference vibration level (in vertical direction, dB)
1	Excavator	80
2	Bulldozer	79
3	Heavy Duty Trucks	74
4	Roller	82
5	Air compressor	81

Source: U.S. Environmental Protection Commission Vibration from Construction Equipment and Construction Machinery NJID, 300.1, 31 - 12 - 197

To forecast the vibration level that decreases with distance, use the formula:

$$L = L_0 - 10 \lg (r/r_0) - 8.7a (r - r_0) \text{ (dB)} \quad [\text{CT9}]$$

Where:

- L is the vibration in dB at the distance "r" meters from the source;
- L_0 is the vibration in dB measured at a distance of "r₀" meters from the source. Vibration at a distance of r₀ = 10 meters is generally acknowledged as the source vibration.
- a is the intrinsic reduction coefficient of vibration for the surrounding environment, approximately 0.5.

By applying formula [CT9], the forecasted vibration decrease over distance at the construction sites of subprojects 1 and 2 is calculated. The results are presented below.

Table 4-16: Vibration level decreases with the distance during construction – Subproject 1,2

No.	Equipment	Source vibration (r ₀ =10m)		Vibration level at a distance							
				r=12m		r=14m		r=16m		r=18m	
		L _{aeq} (dB)	L _{veq} (mm/s)	L _{aeq} (dB)	L _{veq} (mm/s)	L _{aeq} (dB)	L _{veq} (mm/s)	L _{aeq} (dB)	L _{veq} (mm/s)	L _{aeq} (dB)	L _{veq} (mm/s)
1	Excavator	80	1.72	70.5	0.58	61.1	0.20	51.9	0.07	42.6	0.02
2	Bulldozer	79	1.53	69.5	0.51	60.1	0.17	50.9	0.06	41.6	0.02
3	Heavy Duty Trucks	74	0.86	64.5	0.29	55.1	0.10	45.9	0.03	36.6	0.01
4	Roller	82	2.17	72.5	0.73	63.1	0.25	53.9	0.08	44.6	0.03

No.	Equipment	Source vibration ($r_0=10m$)		Vibration level at a distance							
				r=12m		r=14m		r=16m		r=18m	
		L_{aeq} (dB)	L_{veq} (mm/s)	L_{aeq} (dB)	L_{veq} (mm/s)	L_{aeq} (dB)	L_{veq} (mm/s)	L_{aeq} (dB)	L_{veq} (mm/s)	L_{aeq} (dB)	L_{veq} (mm/s)
5	Air compressor	81	1.93	71.5	0.65	62.1	0.22	52.9	0.08	43.6	0.03

QCVN 27:2010/BTNMT, the permissible level is 75dB from 6 ÷ 21h and the floor level is from 21h ÷ 6h.

According to the document DIN 4150, 1970 (German LB), 2mm/s: no damage; 5mm/s: mortar peeling; 10mm/s: possible damage to the bearing part; 20 ÷ 40mm/s: damage to the bearing part.

According to the calculation results, the vibration level of construction vehicles and equipment at a distance of 12m is within the permissible limit of QCVN 27:2010/BTNMT (<75dB) and will decrease as the affected location is farther away from the source of vibration. The vibration of construction equipment will directly affect the construction workers at the construction site and construction works on the site of subproject 1, 2. However, vibration impacts on the nearest residential areas are minimal: approximately 20m away in Hoang Tien commune for Subproject 1; 20–120m away in Hoa Loc commune and the existing port for Subproject 2; and 20–100m away near Phu Son 2 canal and Bao Trieu canal for Subproject 3. The predicted vibration levels beyond 14 meters remain low for general areas (≤ 70 dBA), and beyond 16 meters for areas requiring special quiet conditions (≤ 60 dBA). For subprojects 3 through 9, vibration levels are approximately equal to baseline levels measured prior to construction. Therefore, vibration impacts on these remaining subprojects are considered insignificant.

In general, direct vibration impacts are assessed as MINOR because: (i) Equipment operation is intermittent rather than continuous. (ii) Vibration effects are localized to specific construction areas. (iii) Workers operate machinery in shifts and are equipped with appropriate personal protective equipment. Vibration impacts can be effectively mitigated through the implementation of suitable construction methods and scheduling plans tailored to each subproject site. Therefore, vibration is considered to have no significant impact.

Impact of vibration on existing structures during construction of fishing port and canal embankments

Two out of nine subprojects involve port embankment construction activities, including: Subproject 1 - Hoang Truong fishing port and Subproject 2 - Lach Truong fishing port. In which, the structure consists of a soft-base pier on a D800mm bored pile foundation (does not affect the sediment flow at the river mouth), the average length of the piles is expected to be from 13.0m ÷ 15m, the pile tips embedded in a hard rock layer; Each transverse frame segment includes two rows of bored piles with a diameter of D800mm. The transverse pile spacing for one segment is 10m (1.7m + 6.8m + 1.5m). Each longitudinal frame segment includes six rows of piles, with longitudinal spacing of 30m (1.0m + (5.6m × 5) + 1.0m). The use of bored pile drilling method poses minimal risk of vibration impact and causes less disturbance to nearby structures compared to traditional pile driving methods. Vibrations mainly arise during the drilling through soil and rock layers and during casing installation. The impacts of vibration on existing structures depend on various factors, including:

- **Distance:** is considered the most important factor. The vibration intensity decreases rapidly as the distance from the vibration source (drill bit) to the structure increases. Nearby structures (within 10-15m) will be more significantly affected. Within subproject 1 scope, the existing structures of Hoang Truong fishing port are more than 20m away from the construction area, so they are not significantly affected by bored pile drilling activities. For the subproject 2, neighboring structures such as Truong Xa parish church, Hoa Loc fishing port center, and the aquaculture area are 50-250m away from the

construction area, and are not affected by vibrations caused by this bored pile drilling activity; Some seafood processing, trading, and frozen export facilities are located relatively close to the construction site; The adjacent areas consist of open yard and inter-communal traffic roads, so the level of impact on the existing workshops (about 20-25 m away) is assessed to be minimal.

- **Stiffness and types of soil:** Soft, weak ground has the ability to amplify vibration waves, while hard or rock ground will transmit vibrations more effectively. The fact that the pile tip embedded in a hard rock layer can increase the localized vibration level during the rock drilling phase. For the subproject 1 - Sedimentary siltstone, and sandy siltstone are strongly weathered into: Clay mixed with fine sand particles, gravel, fragments, and a few small pebbles with mottled yellow-gray, purple-brown, blue-gray. The soil condition is semi-hard; Subproject 2 - The geological layer in the water area in front of the port has a single layer: silty clay mixed with organic humus, clam and oyster shells, interspersed with very thin layers of sandy silt in gray-brown, dark gray, and gray-green colors. The soil condition ranges from flowable to plastic-flowable. The surveyed layer thickness is 5.0m. Given the stiffness and soil types, the vibration will be greatly reduced when drilling through these geological layers.
- **Structure and age of the works:** The existing structure at Hoang Truong fishing port and the old Hoa Loc fishing port have weak construction, posing the risks of crack and damage. These structure, built from reinforced concrete, were built long ago (between 2008 and 2007), some sections of the embankment are made of tightly packed rubble stone, many of which have deteriorated. Sediment accumulation near the embankment, along with years of unauthorized landfilling by surrounding residents for spontaneous business activities, has reduced their functional efficiency. However, these constructions are basically 20 - 25 m away from the construction area, so the impact on existing constructions is considered insignificant.

Seven out of nine (subproject 3 -> subproject 9) involve pile driving during dredging and construction of infrastructure components on the canal, including: (i) M300 reinforced concrete piles with diameters of 30 cm x 30 cm, about 6 m long, and bamboo piles with diameters of $\phi 6-8$ cm, driven at a density of 25 piles/m² with a driving depth of 2.5–3 m. The pile driving method poses significant risks of cracking, damage, or collapse to nearby existing structures. During execution, the pile driving equipment exerts a large force to drive the piles to the required depth. The impact force generates wave-like ground vibrations. These vibrations can cause fractures in geological bonds and in the connections between structures and their foundations, leading to shaking, cracking, or even collapse of buildings. According to initial technical calculations, the risk of infrastructure collapse lies within a radius of 30–50 m (for piles driven deeper than 10 m) and within a radius of approximately 5–30 m (for piles driven less than 10 m deep) depending on geological characteristics and pile depth at each location as well as factors such as distance, soil stiffness and type of ground and structure, and age of potentially affected buildings. Specifically:

For the subproject 3, the pile driving construction area is located more than 50m away from existing structures (aquaculture area, Nga Tien kindergarten, Nga Tien primary school which are situated 180–350m away); Some poultry farming areas adjacent to the Phu Son canal consist only of temporary shelters made from tarpaulin and thin corrugated metal sheets or Nga Tien market area is 20m from the canal route, a secondary market and no permanent structures but only 3-4 households who conduct small scale trading activities; Therefore, the potential risk of cracking or subsidence affecting nearby road and structures is negligible. The level of impact is assessed as low because the inter-village and inter-communal roads within the port are reinforced and paved with solid concrete. Moreover, the pile driving process is intermittent and localized at each pile point.



Aquaculture Area – Subproject 3



Nga Tien Market – Subproject 3

For Subproject 4 – Hoang Yen commune, the pile driving areas for reinforcement of embankment toe (Son Trang 1, 2, Nghia Thuc canal, Hung Tien canal) area scattered in across various locations. Additionally, the embankment generally located more than 50m away from existing residential houses/works/structures, except for the section near the aquaculture area which is about 10-20m away and therefore pose a potential risk. The impact level is assessed as low because the internal port road is reinforced and paved with solid concrete. Besides, the pile driving process is not continuous and localized at each pile point. These impacts can be mitigated through appropriate technical measures and well-organized construction planning.



Aquaculture area located 10-20 m away from the canal – subproject 4

For subproject 5 - Hoang Phong commune and subproject 6 - Hoang Luu commune, subproject 9 - Quang Xuong commune, the pile driving areas is located more than 50 from residential area and structures/infrastructure and canal route. Therefore, there is no significant risk of cracking or collapse affecting nearby roads or structures.

For subproject 7 – Hoang Chau commune, the aquaculture pond area is located approximately 10m from the Khe River canal route. The impact level is assessed as low due to the internal port roads being reinforced and paved with solid concrete. Aquaculture areas are divided into separate plots/sections, and the pile driving process is non-continuous and localized at each pile point. These impacts can be mitigated through appropriate technical measures and well-organized construction planning.



Aquaculture area located 10m away from the canal – subproject 7

For subproject 8 – Da Loc commune, the aquaculture pond area is located approximately 10m from the Khe River canal route. There are several temporary shelters used by workers/families for midday rest, situated about 70–80m from the embankment construction site. The impact

level is assessed as low due to the internal port roads being reinforced and paved with solid concrete. Aquaculture areas are divided into separate plots/sections, and the temporary shelters are located at a safe distance from the construction site. Pile driving activities are non-continuous and localized at each pile point. These impacts can be mitigated through appropriate technical measures and well-organized construction planning.



The aquaculture area located 10 m away from the canal and the temporary shelters for workers located about 70-80 m from the canal – subproject 8

In general, the risk of cracking existing structures due to canal embankment pile driving is considered low and may not occur if the contractor adheres to construction methods and implements ground reinforcement measures, including driving piles for protecting nearby structures prior to construction activities. In the event such risks occurring, the contractor must commit to reconstruction or compensation in accordance with agreements made with the homeowners, property owners, or management entities of the affected structures. This commitment is clearly stated in the agreement between the contractor, project owner, local government representatives, and residents prior to construction commencement in the area.

4.4.1.3. Impacts arising from wastewater

Wastewater generated during the construction phase of the subprojects consists: (1) Domestic wastewater from workers (2) Construction wastewater (3) Stormwater runoff. The estimated volume of wastewater generated is assessed as follows:

❖ Domestic wastewater of workers

The number of workers is highest during the initial phase of the project and gradually decreases as construction progresses toward completion. According to QCVN 01:2021/BXD – National Technical Regulation on Construction Planning, the standard water supply is 100 liters per person per day and night. Based on TCXDVN 33:2006 – Water Supply: Pipeline Network and Design Standards, the domestic water demand for workers working in 8-hour shifts and not residing on-site is estimated at 25 liters per person per day. The total volume of wastewater generated in each construction area is calculated as follows:

Table 4-17. Volume of domestic wastewater generated

Subprojects	Subp 1	Subp 2	Subp 3	Subp 4	Subp 5	Subp 6	Subp 7	Subp 8	Subp 9
No. of workers	200	175	145	155	140	155	150	145	130
Domestic wastewater (m³/day)	5	4.4	3.6	3.9	3.5	3.9	3.8	3.6	3.3

The volume of wastewater generated at subprojects 3 through 9 ranges from approximately 3.3 to 5.0 m³/day. The pollutant load and concentration levels are calculated based on the subproject with the highest number of workers—Subproject 1—as a representative case, as follows:

Table 4-18. Pollution load and concentration of untreated wastewater

Pollutants	Pollution coefficient	Load		Pollution		QCVN 14:2025/BTNMT (Table 2, column C)
		(Kg/day)		(mg/l)		
	8h (g/person/)	Min	Max	Min	Max	
Subproject 1	200 workers - 5 m³/day – receiving source is the coastal area of Hoang Truong Port					
BOD ₅	22.5-27	4.5	5.4	900	1080	≤40
COD	36-51	7.2	10.2	1440	2040	≤100
SS	35-72.5	7	14.5	1400	2900	≤70
Total N	3.0-6.0	0.6	1.2	120	240	≤40
Total P	0.4-2	0.08	0.4	16	80	≤10
Amonium	1.2-1.4	0.24	0.28	48	56	≤10
Grease	5.0-15	1	3	200	600	≤20
Total Coliform*	10 ⁶ - 10 ⁹	10 ⁶	10 ⁹	10 ⁶	10 ⁹	≤5.000

The concentrations of pollutants such as BOD, COD₅, TSS, NH₄⁺, etc., typically observed in Subproject 1 indicate that pollutants in untreated domestic wastewater generated during the construction phase of all subprojects exceeds the permissible limits set by QCVN 14:2025/BTNMT (Table 2, Column C). In this case, surface water sources such as Lach Truong River and internal irrigation canals will be affected. Specifically, the total volume of construction wastewater generated at each subproject is as follows:

Table 4-19. Receiving bodies and receptors affected by domestic wastewater

No.	Subprojects	Receiving bodies	Affected receptors
1	Subproject 1	Coastal area of Hoang Truong Port – Lach Truong River	- Coastal marine ecosystem along the Lach Truong River - Aquatic flora and fauna - Fishing, purchasing, and processing activities conducted by local fishermen and traders.
2	Subproject 2	Lach Truong River and De Canal at the existing Hoa Loc Port	- Surface water ecosystem in Lach Truong River and De Canal - Aquatic flora and fauna - Fishing, purchasing, and processing activities conducted by local fishermen and traders.
3	Subproject 3	Irrigation canals of Ong Ty, Bao Trieu	- Surface water ecosystem in the irrigation and drainage canals serving the aquaculture areas of Nga Son and Tan Tien communes. - Aquatic flora and fauna in irrigation canals - Cultivated Area for Crops and Aquaculture in Nga Son and Tan Tien Communes. - Local residents engaged in aquaculture and crop cultivation.
4	Subproject 4	Irrigation canals of Hung Tien, Nghia Thuc	- Surface water ecosystem in the irrigation and drainage canal network serving the aquaculture area of Hoang Tien commune. - Aquatic flora and fauna in irrigation canals - Cultivated area for crops and aquaculture. - Local residents engaged in aquaculture and crop cultivation.
5	Subproject 5	Irrigation canals of Dong	- Surface water ecosystem in the irrigation and

No.	Subprojects	Receiving bodies	Affected receptors
		Coi, Cau Dua, Hoi Trieu, Tay Canal	drainage canal network serving the aquaculture area of Hoang Chau commune. - Aquatic flora and fauna in irrigation canals - Cultivated area for crops and aquaculture - Local residents engaged in aquaculture and crop cultivation.
6	Subproject 6	Irrigation canals of Thach Sluice, Con Voi Sluice, and Phuong Khe village supply canal	- Surface water ecosystem in the irrigation and drainage canal network serving the aquaculture area of Hoang Chau commune. - Aquatic flora and fauna in irrigation canals - Cultivated area for crops and aquaculture - Local residents engaged in aquaculture and crop cultivation.
7	Subproject 7	Khe River canal and branch canals 1, 2, 3	- Surface water ecosystem in the irrigation and drainage canal network serving the aquaculture area of Hoang Chau commune. - Aquatic flora and fauna in irrigation canals - Cultivated area for crops and aquaculture - Local residents engaged in aquaculture and crop cultivation.
8	Subproject 8	Irrigation canals along Ong Hong, Ong Ninh, and Quay Co sluices	- Surface water ecosystem in the irrigation and drainage canal network serving the aquaculture area of Van Loc commune, Len river - Aquatic flora and fauna in irrigation canals - Cultivated area for crops and aquaculture S - Local residents engaged in aquaculture and crop cultivation.
9	Subproject 9	Irrigation canals along Ong Thuoc Sluice (right bank of Hoang River) and Ong Vanh Sluice (left bank of Yen River)	- Surface water ecosystem in the irrigation and drainage canal network serving the aquaculture area of Quang Chinh commune, Hoang river, Yen river. - Aquatic flora and fauna in irrigation canals - Cultivated area for crops and aquaculture. - Local residents engaged in aquaculture and crop cultivation.

The impact level is assessed as Low because: (i) The volume of domestic wastewater generated at each worker camp is relatively small (3.3–5 m³/day). (ii) Wastewater is concentrated within construction site areas. (iii) Wastewater generation is not continuous throughout the day, occurring mainly during rest periods and after daily work hours. Local labor is prioritized (typically accounting for 30–50% of the workforce mobilized for each subproject), and housing is rented from nearby residents, resulting in actual wastewater volumes being significantly lower than estimated. (iv) Although the flow rate of receiving bodies is not high, pollutant concentrations are relatively large. However, these water bodies have continuous flow. The receiving sources for wastewater are irrigation and drainage canals serving aquaculture zones, including the De Canal, Lach Truong River, and Hoang Truong Port. These areas primarily support vessel movement and storm sheltering, and are not intended for domestic water supply. (v) The duration of impact is not long (12–24 months) and occurs intermittently, with fluctuations in workforce size depending on the construction phase. Appropriate mitigation measures can be implemented to reduce these risks.

❖ **Construction wastewater**

The sources of **onshore construction wastewater** during the implementation of the subprojects include: (i) Wheel-wash wastewater before vehicles exit the construction site; (ii) Wastewater from small-capacity mortar and concrete mixers used to cast small precast components (with

the remaining concrete sourced as ready-mix); and (iii) Wastewater from washing construction equipment and tools. This type of wastewater is generated at a volume equal to 100% of the supplied water. Its composition mainly includes suspended solids, soil, stone, mortar, and cement. The pollution characteristics include hindering oxygen diffusion into the water and elevating pH, which adversely affects aquatic life in the area. Total volume of construction wastewater generated at each subproject is detailed as follows:

Table 4-20. Wastewater load generated from construction activities

Subproject	Subp 1	Subp 2	Subp 3	Subp 4	Subp 5	Subp 6	Subp 7	Subp 8	Subp 9
Vehicle washing water (m³/day)	8	7	3	3	3	3	4	3	3

According to the 2005 study conducted by the Center for Urban and Industrial Environmental Engineering – Hanoi University of Civil Engineering, the concentrations of pollutants in construction wastewater are as follows:

Table 4-21. Concentration of pollutants in construction wastewater

Types	Flow rate (m ³ /day)	Concentration of pollutants		
		COD (mg/l)	Grease (mg/l)	TSS (mg/l)
Vehicle washing water	37	50 – 80	1.0 – 2	150
Equipment washing water	5.0	10 – 15	0.5 – 1	10
Total	20.0	-	-	-
QCVN 40:2025/BTNMT (Table 1,2, F ≤ 2000m³/day, column B)		≤ 90	≤ 3	≤ 80

(Source: Center for Urban and Industrial Environmental Engineering, 2007)

This type of wastewater is characterized by the presence of floating oils and suspended solids. Wastewater generated from washing machinery, equipment, and vehicles contains high levels of suspended sediments, oils, grease, soil, and sand. If this wastewater is not collected and directed to sedimentation pits for preliminary treatment, but instead discharged directly into drainage ditches or surrounding areas, it may negatively affect the quality of receiving water bodies at each subproject site. Such discharge can increase turbidity, cause sediment accumulation, and disrupt aquatic ecosystems. It may also degrade the quality of irrigation water used for crops and aquaculture in nearby communities. Without proper treatment measures prior to discharge into rivers, seas, or irrigation canals associated with each subproject, the following impacts may occur:

- High concentrations of suspended solids increase water turbidity and reduce the ability of oxygen to dissolve from the air into the water.
- Accelerated sedimentation in the receiving water bodies.
- Elevated concentrations of pollutants in the receiving sources.

The level of impact is assessed as low to moderate. The increase in suspended solids and water turbidity negatively affects the survival of aquatic species. If vehicle wash water containing oil and grease is discharged without treatment, it may directly impact the aquatic ecosystem. At high concentrations, such pollutants can cause toxicity and reduce the abundance of certain aquatic species. However, since the volume of construction wastewater is relatively small, the construction period is not long (12–24 months) and occurs intermittently—mainly during the final 1–2 hours of each workday—the potential impacts can be effectively mitigated through appropriate management and technical measures.

In addition to construction wastewater generated from onshore activities, attention must also be paid to wastewater arising from **underwater construction works**. Specifically:

Dredging activities at Subproject 1 involve suction dredgers, clamshell dredgers, and self-propelled barges. At the end of each workday, suction dredgers are cleaned to remove dredged materials adhering to the hull, generating wastewater from equipment and vessel cleaning. Based on actual data from similar dredging projects, the estimated volume of wastewater at Subproject 1 is approximately 3 m³/day. This cleaning process causes soil and sand to be washed into the dredging channel, potentially increasing turbidity in the surface water of the Lach Truong River and De Canal. Affected receptors include aquatic organisms, fishery resources, and nearshore fishermen. However, these impacts are considered minor due to the small volume of wastewater and the nature of the suspended solids—mainly mud and sand—which settle quickly at the discharge site. Appropriate technical solutions and mitigation measures should be taken to minimize the environmental impact of this construction wastewater. Further analysis of water quality degradation due to dredging will be presented in the site-specific impact assessments in the following section.

(ii) Wastewater leakage from the bottom-discharge barge during the transportation and disposal process (Subproject 1)

The total dredged volume for Subproject 1 is approximately 18,800 m³. The dredged materials are transported using bottom-discharge barges from the dredging area to the disposal site in Hai Loc commune (now Van Loc commune), over a distance of about 3.0 km, posing a risk of leakage and overflow—especially during periods of heavy rainfall. During transportation, dredged materials may spill into surrounding waters, affecting aquatic organisms and increasing turbidity in the surface water near Hoang Truong Port. The extent of leakage is considered minor and depends on factors such as the volume of dredged materials on the barge and rainfall intensity. These impacts can be mitigated through appropriate technical measures. A transportation plan for bottom-discharge barges should be developed to minimize environmental risks during dredged material handling.

(iii) Wastewater from the dredged material suction process of cutter suction dredgers discharged to the disposal site – Subproject 2:

During the dredging process at Subproject 2, a cutter suction dredger will be used to pump dredged materials directly to the disposal site in Hai Loc commune (now Van Loc commune), located opposite the storm shelter anchorage area, with an average transportation distance of about 0.5 km. The disposal site is an abandoned salt production area, currently unused, and surrounded by elevated embankments higher than the ground elevation. The total dredged volume of the subproject 2 is approximately 365,000 m³. Based on typical dredging mixture ratios, the water-to-material volume ratio is 40:60, meaning the water content in the dredged slurry is estimated at 263,993 m³. The dredged material is transported by channel water, which flows back through settlement gaps and discharge outlets after passing through sedimentation pits at the disposal site. This wastewater contains silt and suspended solids, but does not contain oil or grease, and therefore does not pose significant environmental harm. However, without proper flow direction planning, sedimentation pits along the route, containment embankments, and wastewater filtration outlets, the discharged water may overflow into existing drainage canals, potentially causing erosion, sand collapse, and other physical disturbances. Affected receptors include aquatic organisms, irrigation canals adjacent to the disposal site, nearby aquaculture areas, and local residents around Van Loc commune. Overall, the environmental impact of wastewater from the dredging process of cutter suction dredgers is considered negligible, due to: (i) No significant intrusion of pollutants into local water sources, thus no substantial environmental contamination; (ii) Minimal impact on affected receptors, with no major ecological or socioeconomic disruption; (iii) Short and intermittent construction duration,

depending on actual progress and contractor's schedules. Appropriate technical and management measures can be implemented to effectively mitigate these potential impacts.

(iv) Wastewater leakage from dredged material during transportation and dumping (Subproject 3, Subproject 4, Subproject 5, Subproject 6, Subproject 7, Subproject 8, Subproject 9)

The construction solutions selected include: (i) Use Lassen III sheet piles to enclose the construction area along the right bank embankment. Flow will be diverted to allow construction of the remaining drainage channel section; (ii) For the main drainage and supply canal section from Ong Ninh Sluice to Quay Co Sluice, and from Ong Thuoc Sluice to Ong Vanh Sluice, including internal branch canals: Use Pontoons to support excavators for dredging the canal bed according to the designed cross-section. Flow will be diverted through the existing drainage channel during construction; (iii) For the canals under Subprojects 4, 5, 6, and 7 located in the communes of Hoang Yen, Hoang Luu, Hoang Phong, and Hoang Chau, construction will be carried out using Pontoons to support excavators for dredging the canal bed according to the designed cross-section. Therefore, flow diversion is not required during construction. Dredged material from these canal sections will be temporarily stockpiled at designated locations along the canal, allowing water separation to reduce the volume and weight of the dredged slurry. Wastewater leakage during the transportation of dredged material—containing organic matter and soil/sand residues—may affect both air (road transportation by trucks) and water environments when overflowing into canals/ditches along the transportation route to disposal site (road transportation by 10-ton truck to dumping site 1, 2 in Nga Tien commune – subproject 3, Son Trang hamlet, Hoang Tien commune – Subproject 4, Bac Hoi Trieu village, Hoang Chau commune – Subproject 5, Phuong Ngo 1 hamlet, Hoang Chau commune – subproject 6, Chau Trieu hamlet, Hoang Chau commune – subproject 7, Hung Thanh village, Van Loc commune – subproject 8, Dung hamlet, Quang Chinh commune – subproject 9, Wastewater leakage from trucks (subproject 3 to subproject 9) carrying dredged material may leave behind dust and sediment, contributing to air pollution and affecting public health along inter-village, inter-commune roads and National Route 10. These impacts are detailed in Table 1-7 – Chapter 1 of the report. In addition, the wastewater also affects the beautiful landscape and sanitation of the entire transportation route. However, since the construction period is relatively short (approximately 12 months) and the activities are intermittent, the overall impact is considered minor. With the implementation of appropriate technical and management measures, these wastewater-related effects can be effectively mitigated.

(iii) Tugboats and barges at Subproject 1

At the dredging site of Subproject 1, tugboats and barges are arranged to transport dredged material from the dredging area to the designated disposal site in Hai Loc commune (now Van Loc commune). At the end of each workday, the suction dredger is cleaned to remove residual dredged material adhering to the hull. Based on actual data from similar dredging projects, the estimated volume of wastewater generated from this cleaning process at the subproject 1 is approximately 2 m³/day. This cleaning activity causes mud and soil to be washed into the receiving water body, specifically the Lach Truong River—within the dredging channel area of subproject 1—potentially increasing surface water turbidity. However, the impact is considered minor, due to the small volume of wastewater and the nature of the suspended solids, which are primarily mud and sand that settle quickly at the discharge site.

(iv) Bilge Water

During the dredging operations at Subprojects 1 and 2, cutter suction dredgers, tugboats, and canoes are used. Given the 12-month construction period, bilge water is expected to be generated. According to the International Maritime Organization (IMO), improper discharge of bilge water from vessels can lead to oxygen depletion, negatively affecting marine life. It can also cause visible pollution, especially in coastal areas. Based on actual data from similar

dredging projects in the region, bilge water is typically generated due to leakage from pipes, faulty sea valves, or the propeller shaft assembly into the engine bilge compartment. These issues are usually addressed and repaired promptly. Estimated bilge water volumes are: approximately 0.05 m³ per construction cycle for subproject 1; approximately 0.1 m³ per construction cycle for subproject 2. Although the volume is small, specific management solutions are required to manage bilge water as well as minimize impacts on the sea.

❖ Stormwater Runoff

Stormwater runoff in the construction phase is calculated is based on the land-based construction area only, excluding the surface water area. According to TCVN 7957:2008, the volume of rainwater runoff across the construction site areas is calculated using the following formula:

$$Q_m = q.C.F \text{ (l/s)} \quad [\text{CT13}]$$

Where:

- Q: Max rainwater runoff flow rate (l/s)
- q: Rainfall intensity (l/s.ha).
- C: Runoff coefficient
- F: Construction site area (ha)

Rainfall intensity is calculated using the following formula:

$$q = \frac{A (1 + C \lg P)}{(t + b)^n} \quad [\text{CT14}]$$

Where:

- q: Rainfall intensity (l/s.ha).
- P: Repeated cycle of rain (P = 02 years).
- t: Time of rain flow in the project area (about 90 minutes);
- A, C, b, n: Climatic constants are based on local rainfall conditions, with the following values: A=9.150; C=0.53; b=28; n=0.97 depending on climate of each region. The calculated rainfall intensity at the project construction site is: **q= 103.75 (l/s.ha)**, converting this value to **m³ per day (m³/day)** using $k=10^{-3} \times 24 \times 3600$. Therefore, rainwater runoff volume across the land-based construction areas of each subproject is calculated and presented in the following table:

Table 4-22. The largest stormwater runoff volume in construction phase

No.	Subprojects	Runoff coefficient (C)	Area (F – m ²)	Stormwater flow rate (Q – m ³ /day)
1	Subproject 1	0.3	80,117	7,211
2	Subproject 2	0.9	56,500	15,255
3	Subproject 3	0.15	37,202,30	1,674
4	Subproject 4	0.15	14,518,32	653
5	Subproject 5	0.15	19,198,45	864
6	Subproject 6	0.15	9,636,33	434
7	Subproject 7	0.15	15,255,75	687
8	Subproject 8	0.15	18,974,09	854
9	Subproject 9	0.15	3,446	252

Rainwater runoff must be managed through appropriate collection and flow diversion systems to ensure discharge into the local common drainage ditches, thereby preventing localized flooding within the project area. The concentration of pollutants in rainwater depends on the interval between rainfall events and the cleanliness of the surface area. Pollutant levels are typically highest during the initial phase of rainfall (*defined as the period from when rainwater begins to flow across the surface until approximately 15 to 20 minutes later*).

According to WHO data (1993), the concentration of pollutants in rainwater runoff is approximately: 0.5 – 1.5 mg N/l, 0.004 – 0.03 mg P/l, 10 - 20 mg COD/l and 10 - 20 mg TSS/l, much lower than the permissible limits set by QCVN 40:2025/BTNMT – National Technical Regulation on Industrial Wastewater Quality. However, rainwater runoff across construction site surfaces can carry loose soil, debris, surface minerals, and leaked oil and grease. This leads to increased concentrations of suspended solids, organic matter, turbidity, and hydrocarbons in nearby water bodies such as coastal waters, rivers, and canals within the project area (as previously mentioned). Such degradation in water quality can have negative impacts on aquatic ecosystems, particularly affecting fish and other aquatic species by impairing respiration and photosynthesis. The ecosystem in the project area is relatively simple, making it more vulnerable to significant impacts from pollution.

The direct impact level of rainwater runoff is assessed as minor because: (i) The volume of rainwater runoff at the construction site is moderate; (ii) Runoff is concentrated within designated construction zones and disposal areas; (iii) Rainwater runoff is not continuous throughout the year—the rainy season typically occurs from July to October, while the construction period spans approximately 12 to 24 months; (iv) The receiving water bodies (sea, rivers, canals, and streams) have relatively large flow capacities; (v) The impact can be effectively mitigated through appropriate technical and management measures.

4.4.1.4. Impacts due to solid waste generated

Solid waste generated during the construction phase consists of three main categories: (1) Construction solid waste; (2) Domestic solid waste; (3) Hazardous solid waste. The estimated quantities of each type of waste are assessed as follows:

❖ Construction solid waste

This type of waste is generated during the site preparation phase and the construction process. The solid waste includes the volume of: (i) Cleared vegetation cover and soil or rocks spilled during the transportation of earth and sand; (ii) Dredged materials; (iii) Excess construction materials such as scrap metal, cement bag wrappers, surplus steel, wood fragments, and broken bricks.

Volume of construction solid waste of each subproject is as follows:

Table 4-23. Solid waste during construction phase

Subproject	Source of construction solid wastes						
	Excavated soil		Demolition of existing works		Vegetation clearance	Construction solid wastes	
	Dredged materials	Removed surface soil	Broken concrete, brick	Steel, iron, metal door panels	Trees/plants	Loose materials (stone, sand)	Construction materials (iron, steel, packaging, etc.)
	m ³	m ³	m ³	Ton	Ton	Ton	Ton
Subp 1	18,800					1,362.98	41.76
Subp 2	365,000					389.60	30.52
Subp 3	93,76		919.60	43.78	33.45	123.32	53.06

Subproject	Source of construction solid wastes						
	Excavated soil		Demolition of existing works		Vegetation clearance	Construction solid wastes	
	Dredged materials	Removed surface soil	Broken concrete, brick	Steel, iron, metal door panels	Trees/plants	Loose materials (stone, sand)	Construction materials (iron, steel, packaging, etc.)
	m ³	m ³	m ³	Ton	Ton	Ton	Ton
Subp 4	20,820.99	2,071.26	39.96	48.00	31.30	80.48	4.76
Subp 5	13,720.30	1,997.15			2.20	51.61	5.16
Subp 6	6,806.66	3,169.00	10.80		1.20	85.60	9.49
Subp 7	11,631.51	3,045.93	1.36		1.50	60.36	15.54
Subp 8	11,517.21		296.95		1.30	49.61	3.62
Subp 9	3,468.50		332.16		1.50	65.16	7.09

(Source: Project's cost estimates)

Based on Circular No. 12/2021/TT-BXD dated August 31, 2021, issued by the Ministry of Construction regarding the norms for material usage in construction, the waste volume is determined by the loss rates of various construction materials.

The affected group includes workers, residents living around the subproject areas. Details are as follows:

Table 4-24. Groups affected by construction solid waste during construction phase

Subprojects	Affected group
Subproject 1,2	- Workers - Fishermen, local people in seafood exploitation, processing, transportation, trading areas - Local people living along the road to Hoang Truong port (subproject 1). - Residents traveling along the road adjacent to Hoang Truong Port (Subproject 1) and the road adjacent to Hoa Loc Port (Subproject 2); - The site for receiving surplus materials and dredged materials located in Hai Loc commune (currently Van Loc) - Scrap collectors
Subproject 3 to Subproject 9	- Workers - Residents in the area involved in transportation, agricultural production, and aquaculture - Nearby residents; - Sites for receiving dredged and waste materials in Nga Tien village for Subproject 3 (the site of Mai Sy Tuan household and Long Son site); in Son Trang village, Hoang Yen commune (Subproject 4); in Hoang Phong commune (Subproject 5), in Hoang Luu commune (Subproject 6); in Hoang Chau commune (Subproject 7); in Da Loc commune (Subproject 8) and Quang Trung commune (Subproject 9). - Scrap collectors

If not properly managed and treated, the entire volume of construction solid waste (CSW) may negatively impact the surrounding environment of the project area, as well as affect construction progress and the quality of the built structures. This direct impact is assessed as moderate because: (i) The volume of waste generated is relatively large but localized within the construction site; (ii) The construction period is relatively short, approximately 12–24 months;

(iii) Construction solid waste (including excess excavated soil and dredged materials) will be collected and transported to approved disposal sites; (iv) A significant portion of the dredged material (primarily sand) may be reused as a sand resource (e.g., for landfilling), provided it meets construction material standards, and may later be auctioned in accordance with the Mineral Law; (v) These impacts can be mitigated through appropriate mitigation measures.

❖ **Domestic solid waste:**

Source of domestic solid waste: originates from daily activities of construction workers living in temporary camps, which are expected to be set up at the construction sites of the subprojects. The waste composition includes: Organic waste (leftover food, excess processed food, and fruit peels) and inorganic waste (plastic bags, food containers, beverage cans, and packaging materials).

Estimated waste generation per worker in the project area is approximately 0.9 kg/day (According to QCVN 01:2021/BXD – the National Technical Regulation on Construction Planning). However, since cooking activities will not be carried out on-site for workers, the waste generation per worker is adjusted to be 0.3 kg/day. The total volume of domestic solid waste generated during the project's operational phase is detailed as follows:

Table 4-25. Domestic solid waste of workers during construction phase

No.	Subprojects	No.of workers	Volume of solid waste (kg/day)	Duration (month)	Total (ton/entire construction period)
1	Subproject 1	200	60	12	21.600
2	Subproject 2	175	52.5	12	16.380
3	Subproject 3	145	43.5	16	18.096
4	Subproject 4	155	46.5	16	19.344
5	Subproject 5	140	42	16	17.472
6	Subproject 6	155	46.5	16	19.344
7	Subproject 7	150	45	16	18.720
8	Subproject 8	145	43.5	16	18.096
9	Subproject 9	130	39	16	16.224
Total			418.5		165.276

The impacted groups include construction staff and workers directly involved at the site, residing in temporary camps, as well as local residents in surrounding areas. Environmental components potentially affected include: Surface water quality at Hoang Truong coastline (Subproject 1), Truong Giang River (Subproject 2), Irrigation canals and aquaculture areas (Subproject 3 through Subproject 9), Len River (Subproject 8), Hoang and Yen Rivers (Subproject 9). Soil quality in the subproject areas.

Domestic solid waste typically consists of 60–70% organic matter and 30–40% other materials, and may contain a high concentration of bacteria and pathogens. If not properly planned for collection, transportation, and treatment, the organic components—especially those carrying disease-causing agents—can pose significant risks to water and air quality, and indirectly affect the health of construction workers, nearby residents, and the operation of adjacent infrastructure.

The individuals directly impacted by construction solid waste include site staff and workers, fishermen operating at the existing fishing port, and employees of the ship repair workshop at Hoang Truong Port. This waste is a source of increased dust concentration, which may affect the health of workers and fishermen. Improper stockpile of bulky waste materials can obstruct pathways, create slippery surfaces, and pose accident risks for both construction personnel and seafood harvesters. If the substantial volume of construction solid waste is not properly collected, stored, and treated, it may be washed away by rainwater runoff into water bodies such as Lach Truong River, internal canals, and irrigation ditches. This can lead to sedimentation and blockage of surface water flow at the port

area, increasing the risk of localized flooding at the construction site and surrounding areas—especially during the rainy season. Such conditions may pollute water sources, disrupt water usage, and negatively impact the local aquatic ecosystem. The impact level is assessed as moderate, and with the implementation of appropriate mitigation measures, these environmental and human health risks can be effectively avoided or minimized.

❖ *Hazardous waste*

Hazardous waste generated during the construction phase includes: (i) Oil-contaminated materials from machinery maintenance activities (code 18 02 01) (ii) Discarded asphalt from road construction and asphalt containers (iii) Packaging waste and containers for lubricants, asphalt, fuel, and paint (code 18 01 02) (iv) Welding rod stubs (code 07 04 01) (v) Batteries, light bulbs, and toner cartridges from on-site office (code 16 01 06). The volume of hazardous waste depends on the number of machines and equipment used, the workforce size, and the quantity of construction materials. The specific amount of hazardous waste (both solid and liquid) generated during the construction phase of each subproject is as follows:

Table 4-26. Volume of solid hazardous waste in construction phase

No.	Subprojects	Norms according to project estimated cost	Construction period (month)	Solid waste volume— solid (kg)	Solid waste volume— liquid (l)
1	Subproject 1	2.6	12	31.2	237
2	Subproject 2	2.3	12	27.6	311
3	Subproject 3	1.5	16	24.0	195
4	Subproject 4	1.8	16	28.8	75
5	Subproject 5	2.0	16	32.0	20
6	Subproject 6	1.6	16	25.6	25
7	Subproject 7	2.0	16	32.0	72
8	Subproject 8	1.6	16	25.6	26
9	Subproject 9	1.2	16	19.2	33

In addition to solid waste, hazardous liquid waste generated during construction primarily consists of waste oil from oil changes in construction machinery. Based on the number of machine shifts and the oil change norms per machine, the total volume of waste oil from machinery used for the project is summarized as follows:

The individuals directly impacted include staff and workers on-site and residing in temporary camps, as well as local residents in surrounding areas. Environmental components potentially affected are: Surface water quality along the Hoang Truong coastline (Subproject 1), Truong Giang River (Subproject 2), Irrigation canals and aquaculture zones (Subproject 3 through Subproject 9), Len River (Subproject 8), Hoang and Yen Rivers (Subproject 9), Soil quality in the subproject areas.

The level of impact is assessed as low because: (i) The volume of hazardous solid waste generated on-site is relatively small (averaging 7.3 kg/month/subproject) and is localized to specific construction stages; (ii) In the project area, there are designated units responsible for the collection and treatment of hazardous waste (HW); equipment and machinery repairs are expected to be carried out at local professional repair centers; (iii) The impact duration is not continuous, occurring over an estimated 12–16 months of construction; (iv) The impact can be effectively mitigated through the implementation of appropriate mitigation measures.

4.4.1.5. Impact on Terrestrial and Aquatic Flora and Fauna

❖ *For terrestrial animals*

Impacts on terrestrial organisms primarily arise during the construction phase, due to the removal of the organic soil layer for foundation works at Hoang Truong and Lach Truong fishing ports, leading to loss of existing vegetation cover. Additionally, noise and vibrations from machinery may affect certain terrestrial species such as field birds, reptiles, livestock, and domestic animals in the surrounding project area. However, based on current site surveys, the project area does not contain any rare or endangered species, and the habitat is relatively simple with low biodiversity. Therefore, the level of impact is assessed as minor. These effects can be effectively mitigated through appropriate construction management measures, including limiting the construction footprint, controlling noise levels, and restoring vegetation after construction.

According to Chapter 2 of the report, the terrestrial biological resources in the project area are not diverse, with a simple species composition and no rare or endangered species requiring conservation. Therefore, the impacts on terrestrial animals are considered insignificant.

❖ *For aquatic species*

During the construction phase, the primary sources of impact on aquatic ecosystems include domestic wastewater, rainwater runoff from worker camps and construction sites, and dredging activities. These factors contribute to increased turbidity, organic matter, nitrogen, and oil concentrations in receiving water bodies such as the Hoang Truong coastline, Truong Giang River, internal irrigation canals, aquaculture zones, and major rivers including Len, Hoang, and Yen. Dredging may also disrupt water flow and degrade water quality, thereby affecting aquatic habitats. However, based on current site surveys, the project area exhibits low biodiversity, with no rare or endangered species recorded. The aquatic ecosystem mainly consists of brackish water fish, zooplankton, small shrimp and crabs, benthic algae, clams, mussels, and snails, all with relatively low population density. Therefore, the level of impact is assessed as minor and can be effectively managed through appropriate construction practices and water quality control measures.

Subproject 1,2:

Impact on Phytoplankton: The impact on phytoplankton primarily occurs during dredging activities, which increase water turbidity and total suspended solids (TSS). This reduces light penetration through the water column, thereby limiting photosynthesis and growth of phytoplankton, and affecting their productivity and role in nutrient cycling within the aquatic ecosystem. Some phytoplankton may also be displaced or damaged by construction equipment. However, these impacts are confined to a limited spatial range (approximately 500m in radius) and a short duration (sediment settles within about 15 minutes after dredging stops). Once dredging activities conclude, environmental conditions gradually stabilize, allowing phytoplankton to recover quickly and reestablish ecological balance—especially when turbidity and TSS return to acceptable levels. Therefore, the impact is assessed as minor.

Impact on Zooplankton and Benthic Organisms

Dredging activities disturb the bottom sediment layer, causing some species to relocate to adjacent habitats. However, this process may make certain benthic organisms to be swept away with the sediment and removed from their natural environment. Others may perish due to habitat destruction. These impacts are largely confined to the dredging corridor, are unavoidable, and localized in nature. Nevertheless, aquatic ecosystems typically possess strong self-recovery capabilities. The benthic communities in the affected area may gradually reestablish themselves within approximately 6 to 12 months, depending on environmental conditions and water flow.

Potential impacts on fish, shrimp, and aquatic species in rivers and coastal waters: Increased water turbidity and suspended solids can hinder the respiration of aquatic species in rivers and

sea. CH₄ and H₂S⁵ released from disturbed bottom sediments may adhere to the gills of aquatic organisms, further obstructing their breathing. However, fish and shrimp tend to respond quickly to habitat disturbances, often swimming away as soon as dredging begins. Therefore, the risk of mortality due to habitat changes during dredging is considered very low. If oil or grease spills into the water during construction, it may cause acute toxicity to aquatic organisms and accumulate in the food chain—from lower-level organisms such as algae and phytoplankton to higher-level species like shrimp and fish. Once dredging activities cease, sediment layers are restored, and due to the short life cycles of many aquatic species (ranging from 7 to 30 days), recovery is typically rapid following stabilization of the riverbed in areas such as Lach Truong River and De Canal. Additionally, the project area experiences frequent vessel traffic, resulting in low species density and limited species diversity. As such, the overall impact of the project on the aquatic ecosystem is considered insignificant.

Impact on wetland vegetation: The impact on wetland vegetation primarily concerns species such as mangrove apple (*Sonneratia*), mangrove (*Avicennia*), and scattered wild plants growing along both sides of the Lach Truong estuary and De Canal, with heights ranging from 0.2 to 1.2 m and located approximately 25–80 m from the dredging area. Since dredging is carried out using suction dredgers and barges, with a discharge system that transports sediment to disposal sites located about 500m away, the direct impact on wetland vegetation is minimal. The disturbance is limited in both spatial extent and duration, occurring mainly during the construction of the port's frontage and storm shelter area. These wetland plant species possess natural regenerative capacity after construction activities. Therefore, the impact level is considered low and controllable.

Subproject 3,4,5,6,7,8,9:

Disturbance of bottom sediments: Dredging activities stir up bottom sediments, increasing suspended silt and sand in the water, which in turn increases the concentration of pollutants. Elevated levels of total suspended solids (TSS) reduce light penetration to the seabed, thereby hindering the photosynthesis of algae species within the project area. This disruption limits metabolic processes and the growth of aquatic organisms, ultimately reducing the availability of food for higher trophic levels in the ecosystem.

Flow changes due to dredging activities. Dredging activities can change natural water flow patterns, creating conditions that allow aquatic organisms from surrounding areas to migrate into the project zone. This may lead to the formation of new biological interactions with native species. If these interactions are symbiotic or mutually beneficial, the aquatic ecosystem may thrive and experience increased biodiversity. Conversely, competitive or predator–prey relationships could shift species composition and abundance, potentially restructuring the local ecosystem. However, due to the short life cycles of many aquatic species (typically 7–10 days) and the restoration of sediment layers following construction, the recovery potential of the aquatic ecosystem is considered high. Once the canal and riverbed stabilize, ecological balance is expected to reestablish rapidly.

Potential impacts on aquatic ecosystems in subproject areas: The potential impacts on aquatic ecosystems across the subprojects are assessed as low because: (i) There are no rare or endangered aquatic species identified within the project area. However, wastewater and rainwater runoff may increase water turbidity, which can negatively affect aquatic organisms. (ii) The duration of impact is intermittent and short-term, estimated to last 12–24 months during construction. (iii) These impacts can be effectively mitigated through the implementation of appropriate environmental management measures.

4.4.1.6. Impacts due to erosion, sedimentation, and local flooding

⁵ According to secondary study, the main gases are CH₄ and H₂S

During the construction phase, activities such as dredging, excavation, and filling in the subproject areas, combined with erosive forces of rainfall and tidal fluctuations at estuaries and rivers, may lead to a significant increase in suspended sediment levels over an extended period. This elevated sediment load contributes to enhanced deposition within the construction area. Heavy rainfall can cause surface erosion, mobilizing suspended materials from the construction site. These materials may be carried by runoff into receiving water bodies, degrading water quality and contributing to sedimentation in those aquatic environments. However, based on environmental assessments, these impacts are considered temporary, occurring only during the construction period (estimated at 12–24 months, intermittently). Once the technical infrastructure is completed and the area is concreted, these impacts are expected to cease entirely, specifically:

Subproject 1:

Sediment buildup at the estuary poses significant challenges for waterway navigation and flood discharge safety. Therefore, dredging the navigation channel in the frontage area is essential. However, dredging activities may change the seabed morphology in the frontage area, which can affect water flow patterns both within and around the dredging zone of Subproject Area 1. This change is a contributing factor that may increase the risk of shoreline erosion, particularly along the protective embankments and the revetment behind the wharf, throughout the 24-month construction period.

During the dry season, it is difficult to divert water in the Ma river into the Lach Truong River, causing the estuary to be heavily influenced by wave action and tidal forces, which lead to significant sediment accumulation. (i) The Lach Truong estuary experiences a diurnal tidal regime, with large tidal amplitudes reaching up to ΔH max of 3.0–3.5m. Tidal effects during the dry season are particularly pronounced, influencing both the estuary and the frontage area of the port. The forechannel area in front of the port significantly influence seabed morphology and increased disturbance of bottom sediments during low-flow periods. (ii) The estuary exhibits an asymmetric morphology, with weak hydrodynamic conditions and complex interactions among river flow, tidal currents, and wave energy. As a result, the deep channel alignment tends to shift northward, and the northern shoreline of the estuary experiences frequent sediment deposition⁶. On average, the estuary accumulates approximately 850,000 cubic meters of sediment annually, with sediment thickness ranging from 0.2 to 1m. The highest accumulation is observed at the head of the deep channel and the area in front of the estuary, extending toward the southern rocky cape.

The subproject 1 site is the water surface area located along the southern bank of the Lach Truong River. The terrain elevation varies from +2.9 m to –7.27 m from the shoreline outward. Dredging of the navigation channel is expected to bring primarily positive impacts, facilitating vessel movement and improving flood drainage capacity in the area. However, dredging activities may slightly affect the seabed morphology in the frontage area and pose MINOR risks to the structural integrity and safety of existing infrastructure. Measures on construction methods and assessment of structures and connection to existing Linh Truong port area and investment in new port are necessary to reduce to erosion risks as well as promote the efficiency of this port.

In addition, the leveling of entire planned land plots for site preparation and technical infrastructure in Subproject Area 1 will alter the area's natural elevation. Previously unused flat terrain will be replaced with compacted sand or concrete surfaces during construction. This transformation reduces the area's natural water retention capacity, causing rainwater to flow more rapidly into the river during heavy rainfall events. As a result, localized flooding may

⁶*Study on Hydrodynamic Regime and Erosion–Sedimentation Trends at Lach Truong Estuary, Thanh Hoa Province, November 2023, conducted by the National Key Laboratory for River and Coastal Dynamics.*

occur within the watershed during the construction phase. The impact is assessed as MINOR, occurring only during short-term periods of intense rainfall, and may affect construction progress and quality. However, in most cases, construction is paused during heavy rain or scheduled for the dry season, minimizing disruption. With the implementation of appropriate mitigation measures, these impacts can be effectively avoided or reduced.

Subproject 2:

Similar to the subproject 1, the general trend at the Lach Truong estuary is predominantly sediment accumulation, with a relatively large annual volume of silt and sand deposition. This sediment buildup poses significant challenges for waterway navigation and flood discharge safety. According to the hydrodynamic regime and erosion–sedimentation trend study for the Lach Truong estuary, the area experiences consistent sedimentation, with an annual deposition thickness ranging from 0.2 to 1 m, concentrated at the upper section of the estuary. The sediment source originates from the Lach Truong River, carried downstream by river flow, with an estimated volume of approximately 166,000 m³ per year. Dredging activities in the forewater area and storm shelter area under the subproject 2—Lach Truong Port, Hoa Loc Commune—may disturb the sediment layer, alter seabed morphology, and affect water flow patterns in and around the dredging site. These changes may also increase the risk of shoreline erosion, particularly along the protective embankments and the existing Hoa Loc wharf revetments, throughout the 24-month construction period.

The subproject 2 is the water surface area located along the eastern bank of the Lach Truong River and the alluvial ground of the Kenh De River. The elevation ranges from +1.5 to +2.5 meters. The filling of the designated land plots for site preparation and construction of technical infrastructure, creating space for vessel turning and mooring—will change the area’s natural elevation. As a result, during rainfall events, rainwater will flow more rapidly into the river due to reduced natural retention capacity. This may affect watershed hydrology and cause local flooding during short periods of heavy rain. The flooding impact is assessed as MINOR, short-term, and localized within the construction area during heavy rainfall events. These effects can be effectively mitigated by appropriate construction methods, engineering techniques, and construction scheduling.

In addition, dredging activities may pose risks to the structural integrity and safety of existing facilities. However, the level of impact is assessed as MINOR. Geological and topographic surveys were conducted in July 2024 to determine the geotechnical properties of the foundation soils and embankment materials, with boreholes drilled along the channel and road centerlines to depths of 3–5 meters. The implementation of appropriate construction methods, along with structural assessments and integration with the existing Hoa Loc Port and the newly planned port facilities, is essential to reduce the risk of shoreline erosion and enhance the port’s operational efficiency. This issue was also raised and acknowledged during the community consultation process, with input from local authorities of Hoa Loc commune and representatives of the local residents. By combining the results of geological surveys, laboratory testing, and stakeholder feedback, it is concluded that the impacts related to sedimentation and erosion during dredging on both the environment and existing infrastructure can be effectively mitigated through suitable engineering measures.

Subproject 3 → Subproject 9: The terrain elevation of the project site will be raised, and the surface conditions will be altered, resulting in faster water concentration during rainfall events. This reduces the area’s natural drainage capacity, thereby increasing the risk of local flooding and potential subsidence within the construction zone, specifically:

Subproject 3: The project area is the water surface area of a irrigation canal. Geological conditions vary across construction zones, with elevations ranging from 0.08 m to +2.29m. The

terrain elevation also changes gradually from the canal banks toward the channel bed, covering Phu Son 2 Canal, Bao Trieu Canal, and the T4 sluice area.

Subproject 4: The natural elevation of the area varies significantly, ranging from –2.0 m to +3.86 m, with uneven topography. The existing canals including Son Trang 1, Son Trang 2, Hung Tien, and Nghia Thuc are currently narrow and silted, while other sections have been completely filled in. As a result, the area is frequently flooded. The surface layer consists mainly of alluvial deposits and sediment accumulation, which reduces the natural water retention capacity of the site. Consequently, rainfall runoff flows rapidly into the river, leading to potential impacts such as erosion, sedimentation, and local flooding within the aquaculture canal under the subproject 4 in the protective dikes of the aquaculture area, Son Trang 1 and 2 sluices, Son Trang 2 drainage canal, Hung Tien Canal, and Nghia Thuc Canal in Hoang Yen commune.

The subproject 5 is located within the irrigation canal system serving the aquaculture area. Terrain elevation varies from the canal banks to the canal beds as follows: Cau Dua canal ranging from 0.15 m to +1.88 m, Tay canal: –0.11 m to +2.15 m, Hoi Trieu canal: –0.35 m to +1.41 m, Dong Coi canal: –0.91 m to +1.74 m. The stockpiling of construction materials and dredged sediments may affect the upgrading works of Dong Coi, Hoi Trieu, Tay, and Cau Dua Canals, causing erosion of canal banks and local flooding within the construction area.

Subproject 6: The landfiling process will alter the natural elevation of the area, transforming the terrain from uneven levels ranging between –0.12m and +1.75m into a more stable and uniform elevation. Previously, the surface layer consisted mainly of alluvial deposits and sediment accumulation, which provided limited natural water retention capacity. As a result, rainfall runoff tended to flow rapidly into the river. Upon completion of construction, however, the stabilized ground conditions will create favorable conditions for water irrigation and drainage in the aquaculture area along both sides of the canal, as well as for the operation and management of associated infrastructure such as the Thach sluice, Voi sluice, and management roads.

The location of subproject 7 is the surface water area of the existing irrigation canal system serving the aquaculture area of Hoang Chau commune. The terrain in this area is moderately varied, which is favorable for site leveling and construction activities. The elevation differences from the canal banks until the project boundary are as follows: Canal banks and internal roads within the aquaculture area: +1.50 m to +2.80 m, riverbank area: +1.30 m to +1.50 m. Field area: +0.01 m to +0.60 m. During construction, the ground elevation will be raised, and the surface conditions will be modified, leading to faster water concentration during rainfall events. This change is expected to enhance both drainage capacity and water storage functions of the irrigation canal system in the project area.

Subproject 8: The project site is located within the water surface area of the irrigation canal system in Da Loc commune. Terrain elevation varies from the canal banks to the project boundary, ranging between +0.01m and +0.56m. Previously, the surface layer consisted mainly of alluvial deposits and sediment accumulation, which provided limited natural water retention capacity. As a result, rainfall runoff tended to flow rapidly into the river, reducing the area's ability to regulate water naturally and affecting local hydrology. Upon completion of construction, however, the improved ground conditions will create favorable conditions for water storage and regulation, ensuring adequate irrigation and drainage for the aquaculture area of Da Loc commune and adjacent area along the main irrigation canals, including Ong Hong sluice, Quay Co sluice, and Ong Ninh sluice.

Subproject 9: The irrigation canal system is located in Quảng Trung commune. Terrain elevation from the canal banks and bed until the project boundary ranges from –1.39 m to +5.82 m. Previously, the surface consisted of alluvial deposits and sediment accumulation, which

reduced the area's natural regulation capacity and caused rainwater to flow rapidly into the rivers, affecting the hydrology of the Yen River and Hoang River. After completion, the project will facilitate water storage and regulation for the aquaculture area and incorporate an operation and management road along the canal from Ong Thuoc Sluice (right dike of the Hoang River) to Ong Vanh Sluice (left dike of the Yen River).

However, during the construction period of Subproject 3 to Subproject 9, the stockpiling of construction waste and dredged materials may affect the project sites, potentially causing erosion, sedimentation, and local flooding along canal banks, canal beds, and sluice areas. The level of impact is assessed as MINOR, localized, and intermittent, occurring mainly during heavy rainfall events within the overall 12–24 month construction period. These impacts can be effectively mitigated through the application of appropriate construction methods, management practices, and technical measures.

4.4.1.7. Impacts due to increased risks and traffic disturbance

❖ For road traffics

In the project area, the existing transportation system consists of National Highway 10, Provincial Road 10, and inter-village/commune roads, with widths ranging from 4 to 20 m. These roads are surfaced with concrete or asphalt and currently experience low traffic density. Construction activities, however, are expected to significantly increase the number of vehicles using these routes, including: Trucks transporting construction materials, dredged materials and excess excavated soil, and machinery and equipment moving in and out of the subproject areas. The transportation of heavy vehicle (e.g., excavators, cranes, hoists, rollers) may disrupt existing traffic flows, particularly on narrower inter-village and commune roads, increase traffic safety risks for road users, especially during peak hours and in areas near People's Committee offices and schools, where there is a high concentration of commuters, civil servants, and students. Affected groups are identified in Table 4-3 above:

- Subproject 1 – (i) The provincial road 510 passing through the project area has a length of 850 m. The road is constructed of concrete pavement, with a carriageway width of 5.5m and total width of both carriageway and roadsides is 8 meters. Along the southern side of the road is an existing residential area, while the northern side is the water surface along the Lach Truong shoreline. (ii) The inland waterway canal extends from the western part of the Lach Truong estuary to the sea, R = 40 m. The protection corridor on each side is 15 m, giving a total water surface width of 70 m. The edge of the inland waterway protection corridor is located approximately 15–55m to south of the existing embankment line.
- Subproject 2: Dyke road to the North of Hoa Loc Port and the road to the West of the Fisheries Management Board, dyke road to the West of De canal, running through Xuan Loc commune and Diem Pho urban area to the north, with a total length of approximately 436 m, roadbase width: 7.5 – 10.0 m, roadbed width: 6.5 – 7.0 m, shoulder width: 0.5 – 1.5 m, pavement structure of cement concrete. Within the Hoa Loc port area, there is a wharf with a width of 11.5 – 13.5 m and a port yard with a width of 49 – 68 m. Structure of both wharf and port: cement concrete.
- Subproject 3 – About 20 km with a roadbase of 10 m, roadbed of about 7 m, shoulder of 0.5 m, road surface of cement concrete. NH 217 is about 4.5 km, at least class III, 4 lanes; NH 217: the section through Nga Son is about 4.5 km long, class III, 4 lanes, asphalt concrete structure.
- Subproject 4: Inter-commune road Hoang Yen - Hoang Truong, PR 510, concrete road, road surface width 5.5m, average road shoulder of 1-1.5m. NH 1A is 7.58km long; class III. PR510B (Hoang Truong - Hoang Phu) is 15km long, road class VI-V. The

- management and operation route of Hung Tien and Nghia Thuc canals has been eroded, cracked, 4-5m wide, 1m shoulder on each side.
- National Highway 1A is 7.58km long; road class: III; NH 10 is 8.52km long; road class: IV. PR 509 (Nghia Trang-Cho Phu) is 5.2km long, road class V; PR10 (Hoang Thanh-Gong Intersection-Cho Vuc) is 12.90km long, road class IV-VI; PR 510B (Hoang Truong-Hoang Phu) is 15.0km long, class VI-V.
 - Subproject 6 – NH1A is 7.58km long; road class: III; NH 10 is 8.52km long; road class: IV. PR DT509 (Nghia Trang-Cho Phu) is 5.2km long, road class: V; PR510 (Hoang Thanh-Gong intersection-Cho Vuc) is 12.90km long, road class: IV-VI; PR510B (Hoang Truong-Hoang Phu) is 15.0km long, road class: VI-V;
 - Subproject 7: NH1A is 7.58km long; road class: III; NH10 is 8.52km long; road class: IV. PR509 (Nghia Trang - Cho Phu) is 5.20km long, road class: V; PR510 (Hoang Thanh - Gong Intersection - Cho Vuc) is 12.90km long, road class: IV-VI; PR510B (Hoang Truong - Hoang Phu) is 15.0km long, road class: VI-V.
 - Subproject 8- NH1A: about 6.3km, road class III, 4 lanes; road surface structure of asphalt concrete. NH 10: total length about 13km from Tham bridge (connecting with Nga Son) to Sai bridge (connecting with Hoang Hoa), 16m-20m. The remaining section class: V, VI (through Thuan Loc) 2 lanes; road surface structure of asphalt concrete. PR526: from Dai Loc (intersection of NH 1A) through Hoa Loc - Minh Loc to Da Loc, road class-IV, VI, 2 lanes; asphalt surface structure. PR 526B: road class VI, 2 lanes; asphalt surface structure.
 - Subproject 9 – NH 1A: 17.5km long, 4-lane, road class III, 21.5m wide roadbed; the section passing through the urban area has a 29.5m wide roadbed. Structure of asphalt concrete surface. NH 45: 8.5km long, 2-lane, class IV plain road, 9.0-11m wide roadbed. Structure of asphalt concrete surface. PR 504: 11.0km long, road class IV, 9.0m wide roadbed; 7.0m wide roadbed and road class V, 6.5m wide roadbase; 3.5m wide roadbed. PR 511: 10.3km long, road class III, IV, 9.0m wide roadbase; 7.0m wide roadbed.

Impacts on road traffic: (i) The construction process will significantly affect the mobility of local residents and surrounding areas. During peak hours, when construction activities are ongoing, traffic congestion will be unavoidable. This requires the project owner to coordinate with contractors for proper management and supervision, and to take measures for traffic guidance and diversion along the affected routes. (ii) The risk of traffic disruption and accidents is particularly high in areas near commune People's Committee offices and primary schools, due to the presence of residents commuting to administrative offices and students traveling to school. These risks are especially relevant during the construction phase, when road connections and underpasses for local access have not yet been completed. (iii) In addition, the quality of the main dyke roads used for transportation—such as Phu Son 2 Canal (subproject), dyke roads 1 and 2, Son Trang 2 drainage canal (subproject 4), operation and management roads and Hoi Trieu Canal (subproject 5), operation and management roads along the main supply canal (subproject 6), Khe River Canal, branch canals 1, 2, 3 (subproject 7), and the main supply canal from Ong Thuoc Sluice to Ong Vanh Sluice (subproject 9)—as well as existing irrigation sluices along the dykes, may also be affected by the operation of heavy trucks and construction machinery. These impacts may include the formation of potholes, uneven surfaces, and waterlogged depressions during rainfall, thereby increasing traffic safety risks for both people and vehicles.

Impacts on waterway (i) During the dredging process, the equipment used includes 1,200 CV suction dredgers, barges of 200T, 250T, and 400T capacity, and cable-bucket excavators with crane systems mounted on barges. These vessels are constantly anchored or moving near the dredging area, which may obstruct the navigation of passing boats and ships. (ii) In addition, the transportation of dredged materials on the river will increase traffic density along the

navigation channel, leading to obstruction and congestion of inland waterway traffic within the navigation channel during dredging at subproject 1 – Hoang Truong Fishing Port and Subproject 2 – Hoa Loc Fishing Port; Collisions and accidents as vessels enter and exit the channel; Narrowing of the navigable channel available for vessel movement; Oil spills or leakage incidents caused by vessel collisions, leading to water pollution and damage to ship equipment; Delays in dredging progress and disruption of cargo transportation schedules along the channel; Impacts on the ecosystem (ECS) in the port area; Negative effects on the economic activities of vessels entering and leaving the port, as well as fishing boats operating outside the transportation route; Increased vessel density, which raises the risk of marine accidents and potential environmental incidents.

The level of impact is assessed as moderate due to the following reasons: (i) The number of trucks involved in transportation is relatively low (2–36 trips per day), and construction machinery is only mobilized during specific periods when required and will cease operation once the works are completed. (ii) The impact duration is not continuous, but rather short-term, within approximately 12–24 months. (iii) The number of affected stakeholders is not large, since the density of existing traffic on the main transport routes is low. Moreover, construction-related traffic can be scheduled to avoid peak hours when residents commute to work and students go to school. (iv) These impacts can be effectively mitigated by taking appropriate management and technical measures.

❖ *For waterway traffic of Subproject 1, 2:*

Impact: Waterway traffic may also be affected due to the increased number of construction machines and equipment that must be transported by water to the construction sites. In particular, during the dredging process, a variety of vessels and equipment will be mobilized, including: Sand-suction dredger 126 CV, cranes 5–50 tons, large suction dredger 1,200 CV, barges 200T – 400T capacity, tugboats 150 CV, boats of 40T capacity, canoes, pile-driving vessels, etc.

Impacts and obstacles to inland waterway traffic: (i) Obstruction and congestion of inland waterway traffic within the navigation channel during dredging activities at subproject area – Hoang Truong Fishing Port and subproject 2 – Hoa Loc Fishing Port. (ii) Collisions and accidents caused by vessels entering and exiting the navigation channel. (iii) Narrowing of the navigation channel, reducing the available space for vessel movement. (iv) Oil spill or leakage incidents resulting from vessel collisions, leading to water pollution and damage to ship equipment. (v) Negative impacts on dredging progress and delays in the transportation of goods entering and leaving the channel. (vi) Impacts on the ecosystem (ECS) in the port area. (vii) Impacts on the overall economy of vessels entering and leaving the port, as well as fishing boats operating outside the transport route:

Waterway traffic – Subproject 1

The inland waterway channel at the Lach Truong estuary has a width of 40m, with a 15-meter protection corridor on each side, giving a total water surface width of 70m. The channel passes through the project area, located approximately 15–55 m to the south of existing embankment. During the 12-month construction phase, the transportation of materials and dredging activities using vessels and barges may increase traffic density, causing temporary obstructions to inland waterway traffic and posing a risk of collisions, particularly in the Linh Truong wharf area. However, the impact is assessed as low and localized, since the cross-section of the wharf is 130 m wide, and the dredging area occupies only about one-third to one-fifth of the total water surface, leaving sufficient space for vessels to navigate.

At present, Hoang Truong Port accommodates approximately 300 fishing vessels, with an annual catch of 2,000–3,000 tons and a daily traffic volume of around 250 vessels. Of these, about 225 trips per day are of 450 nearshore fishing vessels, and 32 trips/2-3 days of 32

medium-shore vessels. Since vessel arrivals and departures occur within specific timeframes and the port has multiple berthing positions, construction activities can be scheduled and regulated to minimize conflicts with fishing operations. In addition, attention must be given to the control of floating waste (e.g., plastic bags, styrofoam boxes, damaged nets) to prevent impacts on port equipment and vessels. The project owner should ensure appropriate construction planning and coordinate traffic management to reduce risks throughout the project implementation period.

Impacts on waterway traffic is assessed as low to medium and localized because: (i) The port cross-section is wide (~130 m), and the dredging area occupies only one-third to one-fifth of the water surface, thus ensuring sufficient passage for local vessels. (ii) Dredging equipment operates only in place for a few hours at a time. However, during dredging operations, attention must be paid to floating waste (plastic bags, styrofoam, damaged nets, etc.), which may affect both equipment and vessels. Therefore, the project owner should implement appropriate construction methods and traffic regulation measures during material transportation and dredging activities to minimize impacts on inland waterway traffic.

Waterway traffic – Subproject 2

The inland waterway channel located in the west of the Lach Truong estuary to the sea has a width of 40 m, with a 15 protection corridor on each side, giving a total water surface width of 70 m. During dredging, types of vessels will be in operation, including suction dredgers, barges, tugboats, small boats, and supply vessels for fuel and water. At present, the Hoa Loc Port area accommodates frequent vessel traffic, with more than 100 offshore fishing vessels operating twice per month. On average, there are approximately 492 vessel departures and 364 arrivals annually, with a total yield of about 1,500 tons. The dredging and port construction works are expected to last about 12 months, which may cause temporary obstructions to inland waterway traffic due to channel narrowing and an increased risk of collisions between dredging equipment, supply vessels, and fishing boats. In addition, the anchoring of barges and the transportation of dredged materials along the channel may disrupt local waterway traffic, particularly in the storm shelter area, affecting the berthing of approximately 700 fishing vessels during the storm season. Collision risks are higher during peak hours of vessel arrivals and departures, especially along the route from the construction site to the disposal area in Hai Loc commune (now Van Loc Commune), and may also increase accident risks for fishermen and ferry passengers at Lach Truong and Hoa Loc ferries (now Hoa Loc Commune). However, these impacts are assessed as minor and controllable, provided that appropriate traffic coordination and management measures are implemented throughout the construction period.

Thus, impacts on inland waterway traffic are assessed as minor to Medium and localized at each dredging and construction site because: (i) The cross-section of the project area is relatively wide. (ii) Dredging equipment is usually stationed at one location and operates for only a few hours at a time. (iii) The density of vessel traffic is low to moderate, depending on the season/day (approximately 100–250 vessel movements per day). (iv) With the application of proper waterway and road traffic safety management during the construction phase, potential impacts including traffic accidents can be avoided, minimized, and mitigated. (v) Appropriate scheduling and allocation of time and berthing positions for vessel owners during fishing period will be arranged when dredging and construction are carried out at subproject 2 area.

4.4.1.8. Risk of Damage to Existing Infrastructure due to Transportation of Construction Materials and Machinery

Most of the road networks surrounding and within the project site are constructed with cement concrete or asphalt concrete pavement. The transportation of construction materials to the site by trucks exceeding the allowable load capacity on these routes may cause damage to road surfaces. Technically, repairing concrete roads can be difficult; therefore, such impacts should

be avoided by applying solutions such as: using alternative transportation routes (e.g., waterways), or restricting access only to trucks with appropriate load capacity. In addition, the operation of cranes and heavy lifting equipment may affect existing technical infrastructure such as power lines, telephone lines, water supply, and drainage systems (as mentioned in Chapter 2), particularly along the routes for transportation of construction materials and waste.

Impacts on infrastructures

Infrastructure such as roads, power systems, canals, bridges, and embankments may be affected during the construction of project works and components. This will have direct impacts on residents and organizations currently residing in the area, as well as on the mobility and daily activities of local people and related entities within the project implementation zone. These impacts may cause inconvenience and disruption, both directly and indirectly, to production activities, particularly in fishponds and aquaculture areas, and will increase pressure on surrounding infrastructure due to the higher frequency and volume of transportation along adjacent routes.

Infrastructure affected by the subprojects:

Table 4-27. Impacts on existing works, infrastructure in construction phase

Subprojects	Affected works	Images
Traffic works		
Subproject 3	A section of 75m of concrete road will be affected due to land acquisition for the Phu Son 2 canal in Nga Tien commune during the construction of subproject 3. This impact is not significant for local travel or the stockpiling of construction materials in the area, since both contractors and residents can use alternative routes for a short period of time. Therefore, the level of impact is assessed as MINOR, localized, and short-term, occurring only during the construction phase.	
Subproject 9	A section of 366m of concrete road in Quang Trung commune will be acquired during dredging along the main supply canal. However, local residents can still travel using alternative routes, so the level of impact is assessed as MINOR and short-term, occurring only during the canal construction period. The affected road section will be reinstated immediately after construction is completed.	
Electricity system:		

Subprojects	Affected works	Images
Subproject 6	Two 0.4 kV low-voltage power poles in Hoang Luu commune will be relocated during the dredging and expansion of the operation and management road. During the land clearance, the construction unit will coordinate with the local power entity to relocate and complete necessary compensation procedures, ensuring that electricity supply to the area remains uninterrupted. The level of impact is assessed as MINOR, and can be effectively managed by appropriate preventive and mitigation measures.	
Subproject 4	power poles (35 kV), 1 transformer station, 16 temporary poles, and about 4,200 meters of 0.4 kV power lines in Hoang Yen commune will be relocated during the expansion of the operation and management road. During the land clearance, the construction unit will coordinate with the local power entity to relocate and complete necessary compensation procedures, ensuring that electricity supply to the area remains uninterrupted. The level of impact is assessed as MINOR, and can be effectively managed by appropriate preventive and mitigation measures.	
Stone embankment system		
Subproject 1	A section of stone embankment with a volume of 2,285 m ³ in Hoang Truong commune will be demolished during the upgrading and expansion of Hoang Truong Fishing Port. In general, the removal of this embankment section will not cause significant impacts on local residents or fishermen. The level of impact is assessed as short-term and localized, and can be effectively mitigated through an appropriate construction plan and mitigation measures.	
Concrete ditch/bridge system		

Subprojects	Affected works	Images
Subproject 9	Concrete ditch with a dimension of 0.4m x 0.4m– Quang Trung commune. Concrete bridge with a dimension of 35m²– Quang Trung commune. These structures will be affected during the land acquisition and site clearance process for infrastructure upgrading works in Quang Trung commune. Local residents can easily use alternative transport routes, so the impact on community travel is not significant. The impacts will end once the construction of subproject 9 is completed. Therefore, the level of impact is assessed as short-term and negligible.	

4.4.1.9. Occupational health and safety (OHS) issues

For the construction of subprojects, around 130-200 workers of each subproject are expected to participate in construction activities over an 12–24-month period. As such, there are potential occupational health and safety risks as follows:

Workers may work in environments with increased dust and toxic gas pollution due to demolition, excavation, and machinery activities, which can lead to dizziness or fainting while working. Workers can have accidents due to exposure to electrical tools/equipment, dangerous objects such as sharp iron, nails, screws, and the simultaneous operation of multiple machines in a narrow construction site, especially when workers are not paying attention, not using full personal protective equipment, and lacking awareness of safety regulations. Construction activities can cause other occupational accidents for workers such as fires and explosions due to welding-gas leaks, fuel leaks, welding activities, electric shocks, working at heights, falling into the sea, construction collapses, and the operation of bulky machinery (barges, cranes, rollers, steel cutters, welders, wheel loaders, trucks, etc.) and materials, as well as working in extreme weather conditions such as large waves, strong winds, and poor construction site organization.

Regarding working conditions, workers' OHS problems can be caused by falling into water or even drowning while working on water/sea due to illness or loss of balance. In addition, they can also come into contact with materials containing toxic substances such as oils, etc. If direct contact is made, short-term health effects can be skin or respiratory system irritation while some substances have can penetrate through the skin and enter the body system. The accumulation of toxic substances during work will lead to more serious long-term health effects, so it is necessary to be concerned.

Other OHS issues related to working conditions would be inadequate lighting or inadequate protection when working in specific conditions or locations.

Working with construction electric or diesel tools and equipment (e.g. 200T – 400T barges, 1200CV suction dredger, 150CV-360CV tugboat, cranes, hoists.), workers can also be electrocuted or burned. Extreme weather conditions also cause OHS risks and issues. Strong winds and very heavy rain during storms in coastal areas can cause unfinished/temporary construction works, even construction factories to become unstable, and even cause some tools and equipment to move. Outdoor construction equipment and materials lead to accidents for

people around, including workers. Working long hours on very hot days can also cause exhaustion and even fainting for workers.

Regarding worker behavior, safety risks can come from workers' awareness and attitude towards the use of Personal Protective Equipment (PPE) and personal behaviors at the construction site. Regarding PPE, it is common for workers at larger and more experienced contractors to be well-trained in EHS and provided with adequate PPE, so they are often subject to more stringent safety rules on site. However, workers of smaller/local contractors using PPE (e.g. used as life jackets in rivers/sea) on construction sites depends on the level of enforcement.

Decline in workers' health

For dredging workers as well as other construction workers, inadequate living conditions in workers' housing also lead to health and safety problems. Illnesses related to water-borne diseases can be caused by not having enough clean water for use, not having access to adequate sanitation facilities, and poor sanitary conditions in and around the camp. Living at a construction site, away from home for a long time, if workers do not follow a healthy lifestyle and get into fights, drinking, or prostitution, they can also suffer long-term health effects from these activities.

Risk of fire and explosion:

Fire and explosion incidents, as well as electrical short circuits, may occur during the transportation and storage of fuel or due to the lack of safety in the temporary power supply system, causing damage to people and property during subproject implementation. The specific causes can be identified as follows: (i) Temporary storage facilities for raw materials serving machinery and technical equipment during construction (paint, gasoline, etc.) are sources of fire and explosion. When incidents occur, they can cause damage to people, property, and the environment; (ii) Electrical incidents such as shocks, explosions, short circuits, etc., due to the temporary power supply system for construction machinery and equipment; (iii) The use of heating devices (welding, heating, etc.) can cause fires, explosions, or workplace accidents if preventive control measures are not in place; (iv) Especially in the case of thunderstorms, lightning strikes and workers' carelessness in using electrical equipment are the main causes of short circuits and explosions; (v) Careless behavior of workers can lead to accidents or even danger in construction areas, including smoking near flammable materials such as fuel tanks, careless handling of electrical wires, unauthorized operation of construction machinery.

Electrical short circuits and explosions can damage construction machinery and equipment, and cause fires in camps and material gathering areas during the construction phase. Since such incidents can occur at any time, the project owner actively takes effective preventive and control measures to minimize and limit these negative impacts as much as possible.

In general, the risk of occupational accidents and traffic accidents at the construction site is assessed as MODERATE, due to the following factors: (i) Such risks are inherently present and may occur at any time during construction activities. (ii) The number of workers is moderate (approximately 130–200 people). (iii) These risks may occur during the 12–24 month construction period. (iv) The risks can be mitigated through appropriate measures, such as: Conducting occupational safety training before and during construction, providing workers with adequate personal protective equipment (PPE), strengthening supervision and monitoring by the contractor's environmental staff, the Construction Supervision Consultant (CSC), and the project owner.

4.4.1.10. Issues related to community safety and health

Local residents living around the construction site, along transport routes, and near disposal areas may be exposed to hazardous waste, unpleasant odors from dredging activities, temporary sludge storage, and pathogens from poor sanitation. Furthermore, increased dust concentration,

noise, and traffic density due to machinery operation and transportation, soil subsidence, construction collapse, and unprotected deep holes on the roads could pose risks to public health and safety.

Risk of spreading infectious diseases: Local people and workers are at risk of transmitting infectious diseases such as sexually transmitted diseases (STDs) and HIV/AIDS. New workers may be more susceptible to infections from diseases in the local community. The impact can be minimized through training to equip workers with essential knowledge. The anticipated level of risk is assessed as LOW, under the condition that national regulations⁷ and control measures are strictly applied, in line with WHO guidelines, combined with the country's established experience in preventing communicable diseases and the lessons learned from the implementation of World Bank-funded projects. However, during the environmental and social assessment, surveys and social assessments should be conducted to identify and assess local infectious disease risks. Prevention solutions will be included in the Subproject Labour Management Plan (LMP). Such impacts and risks are assessed as MINOR and can be managed through the application of the Code of Conduct and other measures outlined in the Labor Management Protocol. In addition, the boundaries of each construction site/component/contract will be clearly defined and agreed upon among contractors under the coordination of the Construction Supervision Consultants (CSC) and the Project Management Unit (PMU) in each province/city.

The risk to community health and safety is assessed as LOW because: (i) Construction activities are carried out in separate, designated construction sites, not extending along existing traffic routes or interspersed within residential areas; concentrated residential zones are located at a distance of about 50 m and have relatively low density; (ii) The number of workers is not large (approximately 130–200 people per subproject), concentrated within a single construction site, which may have some influence on community safety; (iii) The construction period for subproject components is relatively long (about 12–24 months); (iv) The project owner/contractor gives priority to hiring local labor; (v) Workers receive training on occupational safety and environmental hygiene before commencing construction activities; (vi) The risks can be mitigated through appropriate construction methods and rational site layout planning.

4.4.1.11. Social impacts due to labor influx

✓ Labor influx

It is estimated that about 130-200 workers will be mobilized during the peak period of subproject implementation. This number of workers may come from various locations of project provinces/cities or other provinces.

Some potential social risks and impacts related to labour influx of this project are predicted as follows: (i) Inadequate management of workers and labor camps may lead to competition for jobs as well as issues concerning working conditions and social welfare, such as labor standards and access to basic health care services. Conflicts between local residents and workers may also arise due to differences in background, language, occupation, and behavior (particularly between migrant workers and local communities) as well as disparities in income levels and personal interests. (ii) The movement of workers can pose a risk to local security or social stability if some workers engage in social evils (such as drinking, gambling, prostitution, etc.). (iii) The mobilization of migrant workers can increase the risk of transmitting sexually transmitted diseases, including HIV/AIDS, when workers from different localities interact with each other and with local communities. In the case of an epidemic, this would place an

⁷Law No. 64/2006/QH11 dated June 29, 2006 on the prevention and control of the virus that causes human immunodeficiency syndrome (HIV/AIDS). Decision No. 1246/QĐ-TTg dated August 14, 2020 by the Government approving the National Strategy to End AIDS by 2030.

additional burden on the local health system. (iv) Potential conflicts may arise between workers and local communities due to differences in background, culture, customs, employment, income, or minor disputes. (vi) Gender-based violence (GBV), exploitation, and sexual abuse/sexual harassment (SEA/SH) may be associated with the concentration of male workers in the project area. However, the risk of GBV and SEA/SH is considered low and controllable.

There are potential risks of child labor, forced labor, and sexual exploitation and abuse. In addition, both the local community and female workers may face risks related to gender-based violence (GBV) and child abuse, as well as sexual exploitation and abuse (SEA), particularly associated with the influx of workers.

There are potential risks of illegal use of child labor at construction sites. Gender-based violence (GBV) and sexual harassment may also occur due to the presence of migrant workers, leading to negative impacts on the mental health and personal freedom of female workers. However, with the enforcement of national regulations and the experience gained from the implementation of World Bank-funded projects, the risks related to child labor, forced labor, violence against children (VAC), and GBV are anticipated to be low.

✓ ***Community Disturbance***

Construction activities may disrupt commercial operations and daily activities of households and/or businesses located near the construction site. In addition, the proximity of fishing vessels operating in the area, as well as livelihood activities that rely on the use of nearby water resources (such as shrimp, crab, and fish farming), may also be affected.

During construction phase of the fishing port/storm shelter area, local communities would be disturbed by construction activities and environmental impacts resulted from these activities. The disturbance could be:

- Not being able to access by motorbikes to the road side houses, buildings, facilities including markets, schools, temples and grave yards, etc.... The transportation of fishing gear and harvested products from households to the sea may become more difficult when the new road intersects the access routes leading to the beach, fishing port, or anchorage area;
- Nuisance or even illness from waste and waste water from camps and construction sites.
- Hearing, recreation, watching TV, studying or sleeping may be disturbed by the noise from dredging, excavation, especially at lunch time or night time. It is necessary to have agreement and prior notification with the local residents or community, along with the establishment of specific sanctions for any violations.
- House, yard, garden land may flooded due to blockage of ditches after construction wastes fill it up
- Exposure to increased safety risks from construction activities, fuels, materials and wastes, and movements of trucks and other heavy construction plants on roadway and waterway.
- Not being able to access to water fronts, cannot take river water for production due to turbidity.

Exposure to environmental pollution or increased safety risks or being disturbed by construction activities may also be the causes of conflicts between local communities and the workers. Such disturbance and potential conflicts can be minimized through the implementation of RP, informing local communities about construction schedule and the implementation of mitigation measures during construction phase including ESCOP.

✓ ***Impacts on Women***

The concentration of 130-200 workers in construction sites may cause social disturbance, affecting women who directly work on the construction sites or those are living surrounding

the project area. Unmarried women may be disadvantaged in getting married or they may become single mom. Meanwhile, married women can be affected the happiness of their families. In addition, they may also suffer SEA/SH. However, all these potential risks and impacts are MINOR and controllable by mitigation measures.

✓ ***Use of Child Labor and Forced Labor***

To reduce construction costs, child labors may be used for some jobs that do not require high qualifications (according to Vietnam's regulations, child is under 15 years old). Due to limited knowledge, children can suffer from labor abuse that affects their psychology, health and ability to learn. According to the socio-economic survey results, no case of child labor or forced labor was recorded in previous projects in the locality. Child labor and forced labor is prohibited in this project and will be included in bidding document. However, some children may come to project sites to sell food, cigarette or soft-drink for workers. Construction supervision consultant will closely monitor to avoid SEA/SH risks to these children, especially female children.

✓ ***Labor and Working Conditions***

The Project's workforce will include: (i) direct workers, (ii) contracted workers (recruited by third parties such as contractors or as consultants), and (iii) primary supply workers. The project is not likely to engage community workers.

- Direct workers: are those who are directly employed by the PMU (PMU's staff) or individual consultants that PMU hired to support project implementation. The PMU is the project owner, responsible for the assessment and management of E&S risk, detail design, procurement, disbursement, contracts management and internal monitoring.
- Official/contracted employees: The workforce consists of employees hired by consulting firms and contractors during the design, construction, and supervision phases. The demand for labor depends on the scale and timing of each activity.
- Consultants: Cover areas such as technical design, construction supervision, environmental and social management, resettlement, and technical assistance. Each consulting firm typically employs 5–10 staff, while construction supervision companies usually have around 10–30 staff.
- Construction contractor: It is estimated that approximately 130–200 workers will be required for the construction of the subproject. In addition, a technical team consisting of project managers, engineers, environmental officers, health and safety staff, and accountants will include about 10–20 personnel. Unskilled local labor will be recruited directly by the contractors and subcontractors.
- Primary supply workers: Are employees of key material suppliers, including those providing aggregates, bitumen, steel, and precast concrete. The number and type of suppliers will be determined during the implementation phase. Their work will be concentrated primarily during the construction stage.

Other stakeholders: This group includes officials and civil servants from communes and provincial-level agencies such as the Department of Agriculture and Rural Development, Finance, and Home Affairs. They are subject to the provisions of the current civil service labor laws and must comply with Occupational Health and Safety (OHS) requirements when participating in project-related activities, particularly when working at construction sites.

Key labour risks In addition to the risks to the health and safety of the workers caused by working conditions (e.g. expose to extreme weather conditions, not enough lighting, electrical shocks, working in confined space, working underground or at height, lack of protection or non-compliance to safety rules etc.) discussed in the previous assessment of each work item, there are also other social issues related to the labor influx: (i) Possibility of child labor or forced

labor, with reference to the sector or locality; (ii) Gender Based Violence risks/Sexual exploitation and abuse/Sexual Harassment risks related to the concentration of relative large number of male workers to the project area. (iii) Infection during outbreaks of communicable diseases.

✓ ***Impact assessment related to the labor force of the main suppliers***

The main supplier: The project will purchase sand, stone, and other construction materials from suppliers within the province or neighboring provinces. Since most of the work is mechanized, the number of workers from the main suppliers is expected to be only about 5–10 people. Similar to the contractor's workforce, they will also generate domestic wastewater and solid waste. The main risks include: (i) Traffic accidents arising from the transportation of materials by road or waterway; (ii) Potential conflicts with contractor workers or the local community; (iii) Occupational accidents at the construction site; (iv) Health and safety risks for seasonal workers.

However, this indirect impacts and risks are forecasted "Low" level and can be mitigated due to: (i) The number of employees is not much; (ii) The employment time is not long; (iii) The main suppliers' workforce is regularly trained and instructed on traffic safety; (iv) They are usually local people; (v) Due diligence review on labor and working conditions of primary suppliers has been completed and monitoring requirements will also cover primary supply workers during the construction phase.

4.4.1.12. Risks and incidents during the construction phase

a. Fire and explosion risks, incidents

During the construction phase, machinery and equipment using DO fuel will be mobilized. This fuel is stored in tanks on the vehicles. Fire and explosion incidents may occur due to the following causes:

- Fire and explosion caused by electrical short circuits in construction vehicles and equipment. Electrical fires may occur due to substandard wiring, overloading, or the absence of proper circuit breakers and fuses.
- Fire caused by negligence during construction, such as failure to comply with fire safety regulations, or smoking near fuel storage areas.
- Fire resulting from improper operation of machinery and equipment, including failure to follow proper machinery operation procedures.

In the event of a fire or explosion, depending on the scale of the incident, damages may include loss of property as well as impacts on the psychology, health, and even lives of workers. Particularly, if a fire occurs in areas where oil is stored, it may lead to oil spills and spread to nearby moored vehicles. The damages caused by fire and explosion are often severe if not properly controlled. Therefore, the project owner and the construction contractor will closely coordinate to manage and minimize the fire and explosion risks.

b. Occupational accident risks and traffic accidents

The project will be implemented mainly on water, with a relatively large area. As a result, workers, machinery, and equipment will operate at high intensity. Occupational accidents may occur because:

- Construction workers not fully understanding or following construction procedures.
- Equipment operators without sufficient skills or appropriate qualifications.

- Construction equipment fails to meet performance standards, or is not inspected prior to use.
- Construction workers are not fully equipped with personal protective equipment (PPE), do not meet health requirements for construction activities, and fail to comply with occupational safety rules and regulations.
- Construction workers may fall carelessly from vessels or equipment during construction, leading to drowning.
- In the event of accidents such as collisions with other vessels, sinking, or capsizing, workers on board may be at risk of drowning.

In the case of an occupational accident, construction activities may be interrupted. Such incidents can affect workers' psychology, health, and even lives. Depending on the severity, accidents may impact one or multiple workers involved in construction. In general, the causes of occupational accidents are largely due to subjective negligence. Therefore, the project owner and the construction contractor will take appropriate measures for prevention and response.

c. Risks, incidents related to sedimentation and riverbed/bank erosion

The project's dredging area is located near several shoreline structures such as the breakwater embankment at Lach Truong fishing port and the embankment of the storm shelter anchorage area. Therefore, during construction, sedimentation and erosion of the riverbed/bank may occur due to:

- Use of construction equipment that is not suitable for site specific characteristics of each project
- Construction locations not consistent with the approved design.
- Failure to comply with the required construction elevation during the construction.
- Failure to monitor and observe changes in shoreline structures within the construction area during dredging activities.
- Heavy rainfall may cause erosion and wash away suspended materials during construction. These materials carried by stormwater can affect the water quality of receiving water bodies and lead to sedimentation in certain areas. However, this process is only temporary during the construction phase. Once construction is completed and the area is concreted, such impacts will cease.

If riverbank erosion occurs, it may cause cracking, breaking, collapse, and destruction of existing structures, as well as sedimentation in the constructed areas. Therefore, the project owner and the construction contractor will take technical measures to prevent and respond to incidents of erosion and sedimentation.

d. Risks and incidents of vessel collisions during dredging.

Vessel collision incidents may occur under the following circumstances: fog, unfavorable weather conditions such as storms or heavy rain; vessels navigating on the maritime channel without being adequately equipped with safety devices and maritime communication equipment; vessels failing to strictly comply with inland waterway traffic safety regulations; or operators lacking sufficient experience.

Therefore, to prevent such incidents, the project owner and the construction contractor must develop an incident response plan and ensure that vessels are fully equipped with collision-avoidance and maritime safety equipment.

e. Oil leakage and spillage risks.

During construction, equipment such as tugboats, dredgers, and barges will be concentrated and

utilized. These vessels consume large amounts of fuel, which may lead to oil leakage into the water. Causes of oil leakage incidents may include fuel transfer operations, leakage from fuel tanks, or collisions between vessels resulting in oil spillage.

During dredging, fuel supply for construction vessels is contracted from providers located in Hoang Hoa and Hau Loc districts. Fuel is transported to the construction vessels by tugboats and barges, and pumped directly from storage tanks into the fuel tanks of dredging vessels through a pipeline system. The refueling process may result in minor oil spills, odors, and solvent vapors; however, the likelihood is low due to the synchronized and secure connections of the fueling equipment. Nevertheless, if personnel fail to follow proper procedures, leakage or spillage may occur, causing adverse environmental impacts.

Impacts of oil spill incidents in marine transportation: When oil spills on water and infiltrates coastal and riverbank areas, if not promptly treated, the longer it remains, the deeper it penetrates. Oil spilled on the water surface quickly forms an oil slick across the dredging area. This has negative impacts on the local ecosystem, particularly shallow-water organisms. Oil spills affect ecosystems when concentrations in water reach 0.1 mg/l, which can cause mortality of plankton species; they also have significant impacts on juveniles and larvae of benthic organisms. Oil adhering to organisms or absorbed through filter-feeding processes reduces their ecological and economic value.

f. Incidents of pipeline rupture or embankment failure at waste disposal sites during dredging.

During dredging, incidents may occur such as rupture or dislodgement of dredged material discharge pipelines, and failure or overflow of containment embankments at disposal sites. Pipeline rupture or dislodgement may result from several causes, including poor pipeline quality, improper technical connection of pipeline segments, clogging during suction and discharge, or external mechanical impacts. Causes of containment embankment failure or overflow may include poor construction quality of the embankment, excessive discharge of dredged material at a single point, or external mechanical impacts.

In the event of dredged material being accidentally released into the surrounding environment, the nature of the material—primarily sand—means it has limited potential to pollute soil, water, or air in the area. Depending on the scale and duration of the incident, the amount of material dispersed into the environment may vary. The overall level of impact is not significant if the incident is promptly detected and appropriate remedial measures are taken.

g. Incidents during bored pile construction

Bored pile construction is a widely chosen method for many projects. However, during the construction process, the following incidents are commonly encountered:

- Inclination or deviation of boreholes: This may occur when drilling equipment encounters large rocks, causing the drill to shift sideways. Continuous drilling under such conditions can result in borehole deviation. The inclination of bored piles depends on multiple factors from the very beginning of the construction process.
- Concrete volume greater or less than calculated: If excess concrete is required, it indicates that the borehole has collapsed and there is no space for the concrete to descend, causing it to overflow. Conversely, if the concrete volume is less than specified, it suggests that the borehole has collapsed on both sides, creating an enlarged cavity.
- Collapse or cave-in of borehole walls: The main causes under static conditions include: insufficient casing length to penetrate complex geological layers; inadequate maintenance of slurry column pressure; relatively high groundwater pressure; presence of gravel layers with or without flowing water leading to slurry loss in the borehole; insufficient slurry density and concentration; delayed slurry supply;

absence of casing support at drilling locations with soft geological layers denser than bentonite; use of inappropriate slurry for wall stabilization; and excessively fast drilling speed preventing timely formation of a protective slurry membrane inside the borehole.

h. Incidents of containment embankment or cofferdam failure during culvert construction.

During culvert construction at subprojects 3, 4, 5, 6, 7, 8, and 9, incidents such as failure or overflow of containment embankments and cofferdams may occur. These failures can result from poor construction quality and inadequate technical standards, or from extreme weather conditions such as storms, floods, and prolonged heavy rainfall.

Depending on the scale and duration of the incident, environmental impacts may vary in severity. However, the project owner must coordinate closely with the construction contractor to implement timely response and remediation measures.

i. Risks of by natural disasters such as heavy rainfall and flooding, storms and strong waves, and sea level rise.

The project is implemented in an estuarine area, which is highly exposed to risks from sea level rise, the strong impacts of storms and tropical depressions. Natural disaster impacts may arise from both objective and subjective causes. Objective causes include unexpected events such as heavy rainfall, flooding, strong waves, and high winds that occur without prior warning or beyond forecasted levels. Subjective causes include disasters that were forecasted but, due to negligence or lack of appropriate preventive measures, still result in adverse impacts on construction activities, damage to equipment and machinery, and negative effects on human health and safety.

In the event of natural disasters during project construction, equipment may be damaged or sunk, and dredged material may be released into the environment. Depending on the severity of the disaster, economic losses may occur, along with adverse environmental impacts and risks to workers' health and safety. In addition, during both construction and operation phases, disposal sites may experience localized flooding during storms and heavy rainfall.

4.4.2. Site-specific impacts

Subproject 1: Upgrade of Hoang Hoa fishing port

With the location, investment scale and environmental-social characteristics in the location of the subproject 1 as mentioned in the Chapter 1 and 2, site-specific impacts of the subproject 1's construction activities include:

- Disruption to the operations of the existing Hoang Truong fishing port;
- Degradation of water quality in the Lach Truong River due to dredging activities;
- Impacts on the operations of the ship repair facility within the existing port;
- Impacts associated with the disposal site serving the subproject 1;
- Affected sensitive receptors – subproject 1.

Details about impact assessment are presented below:

(i) Disruption to the operations of the existing Hoang Truong fishing port

Hoang Truong Fishing Port is classified as a Class III fishing port, capable of accommodating 50 vessel trip/450 CV, an annual throughput of about 5,500 tons of aquatic products, with around 200–300 fishing vessels entering and anchoring at the port.

During construction, approximately 520m of the existing wharf downstream of the Lach Truong River will be retained for the operation of the existing fishing port. The project will invest in

the construction of a new 330m embankment upstream of the Lach Truong River. Consequently, construction activities may cause adverse environmental impacts such as dust, emissions, wastewater, solid waste, and noise, and may partially disrupt the operations of the existing fishing port area, but will not interrupt the overall functioning of the port.

It is anticipated that the demolition, construction of the embankment and port quay will require the use of various types of underwater construction equipment, such as canoes, 30T floating cranes, barges, and pile-driving vessels. In addition, 46 pieces of construction machinery (as presented in Chapter 1, Section 1.4) will be mobilized. During the construction process, additional vessels such as fuel supply boats and water supply boats will also be deployed to support these operations. These activities may give rise to the following specific impacts:

- The increase in the number of construction vessels moving on the water such as canoes, 30T floating cranes, barges, and pile-driving vessels required for the subproject implementation will disrupt the entry and exit of fishing boats at the existing port. Approximately 450 offshore fishing households, 32 midshore fishing households, and 103 nearshore fishing households may be also affected during the construction period.
- The risk of waterway traffic accidents also increases due to potential collisions between fishing vessels entering or leaving the port and the construction machinery deployed. At present, waterway traffic on the Lach Truong River in the Hoang Truong port area is of moderate density (approximately 20 vessel calls per port entry, with about 200–300 vessels regularly anchored).
- In-water construction activities (such as floating cranes, barges, pile-driving vessels, etc.) for the construction of the embankment and mooring quay may narrow or obstruct the existing berthing area at the embankmen section, potentially causing difficulties for fishing vessels entering and leaving the port. However, for the newly expanded section of the port, such impacts are not existed.

This impact is assessed as Moderate, localized, and intermittent during the 24-month construction period because: (i) At the subproject 1 area, the Lach Truong estuary has a width of approximately 1–1.5 km (at the project section, about 1.5 km from the river mouth). The remaining width of the Lach Truong River is still sufficient for local vessels to navigate; (ii) Construction machinery on the water will be anchored at fixed sections, thereby limiting interference with the entry and exit of fishing vessels at the port; (iii) The Hoang Truong anchorage area, located adjacent to the existing fishing port, will be arranged as a temporary berthing area during the demolition of the existing quay; and (iv) These impacts can be mitigated by applying waterway traffic safety management and successive construction method.



Seafood planning area at the port – Hoang Truong commune

(ii) Degradation of water quality in the Lach Truong River due to dredging activities:

Dredging of the riverbed and banks to create navigation channels, turning basins, and port berths may cause significant adverse impacts on the quality of river and coastal waters. Water

quality may deteriorate due to increased turbidity (FTU) and Total Suspended Solids (TSS) as the water column is disturbed during dredging. The loss of water clarity in coastal areas, caused by the presence of suspended particles and colored impurities, may result in water discoloration and pollution.

The dredging process is the main cause of increased turbidity in the water at the dredging site, as sediment particles are disturbed, dispersed, and suspended in the water. Coastal sediments of sand and silt are heterogeneous, both alongshore and cross-shore. As a result, the turbidity of coastal waters in the project area may increase due to dredging activities, arising from the following causes:

- Bottom sediments are disturbed and dispersed from seabed into water surface.
- Sediment spillage during the movement of dredging buckets from the river/sea bottom to the water surface.
- A small portion of dredged material may fall from the bucket during its transfer onto barges.
- Leachate from wet dredged material may flow back into the river/sea within the subproject area.

According to the Handbook on Dredging Assessment in Rivers/Seas⁸, when using trailing suction hopper dredgers, grab dredgers, bucket dredgers, or barges, the dredging of 1 m³ of sand may result in a loss of approximately 0.3–0.4 kg of silt and sand. This loss amount is dispersed along the dredging area of the subprojects, thereby increasing water turbidity before eventually settling back onto the riverbed or seabed.

Dispersion of dredged materials: The extent to which disturbed sediments from the seabed may disperse (and thus affect turbidity) depends largely on the geological composition of the seabed and the dredging method applied. For example, dredging sand layers generally results in lower turbidity compared to dredging silt or sandy–silt layers. Similarly, the use of a grab dredger tends to generate higher turbidity than a suction dredger.

Reference values of turbidity and Total Suspended Solids (TSS) measured from the Ky Ha Port Dredging Project in Quảng Nam Province (a coastal port area in Central Vietnam) are as follows.

Table 4-28. Measurement results of turbidity and suspended solid in the dredging area

Position	Turbidity (FTU).	TSS (mg/l)
5m from the dredging point	115	105
15m from the dredging point	33	29
20m from the dredging point	15	11
QCVN 08-MT:2023/BTNMT (table 2, column B)	-	100
TCVN 13656:2023: aquaculture water	-	100

Notes:

"-" Not applicable; QCVN 08-MT:2023/BTNMT (table 2, column B) – National technical regulation on surface water quality - The water quality is assessed as moderate. The aquatic ecosystem consumes a significant amount of dissolved oxygen due to the presence of a large volume of pollutants. After the application of appropriate treatment measures, the water can be used for industrial and agricultural production purposes; TCVN 13656:2023 – National Regulation on water for aquaculture– water quality for intensive culture of black tiger shrimp, white leg shrimp.

⁸ Japan Ministry of Transport 1982.

Table 4-29. Turbidity measurement results by depth at the dredging area

Position	Turbidity (FTU)		
	Surface point	Middle point	Bottom point
5m from the dredging point	125	365	1,120
15m from the dredging point	41	105	365
30m from the dredging point	17	26	44

(Source: Water quality monitoring during construction phase – Dredging of Ky Ha Port, Quang Nam province)

The data indicate that turbidity and TSS contents decrease with increasing horizontal distance from the suction dredger but increase with river depth. Compared with the standards for brackish-water shrimp farming, within a 5m radius, TSS concentrations exceeded the National Technical Regulation on Surface Water Quality by approximately 1.05 times and 2.1 times. At a distance of 15 meters or more, the parameters complied with the permissible limits. However, due to the influence of currents, sediment transportation, and wind, turbidity and TSS are expected to spread beyond the levels indicated above.

The dispersion of sediments in river and marine waters is the main cause of increased TSS. Sand particles generally settle quickly to the riverbed or seabed under the influence of gravity. Therefore, while sand and silt may temporarily increase turbidity, they do not significantly contribute to long-term increases in TSS. Elevated TSS levels directly affect the ecosystem in the dredging area by reducing light penetration, thereby limiting photosynthesis of aquatic plants (algae, seaweed), restricting growth and reproduction, and altering habitats. However, ecosystems in the port construction areas are typically of low biodiversity because vessel traffics frequently moving through. As such, the overall impact is assessed as Moderate and can be mitigated through appropriate construction methods.

(iii) Impacts on ship repair facilities

In the existing Hoang Truong fishing port area, there is one ship repair workshop located approximately 20m from the construction site. This facility has an area of about 1,000 m² and employs around 10 workers, operating from 7:00 AM to 9:00 PM when vessels are docked for service. Construction and port upgrading activities may partially affect its operation.

During the construction phase, the existing fishing port will remain operational. However, the upgrading and expansion of Hoang Truong port may disrupt the workshop's production and service activities due to factors such as dust, emissions, and obstruction of waterway access for vessels entering and exiting the repair facility due to the gathering of equipment, machinery, and construction materials in the port area.

This impact is assessed as low because: (i) the project is constructed based on successive methods, so the workshop's operations are only disrupted locally. (ii) The waterway within the port is sufficiently wide to accommodate both construction activities and vessel repair operations. (iii) The impact duration is short, estimated at **2–3 months** for the nearest construction area. This impact can be mitigated through appropriate construction and management measures.

(iv) Impacts of the disposal site serving the subproject 1

Construction waste (excavated soil, debris, dredged materials, etc.) from Hoang Truong and Lach Truong fishing ports (subproject 1 and 2) will be transported to disposal site No. 2 in Hai Loc Commune, Hau Loc district (currently Van Loc commune). The site covers approximately 8.15 ha and has a capacity of 383,800 m³, sufficient to accommodate waste from the subproject 1 and 2. Potential impacts on local residents and the surrounding Lach Truong River and canal

areas are assessed as low because: (i) The site borders the areas with low and infrequent traffic, adjacent to ponds and roads, and does not affect local salt-making livelihoods, as the land has been unused for agriculture for over a decade. (ii) The site is elevated above surrounding ground levels, reducing the risk of overflow. (iii) It is encircled by drainage ditches, facilitating the management of the runoff of sedimentation to the outside. (iv) The disposal timeline is short and intermittent. (v) Impacts on nearby communities and the environment can be effectively mitigated through technical and management method.

(v) Affected sensitive receptors in Hoang Truong fishing port

Affected sensitive receptors of the subproject is presented in the following table:

Table 4-30. Sensitive receptors – Subproject 1

No.	Sensitive receptors	Distance to the site (m)	Description	Impacts
1	 Ship repair work shop	20	- Area 1,000 m² - Workers: 10. - Service: repair minor damages of fishing port in the port area. - Working time: 7h00 to 21h00	- Impacts on the travel and repair activities of the workshop - Increase the congestion risks - Increase the risk of conflicts between workers and local residents.

Subproject 2: Upgrading of Lach Truong fishing port (Existing Hoa Loc port)

Based on the location, investment scale, and environmental and social characteristics outlined in Chapters 1 and 2, the subproject 2's construction activities are expected to cause the following site-specific impacts:

- Disruption to operations at the existing Lach Truong fishing port;
- Impacts on nearby seafood processing facilities;
- Disturbance to the center market at Lach Truong fishing port
- Impacts on aquaculture activities along the Lach Truong River
- Impacts from waste disposal at the regulated disposal site of the subproject 2
- Sensitive receptors.

Details about the impacts are presented below:

(i) Disturbance to the activities of Lach Truong fishing port (current Hoa Loc fishing port)

Lach Truong - Hoa Loc) fishing port is a Class II port, covering approximately 3.5 ha. The storm shelter area in the De Canal has an area of 19.5 ha and is designed to accommodate around 300 vessels with capacity of 135 - 450 CV, including over 100 small-scale nearshore fishing households using boats of 24–40 CV.

During construction phase, 270 m of the existing wharf in the upstream of Lach Truong river will remain operational to support daily vessel traffics. The project will build a new 60m embankment downstream. Thus, the construction activities may generate negative impacts on the environment due to dust, emissions, wastewater, solid waste, and noise, causing minor disruption to port operations but not halting them.

The demolition and construction of the embankment and docking area are expected to involve various types of underwater construction equipment, including canoes, 30-ton floating cranes, barges, and pile-driving vessels. In total, approximately 61 construction machines will be mobilized for the implementation of the subproject's infrastructure works (as outlined in

Chapter 1, Section 1.4). Additionally, support vessels such as fuel and water supply boats will be deployed to service the construction fleet. These activities will have the site-specific impacts as follows

- The increased number of construction vessels such as canoes, 30-ton floating cranes, barges, and pile-driving boats will need to navigate via waterways to the construction site. This will be expected to disrupt the regular docking activities of existing fishing vessels at the port. Moreover, the risk of maritime traffic accidents will rise due to potential collisions between fishing boats and construction equipment operating in the area. Currently, waterway traffic on the Lach Truong River near the port is of moderate density, with approximately 50 vessel movements per day and around 300 vessels regularly moored.
- Construction activities on water (use of floating cranes, barges, and pile-driving vessels) for embankment and docking infrastructure may narrow or obstruct the existing docking area during the upgrading phase. This could hinder the movement of fishing vessels entering and exiting the port in the upgrading section but do not affect the expansion section.

This impact is assessed as moderate and localized, occurring intermittently over the 24-month construction period because: (i) The Lach Truong River at the subproject 2 site is 150–200m wide, approximately 4 km from the river mouth, and the remaining width is sufficient for local vessel navigation. (ii) Construction equipment operating on water will be anchored at fixed locations, and since subproject 2 involves building only a short 60m embankment, the impact on fishing vessel movements will be limited. (iii) The Lach Truong mooring area, located adjacent to the existing fishing port, can be used as a temporary docking area during demolition of the current wharf. (iv) These impacts can be effectively mitigated through the implementation of waterway traffic safety management and successive method.

(ii) Impacts on nearby seafood processing facilities

Within the existing Lach Truong fishing port area, approximately 20 to 100m from the port, there are two seafood processing facilities: Chung Huong – specializing in frozen and fresh seafood; Kich Hang – providing ice and seafood-related supplies; These businesses offer fishery services, including seafood purchasing, freezing, and other support services for local fishermen. They operate throughout the day, serving customers as needed. As a result, construction and port upgrading activities may partially disrupt the business operations of these service providers.

During the construction phase, operations at the existing Lach Truong fishing port will remain active. However, the upgrading and expansion works are expected to disrupt production and business activities of nearby facilities (seafood processing, trade, and export of frozen shrimp, squid, and other aquatic products) due to dust and emissions generated by construction activities, causing traffic congestion, affecting the movement of transport vehicles and daily commuting of 30–40 workers, landscape in front of the workshops/facilities due to gather of construction materials, machinery and waste.

However, this impact is assessed as Moderate because: (i) the construction is carried out based on the successive method, causing only localized and intermittent disruption to the operations of seafood processing facilities and fishery service providers. Importantly, construction activities will not coincide with peak fishing periods, such as harvest or vessel departure times. (ii) The internal port roads are over 15m wide, ensuring sufficient space to for simultaneous construction and business operations. (iii) The disruption will be short-term, lasting approximately 2–3 months at the nearest construction areas. These impacts can be avoided or effectively mitigated through appropriate construction and management measures.

(iii) Disruption to activities of center market in existing Lach Truong fishing port

The construction and upgrading of Lach Truong fishing port will disrupt operations at the center market area of the existing fishing port (located 250m from the construction site) due to: dust, emissions, noise, vibration, solid waste, traffic congestion, and traffic accidents; obstruction of access and trading activities for local residents in the market area; risk of community conflict between local residents and construction workers, affecting the trading and exchange of goods of local people.

Business households at the market may experience temporary disruption (approximately 24 months) due to restricted access. However, this impact is assessed as Moderate because: (i) construction components are implemented within the existing port; (ii) the impact occurs over a short duration for construction activities near the market and for the transportation of materials and waste passing through the road in front of the market gate; (iii) once operational, the project will help promote the development of household businesses. This impact can be mitigated through the measures proposed in Chapter 5.

(iv) Impacts on aquaculture activities along the Lach Truong river

Approximately 200 m upstream from the port area (Subproject 2), there are several aquaculture cages of shrimp and clams located in the riverbed/aquaculture area on the opposite bank of the Lach Truong River.

The waterborne construction equipment is mobilized from the Lach Truong estuary into the subproject area, avoiding the river section where aquaculture activities are taking place. Therefore, it will not impact aquaculture operations. Although subproject covers the dredging of the navigation channel leading to the mooring area which is located in a creek adjacent to the Lach Truong River section with the port's docking area, this is a small creek separated from the port and situated downstream from the aquaculture area. As such, the risk of pollution (TSS, turbidity) spread from the dredging process to these areas is considered low.

In reality, **there is** a potential risk of pollutant dispersion (TSS, oil, etc.) from machinery and in-water construction activities affecting the water quality of the Lach Truong River. However, the aquaculture area is located upstream, not too close to the project site (approximately 200–300m away as previously mentioned). The in-water construction area is localized (a short 60-m embankment section, with a brief construction period of around 6 months) within the existing port area, so the level of impact on the river's water quality is considered low. Therefore, the risk of pollutant dispersion from oil leakage incidents involving waterborne construction equipment (canoes, barges, pile-driving vessels, etc.) is assessed as Low and can be controlled through appropriate measures.



Aquaculture area in Lach Truong river, 200-300m from the existing port on the opposite river bank

(v) Impacts of the disposal site serving the subproject 2

Waste from subproject 2 will be disposed of at Disposal Site No. 2, which is the same location used for subproject 1. As outlined in Section (v) regarding the disposal site for subproject, the impact level on local residents and surrounding areas is considered low, short-term, and intermittent, and can be effectively mitigated through appropriate technical and management measures.

(vi) Impacts on sensitive receptors

Affected sensitive receptors of the subproject 2 are presented below:

Table 4-31. Sensitive receptors – subproject 2

No.	Sensitive receptors	Distance to the site (m)	Description	Impacts
1	 Truong Xa Parish Church	200	- Position: 200m from existing fishing port but on the main transportation route - Total parishioners; 500. - Time: every Saturday and Sunday.	- Impact on residents' movement and religious activities - Increase the risk of traffic jams - Increase the risk of conflicts between workers and local people
2	 Workshop in the fishing port	0	- Area of 400m², in existing fishing port; - Worker: 20 workers working daily. - Services: processing, trading, and exporting frozen seafood (various types of shrimp, squid, etc.). - Time: 7h00 to 19h00	- Impacts on production, business activities of the workshop - The risk of increased traffic intensity and transportation vehicles - Risk of conflict between seafood facility workers and construction workers
3	Center market in Hoa Loc fishing Port 	250	- Position: located 250 meters from the existing fishing port but serves port-related activities. - Services: trading various types of seafood, meat, vegetables. - Time: 7h00 am to 21h00 pm daily.	- Impacts on production, business activities of the market - The risk of increased traffic intensity and transportation vehicles - Risk of conflict between seafood facility workers and construction workers
4	Phu La La	50	- Position: located about 50 meters from the storm shelter anchorage area. - Total: 100 people. - Visiting time: on	- Impact on the spiritual activities of local residents and caretakers of Phu La La - Increase traffic density in holidays, the

No.	Sensitive receptors	Distance to the site (m)	Description	Impacts
			every first day and the 15 th lunar day, other holidays within the year.	1st and the 15th day.
5	Aquaculture area 	200 – 300	- Located on the opposite bank of the Lach Truong River, approximately 200 m from subproject 2. - 08 households currently engaged in aquaculture in the area (mainly farming whiteleg shrimp, black tiger shrimp, and clams). - Use water from the Lach Truong River for aquaculture purposes.	- Impact on livestock stocking schedules, and on the quality and yield of aquaculture products - Impact on the circulation of goods and services in the aquaculture area
6	 Lach Truong ferry terminal	0	- This is a waterway route used to transport people and goods from the communes of Hoa Loc and Hai Loc to Hoang Yen Commune across the Lach Truong River - Position: next to existing Lach Truong fishing port - Each ferry trip on the river takes 15–20 minutes; operating hours 6:00 am to 7:00 pm daily, with dozens of trips per day.	- Impact on the travel of residents from Hoa Loc and Hai Loc communes to Hoang Yen commune across the Lach Truong River. - Impact on the income of individuals involved in ferry operations if service is temporarily suspended/disrupted. - Impact on increased travel time and costs for local residents in the absence of ferry transport support.

As stated in Table 2-6 (Chapter 2), sensitive receptors potentially affected by the construction of Subproject 2 – the upgrading of Lach Truong fishing port – include: Truong Xa Parish Church (200m from the construction site), seafood processing facilities within the port, Hoa Loc Center market (250m away), Phu La La (50m away), Lach Truong ferry terminal, and the aquaculture area (200–300m away). The main impacts during construction in areas with these sensitive receptors are primarily related to dust, noise, and traffic obstruction caused by construction activities and the gathering of materials. The level of impact is assessed as LOW to MODERATE, as construction at each location lasts approximately 2–3 months and may affect daily activities, production, transportation, and religious/spiritual practices (e.g., temple ceremonies, festivals), especially on full moon and first lunar days (for Phu La La) or weekends (for Truong Xa Parish Church). These impacts can be avoided or mitigated through appropriate measures.

Site-specific of subproject 3

The site-specific impacts in construction site of Subproject 3 are temporary effects on aquaculture areas of households within the investment scope of Phu Son 2 sluice, the upgraded section of Phu Son 2 canal beneath the right bank of the Can River, Ong Ty canal, and the dredging of the main drainage ditch that supplies water for aquaculture (serving both water intake and drainage for this area). Details are as follows:

(i) Temporary disruption of water intake and drainage activities serving aquaculture

Dredging activities along the water supply/drainage canals (Phu Son 2 canal, 1.43 km long, and Ong Ty Canal, 2.58 km long), along with the reconstruction of two water intakes for these canals, will be carried out using embankment and flow diversion construction methods (dry season from November to June annually; rainy season from July to October annually). These works will only partially obstruct the existing flow and will temporarily disrupt water intake and drainage activities serving aquaculture in the area.

However, water is fetched according to the farming schedule of local households, and successive construction method will be applied for each canal segment and flow diversion (using sheet piles to isolate each segment, temporarily occupying only part of the canal surface) will be carried out. Therefore, the impact is localized and short-term (approximately 1–3 months per segment), and the level of impact is considered low. It can be mitigated through appropriate construction methods and combined with the aquaculture plans of local households.



End of Phu Son 2 canal



Ong Ty canal

(ii) Livelihood of local residents

Approximately 70% of local residents practice extensive aquaculture, with the farming season from February to October. The temporary land occupation for dredging and construction activities under Subproject 3 will reduce water quality and supply in the canals serving aquaculture in the area. Aquatic species such as shrimp, crab, and mullet are unable to relocate and may die due to their sensitivity to increased TSS, dust, noise, and vibration, negatively affecting the quality and growth of farmed seafood. This impacts the livelihoods of local residents.

Additionally, during the rainy and stormy season, drainage from the construction area may accumulate TSS on exposed surfaces, material/waste gathering area, leading to rainwater runoff into aquaculture ponds and causing damage to local farmers.

These impacts are considered moderate and short-term, occurring at specific times and locations during the construction of sluices, canal surfaces, and other structures along Phu Son 2 Canal and Ong Ty Canal. Construction methods, along with response plans and mitigation measures, must be prepared to minimize impacts on the livelihoods of aquaculture households and local trade, sales, and consumption activities.



Ong Ty canal



Duck farming on Phu Son 2 canal

(iii) Impacts of the disposal site serving the subproject 3

Dredged materials of the subproject are disposed at: (i) Disposal Site No. 1 in Tan Tien commune – receiving dredged materials from Phu Son 2 canal, with a total area of 15 ha and a storage capacity of 225,000 m³. (ii) Disposal Site No. 2 in Tan Tien – receiving dredged materials from Bao Trieu canal, with a total area of around 45 ha and a storage capacity of 650,000 m³. Affected parties include nearby residents and surrounding natural areas. The impact level is assessed as low because: (i) The disposal sites have been approved in official document by the Provincial People's Committee or agreed upon between the local authorities and the Thanh Hoa PMU of Construction Investment Works for Agricultural and Rural Development; (ii) The surrounding area of the disposal sites consists of vacant land, with no residential buildings or households, short transportation distance of 0.5–1 km; (iii) The disposal transportation period is not long and not continuous; (iv) Impacts from disposal activities can be mitigated through appropriate management and technical measures.

(iv) Impacts on sensitive receptors

Affected sensitive receptors of subproject 3 are presented in the following table:

Table 4-32. Sensitive receptors – Subproject 3

No.	Sensitive receptors	Distance to the site (m)	Description	Impacts
1	 Aquaculture households	350	- Position: about 350m from the end of Phu Son 2 canal and Bao Trieu canal. - Type: Household size, farming in local area (mainly shrimp farming). - Water is taken from canal for aquaculture.	- Impacts on the production, business of households - Increase the risk of traffic jams - Increase the risk of conflicts between workers and local people.
2	 Nga Tien market	20	- Location:: Located near the canal of the subproject, 20m away. - Service: btrading of seafood, meat, vegetables, fruits - Operation time: 02 sessions per day (2h-6h am, 16h-19h pm).	- Impacts on business and trading of traders and local residents - Increase in traffic congestion and accidents

No.	Sensitive receptors	Distance to the site (m)	Description	Impacts
3	 Nga Tien Kindergarten	200	- Position: 200m away from the subproject site but located on the route transporting materials to the site. - Area of 2,200 m², with 20 teachers and 60 children. - School time: Monday – Friday. Peak hours: 7h – 8h00 am, and 17h00-17h30 daily.	- Impact on the learning time, travelling of children and their parent who take and pick them up from school - Increase levels of dust and noise, affecting the learning and teaching conditions of students and teachers; - Increase the risk of traffic jams and accidents on this route
4	 Nga Tien primary school	180	- Position: about 180m from the site but located on the main route of transporting materials to the site. - Area: About 5,000 m², about 30 teachers and more than 200 students. - Monday to Friday, Peak hours: 6:30–7:30 am, 11:00 am–12:00 pm, 1:00–2:00 pm, and 4:30–5:30 pm.	- Impact on the learning time, travelling of children and their parent who take and pick them up from school; - Increase levels of dust and noise, affecting the learning and teaching conditions of students and teachers; - Increase the risk of traffic jams and accidents on this route
6	 Farming area on the canal	0	- Position: Poultry farming area of local households along Phu Son 2 Canal. - Type: duck (Spontaneous). - Use water from the canal for duck farming.	- Impacts on the production, business of households - Increase the risk of traffic jams - Increase the risk of conflicts between workers and local people.

Affected sensitive receptors include aquaculture households (located 350m away), Nga Tien Market (20m), Nga Tien Kindergarten (200 meters), Nga Tien Primary School (180m), and the poultry farming area along the canal. Affected groups include aquaculture households, residents around Nga Tien Market, students and teachers at the schools, canal-side poultry farmers, and residents along the transportation route. Key impacts along the main material transportation route during the construction phase include: (i) Disruption to local traffics during daily activities, production hours, and school start/end times: Monday to Saturday, with peak hours of 6:30–7:30 AM, 11:00 AM–12:00 PM, 1:00–2:00 PM, and 4:30–5:30 PM; (ii) Increased levels of dust and noise, affecting the learning and teaching conditions of students and teachers; (iii) Elevated risk of traffic accidents during school arrival and end times due to increased vehicle density (approximately 5 trips/day for transporting construction materials and 2 trips/day for waste transportation, using 10-ton trucks). However, the level of impact is assessed as LOW due to the short-term, intermittent disruption, which can be avoided or mitigated through appropriate management measures.

Site-specific impacts of the subproject 4:

The site-specific impacts of the Subproject 4's works in Hoang Yen commune, Hoang Hoa district include effects on aquaculture areas of households within the scope of dredging Son Trang 1 and 2 sluices, upgrading and dredging Son Trang 1 and 2 canals, upgrading and dredging the main drainage ditch that supplies water for aquaculture, combining water intake and drainage at the downstream left bank of Hung Tien Canal and the upstream left bank of Nghia Thuc canal. These impacts also affect the livelihoods of aquaculture households, the disposal site, and several sensitive receptors that may be affected by the project.

(i) Temporary disruption of water intake and drainage activities serving aquaculture activities

Dredging activities along the water supply/drainage canals (Son Trang 1 canal, 0.52 km long, serving 30 ha of aquaculture and 30 ha of drainage area, Son Trang 2 canal, 1.36 km long, serving about 30 ha of aquaculture and 30 ha of drainage area, reconstruction of 3 new water intakes for these two canals; Hung Tien canal, 0.87 km long, serving 45 ha of drainage and 30 ha of irrigation; and Nghia Thuc canal, 0.82 km long, serving 45 ha of drainage and 30 ha of irrigation). The construction method involves embankment works and flow diversion dredging (dry season from November to June annually; rainy season from July to October annually), which will only partially obstruct the existing flow. However, it will temporarily disrupt water intake and drainage for aquaculture.

However, water is fetched according to the farming schedule of local households, and successive construction method will be applied for each canal segment and with flow diversion (using sheet piles to isolate each segment, temporarily occupying only part of the canal surface). Therefore, the impact is localized and short-term (approximately 1–3 months per segment), and the level of impact is considered low. It can be mitigated through appropriate construction methods and combined with the aquaculture plans of local households.

(ii) Livelihood of local people

Aquaculture households practice both extensive and intensive farming, with the farming season from February to October. The temporary land occupation for dredging and construction activities under Subproject 4 will affect the local ecosystem, impacting both the quality and quantity of aquaculture production. Aquatic species such as shrimp, crab, and mullet cannot relocate and may die due to their sensitivity to increased levels of total suspended solids (TSS), dust, noise, and vibration, etc., and negatively affecting the health and growth of farmed seafood, leading to reduced yields. Consequently, this poses a threat to the livelihoods of aquaculture-dependent households.

Aquaculture farm: specializing in shrimp and fish farming using a modern, closed-loop production system, provide to the market with the highest quality and freshest seafood products to meet customer demand on all types of live seafood. The operations are self-contained within the farm. The construction of drainage channels surrounding the aquaculture area and the Son Trang 1 and 2 drainage canals, which encircle the farm on all sides, poses certain challenges in receiving input materials and exporting products. Transportation and distribution of products along the roads adjacent to the canals may be disrupted. Increased traffic volume and personnel presence in the area may affect the farm, along with construction-related disturbances such as noise, lighting, and vibration. These impacts are considered phased, short-term, localized, and of low to moderate intensity, and can be mitigated through appropriate measures.



Linh Trang seafood farm



Linh Trang seafood farm

Additionally, during the rainy and stormy season, drainage from the construction area may accumulate TSS on exposed surfaces, material/waste gathering area, leading to rainwater runoff

into aquaculture ponds and causing damage to local farmers in rainy season (normally July to October annually).

These impacts are considered moderate and short-term, occurring at specific times and each construction sections of Son Trang 1, 2 sluices, embankment surrounding the aquaculture area, Son Trang 1 and 2 drainage canals, Hung Tien canal, and Nghia Thuc Canal. Construction methods, along with response plans and mitigation measures, must be prepared to minimize impacts on the livelihoods of aquaculture households and local trade, sales, and consumption activities.

(iii) Impacts of disposal site serving the subproject 4

Dredged materials of the subproject are disposed at the disposal site in Son Trang Hamlet, Hoang Tien Commune — designated for dredged material storage with a total area of 2 ha and a capacity of approximately 40,000 m³. Affected parties include nearby residents and surrounding natural areas. The impact level is assessed as low because: (i) The disposal sites have been approved in official document by the Provincial People's Committee or agreed upon between the local authorities and the Thanh Hoa PMU of Construction Investment Works for Agricultural and Rural Development; (ii) The surrounding area of the disposal sites consists of vacant land, with no residential buildings or households, short transportation distance of 3km; (iii) The disposal transportation period is not long and not continuous; (iv) Impacts from disposal activities can be mitigated through appropriate management and technical measures.

(iv) Affected sensitive receptors

Affected sensitive receptors of subproject 4 are presented in the following table:

Table 4-33. Sensitive receptors – Subproject 4

No.	Sensitive receptors	Distance to the site (m)	Description	Impacts
1	 Thien Phuc pagoda	280	- Position: 50m from Son Trang 2 canal. - Total: 200 people. - Visiting and worship time: on every 01st or 15 lunar days, holidays in year.	- Impacts on the production, business of households - Increase the risk of traffic jams - Increase the risk of conflicts between workers and local people.
2	Aquaculture area 	10-20	- Existing aquaculture area is located near subproject 4, 10-20m away. - More than ten households do seafood farming in the area (mainly shrimp farming). - Use water from canals for aquaculture.	- Impacts on the production, business of households - Increase the risk of traffic jams - Increase the risk of conflicts between workers and local people.

Affected sensitive receptors as mentioned above, including Thien Phuc pagoda (280m);

aquaculture area (10-20m). Affected groups include aquaculture households, Thien Phuc pagoda, residents along the route in Hoang Tien commune. Key impacts along the main material transportation route during the construction phase include: (i) Disruption to local traffics; (ii) Increased levels of dust and noise; (iii) Elevated risk of traffic accidents during school arrival and end times due to increased vehicle density. However, the level of impact is assessed as LOW due to the short-term, intermittent disruption, and that the construction segments along the canal is applied with successive method and appropriate management measures for minimizing impacts.

Site-specific impacts of the Subproject 5

The site-specific impacts of the subproject 5 in Hoang Chau commune include effects on aquaculture and crop areas due to temporary disruption to drainage activities, impacts on household livelihoods, impacts from the disposal site, and affected sensitive receptors within the scope of upgrading and completing canal surfaces and related structures on Dong Coi canal, Cau Dua Canal, Tay Canal, Hoi Trieu Canal, as well as dredging of primary irrigation and drainage canals and the canal operation and management road. These works aim to ensure water supply for aquaculture and combined water intake and drainage for the area.

(i) Temporary disruption of water intake and drainage activities serving aquaculture activities

Dredging activities along the water supply/drainage canals (Son Trang 1 canal, 0.52 km long, serving 30 ha of aquaculture and 30 ha of drainage area, Son Trang 2 canal, 1.36 km long, serving about 30 ha of aquaculture and 30 ha of drainage area, reconstruction of 3 new water intakes for these two canals; Hung Tien canal, 0.87 km long, serving 45 ha of drainage and 30 ha of irrigation; and Nghia Thuc canal, 0.82 km long, serving 45 ha of drainage and 30 ha of irrigation). The construction method involves embankment works and flow diversion dredging (dry season from November to June annually; rainy season from July to October annually), which will only partially obstruct the existing flow. However, it will temporarily disrupt water intake and drainage for aquaculture.

Dredging activities along the irrigation and drainage canals will be carried out using embankment construction and flow diversion methods (the dry season construction period spans from November to June annually. Specifically: Dong Coi Canal is 1,310.20m long, serving 25 ha of drainage and approximately 25 ha of aquaculture; Hoi Trieu Canal is 1,714.57 m long, with 4 new box culverts to be constructed for water intake, ensuring drainage for 105 ha and aquaculture for approximately 65 ha; Cau Dua Canal is 2,081m long, serving 30 ha of drainage and 30 ha of aquaculture; Tay Canal is 535m long, serving 45 ha of drainage and approximately 30 ha of aquaculture. The rainy season lasts from July to October annually (with storms typically occurring in September and October). Construction activities will only partially obstruct the existing flow and are expected to temporarily disrupt water intake and drainage operations serving aquaculture in the area.

However, water is fetched according to the farming schedule of local households, and successive construction method will be applied for each canal segment and with flow diversion (using sheet piles to isolate each segment, temporarily occupying only part of the canal surface). Therefore, the impact is localized and short-term (approximately 1–3 months per segment), and the level of impact is considered low. It can be mitigated through appropriate construction methods and combined with the aquaculture plans of local households.

(ii) Livelihood of local residents

In this area, about 60–70% of aquaculture households practice extensive farming, while around 30% operate industrial aquaculture under greenhouse systems, with the farming season from February to October. The temporary land occupation for dredging and construction activities

under Subproject 5 will impact the local ecosystem, affecting both the quality and quantity of aquaculture production. Aquatic species such as shrimp, crab, and mullet cannot relocate and may die due to their sensitivity to increased levels of TSS, dust, noise, vibration, and light, shrimp have been observed jumping out of ponds when exposed to nighttime lighting. These factors negatively affect the health and growth of farmed seafood, leading to reduced productivity and quality. Consequently, this poses a threat to the livelihoods of local residents.

Additionally, during the rainy and stormy season (typically from July to October annually), drainage from the construction area may accumulate TSS on exposed surfaces, material/waste gathering area, leading to rainwater runoff into aquaculture ponds and causing damage to local farmers in rainy season.

These impacts are considered moderate, short-term, and localized, occurring at specific times and segments during the construction of canals, canal surfaces, and related structures on Cau Dua, Hoi Trieu, Dong Coi, and Tay canals. Construction methods, along with appropriate solutions and response plans to address changes during the construction process, must be prepared to ensure the minimization of impacts on the livelihoods of aquaculture households and local businesses, trade, and consumption activities.

(iii) Impacts of disposal site serving subproject 5

Dredged materials of the subproject are disposed at the disposal site located in Bac Hoi Trieu Village, Hoang Chau commune: (i) Zone 1 covers an area of approximately 0.33 hectares and storage capacity of around 4,519 m³; (ii) Zone 2 covers an area of approximately 0.6 hectares and storage capacity of around 12,000 m³. Affected parties include nearby residents and surrounding natural areas, surrounding crop cultivation area. The impact level is assessed as low because: (i) The disposal sites have been approved in official document by the Provincial People's Committee or agreed upon between the local authorities and the Thanh Hoa PMU of Construction Investment Works for Agricultural and Rural Development; (ii) The surrounding area of the disposal sites consists of pond land managed by Hoang Chau PPC and was previously leased to local residents for production purposes, but the lease contract has expired. Therefore, the disposal activities do not affect the income or livelihoods of the former land users. The site contains no residential buildings or households, and the transport distance is short, approximately 2 km, along sparsely trafficked inter-communal roads; (iii) The disposal transportation period is not long and not continuous; (iv) Impacts from disposal activities can be mitigated through appropriate management and technical measures.

(iv) Sensitive receptors – subproject 5

Within and around (a 400m radius) the area of Subproject implementation, there are no Physical Cultural Resources (PCRs) such as temples, pagodas, shrines, graves, churches, nor any other sensitive receptors.

Site-specific impacts of subproject 6

Site-specific impacts of the Subproject 6 in Hoang Luu commune include effects on aquaculture areas and cultivated crops due to temporary disruption of drainage activities, impacts on household livelihoods, effects from the disposal site, and sensitive receptors within the scope of upgrading and completing canal surfaces and related structures. These works span from the Tay dike, Cung River to Con Voi sluice, the road section from Ngo Hao to Thach sluice, and involve dredging of primary irrigation canals and secondary drainage branches to ensure water supply for aquaculture, combining water intake and drainage for the area.

(i) Temporary disruption of water intake and drainage activities serving aquaculture operations

Dredging activities along the irrigation and drainage canals (Canal 1, with a length of 819.29m, serving approximately 25 ha of drainage and 25 ha of aquaculture; Canal 2, with a length of

213.38m, serving approximately 25 ha of drainage and 35 ha of aquaculture. The construction method involves embankment works and flow diversion dredging. The dry season is from November to June annually, while the rainy season lasts from July to October. These activities will only partially obstruct the existing flow and are expected to temporarily disrupt water intake and drainage operations serving aquaculture in the area.

However, water is fetched according to the farming schedule of local households, and successive construction method will be applied for each canal segment and with flow diversion (using sheet piles to isolate each segment, temporarily occupying only part of the canal surface). Therefore, the impact is localized and short-term (approximately 1–3 months per segment), and the level of impact is considered low. It can be mitigated through appropriate construction methods and combined with the aquaculture plans of local households.

(ii) Livelihood of local residents

The temporary land occupation for dredging and construction activities under Subproject 6 will impact the local ecosystem, affecting both the quality and quantity of aquaculture production and one season of rice cultivation (aquaculture are of 25ha with water used from canal 1 and 35ha from canal 2). Aquatic species in ponds such as shrimp, crab, and mullet cannot relocate and may die due to their sensitivity to increased levels of TSS, dust, noise, vibration, and light. These factors negatively affect the health and growth of farmed seafood, leading to reduced productivity and quality. Consequently, this poses a threat to the livelihoods of local residents

Additionally, during the rainy and stormy season, drainage from the construction area, from the Tay dike of the Cung River to the Con Voi sluice, and along the road from Ngo Hao to Thach sluice, including dredging of primary and secondary canal branches, may lead to increased accumulation of TSS on exposed surfaces, material/waste gathering areas. This can result in rainwater runoff entering aquaculture ponds, causing damage to local farmers during rainy season.

These impacts are considered moderate, short-term, and localized, occurring at specific times and segments during the construction process. They are controllable and can be mitigated. Local residents are highly supportive and in agreement with the implementation of Subproject 6 in the area. Construction methods, along with appropriate solutions and response plans to address changes during the construction process from the Tay dike of the Cung River to the Con Voi sluice, and along the road from Ngo Hao to Thach sluice, including dredging of primary and secondary canal branches must be prepared to ensure the minimization of impacts on the livelihoods of aquaculture households and local businesses, trade, and consumption activities.

(iii) Impacts of disposal site serving the subproject 6

Dredged materials of the subproject are disposed at the disposal site located in Phuong Ngo village, Hoang Chau commune – with an area of about 1.2ha and storage capacity of 17,500 m³. Affected parties include nearby residents and surrounding natural areas, surrounding crop cultivation area. The impact level is assessed as low because: (i) The disposal sites have been approved in official document by the Provincial People's Committee or agreed upon between the local authorities and the Thanh Hoa PMU of Construction Investment Works for Agricultural and Rural Development; (ii) The surrounding area of the disposal sites consists of pond land managed by Hoang Chau PPC. Therefore, the disposal activities do not affect the income or livelihoods of the land tenant. The site contains no residential buildings or households, and the transport distance is short, approximately 0.75 km, along sparsely trafficked inter-communal roads; (iii) The disposal transportation period is not long and not continuous; (iv) Impacts from disposal activities can be mitigated through appropriate management and technical measures.

(iv) Affected sensitive receptors – Subproject 6

Affected sensitive receptors of the subproject 6 is presented below:

Table 4-34. Sensitive receptors – subproject 6

No.	Sensitive receptors	Distance to the site (m)	Description	Impacts
1	 Hoang Phong Kindergarten	250	- Location: 250m away from the site, but on the main material transportation route to the subproject area. - Area of 2,400 m², with 20 students and more than 70 children. - School time: every Monday – Friday, start at 7h – 8h00, and end at 17h00-17h30 daily.	- Impacts on the production, business of households - Increase the risk of traffic jams - Increase the risk of conflicts between workers and local people.
2	 Hoang Phong primary school	220	- Position: 220m away from the site, but on the main material transportation route to the subproject area. - Area of 7,000 m², with 30 students and more than 180 students - School time: every Monday – Friday, peak hours: 6h30 – 7h30, 11h-12h, 13h-14h and 16h30-17h30	- Impact on the learning time, travelling of children and their parent who take and pick them up from school - Increase levels of dust and noise, affecting the learning and teaching conditions of students and teachers; - Increase the risk of traffic jams and accidents on this route
3	 Hoang Phong secondary school	220	- Location: 220m away from the site, but on the main material transportation route to the subproject area. - Area of 2,600 m², with 30 students and more than 200 students - School time: every Monday – Saturday, peak hours: 6h30 – 7h30, 11h-12h, 13h-14h and 16h30-17h30	- Impact on the learning time, travelling of children and their parent who take and pick them up from school; - Increase levels of dust and noise, affecting the learning and teaching conditions of students and teachers; - Increase the risk of traffic jams and accidents on this route

Affected sensitive receptors – Subproject 6: students/teachers at schools along the transportation route: (i) Disruption to local traffics during school start/end times: Monday to Saturday, with peak hours of 6:30–7:30 AM, 11:00 AM–12:00 PM, 1:00–2:00 PM, and 4:30–5:30 PM; (ii) Increased levels of dust and noise, affecting the learning and teaching conditions of students and teachers; (iii) Elevated risk of traffic accidents during school arrival and end times due to increased vehicle density (approximately 5 trips/day for transporting construction materials and 2 trips/day for waste transportation, using 10-ton trucks).

The level of impact is assessed as low to moderate because: (i) The number of truck trips is relatively low (7 trips/day), and machinery is mobilized only during specific periods and demobilized upon completion of works; (ii) The impact duration is non-continuous and short-term (approximately 24 months); (iii) There are many traffic participants and high vehicle density along the main transportation route, especially during peak hours coinciding with school

and office schedules—typically from 7:00–8:00 AM and 4:00–6:00 PM daily.

Site-specific impacts of Subproject 7

The site-specific impacts of the Subproject 7 in Hoang Chau Commune include temporary disruption of water intake and drainage activities, impacts on livelihoods, effects from the disposal site, and sensitive receptors located within agricultural production areas (aquaculture and crop cultivation) of local households. These impacts fall within the scope of investment in the Song Khe sluice located beneath the left embankment of the Ma River, and dredging of the Song Khe canal/channel system, including branch canals No. 1, 2, and 3, which serve aquaculture operations and provide combined water intake and flood drainage for the area.

(i) Temporary disruption of water intake and drainage activities serving aquaculture operations

Dredging activities along the irrigation and drainage canals include: Song Khe canal, with a length of 1,336 me, serving irrigation with approximately 70 ha and aquaculture with around 60 ha; branch canal 1, 487m long, providing drainage with approximately 35 ha and aquaculture with around 20 ha; branch canal 2, serving drainage with 20 ha and aquaculture for around with ha; branch canal 3, 523m long, ensuring drainage with 15 ha and aquaculture with 15 ha. The construction method involves embankment works and flow diversion dredging. The dry season is from November to June, while the rainy season lasts from July to October annually. These activities are expected to partially obstruct the existing flow, causing temporary disruption of water intake and drainage operations serving aquaculture in the area.

However, water is fetched according to the farming schedule of local households, and successive construction method will be applied for each canal segment and with flow diversion (using sheet piles to isolate each segment, temporarily occupying only part of the canal surface). Therefore, the impact is localized and short-term (approximately 1–3 months per segment), and the level of impact is considered low. It can be mitigated through appropriate construction methods and combined with the aquaculture plans of local households.

(ii) Livelihood of people in Hoang Chau commune – subproject 7

Over 80% of local agricultural households engage in aquaculture, with the farming season from February to October, while the remaining 20% participate in crop cultivation. The temporary land occupation for dredging and construction activities under Subproject 7 will impact the local ecosystem of Song Khe canal, branch canals 1,2,2, Phong Chau canal, affecting both the quality and quantity of aquaculture production. Aquatic species in ponds such as shrimp, crab, and mullet, and crops including corn, legumes, and asparagus. As these species cannot relocate and may die due to their sensitivity to increased levels of TSS, dust, noise, vibration, and light. These factors negatively affect the health and growth of farmed seafood, leading to reduced productivity and quality. Consequently, this poses a threat to the livelihoods of local residents. Vegetables and other crops in the area are traditionally cultivated using freshwater. During the construction process, there is a risk of saltwater intrusion, which may increase soil salinity and adversely affect the health of the crops. This could impact the livelihoods of local residents.

	
<i>Aquaculture pond of local people – Hoang Chau commune</i>	<i>Existing Song Khe canal – Hoang Chau commune</i>

The canal/channel system inside Phong Chau canal (at the junction where the Song Khe Canal connects to Song Khe sluice on the Ma River embankment, including branch canals No. 1 and 3 on the western side) is currently supplying freshwater to a large agricultural production area (rice fields, freshwater aquaculture, and vegetable cultivation such as corn and asparagus) in Hoang Luu commune. The dredging process along these canals poses a risk of saltwater intrusion and may increase TSS and turbidity in the water source at Phong Chau Canal, directly affecting the quality of irrigation water for these agricultural areas. These impacts are considered moderate and require specific plans and mitigation measures. Regulation through sluices and control structures along the Song Khe canal and branch canals No. 1 and 3 must be carefully calculated to protect the quality of irrigation water for the large vegetable cultivation area within Phong Chau Canal and to prevent saltwater contaminated in the irrigation source.



In-field irrigation canal



*Phong Chau canal – Hoang Chau
commune*



Crop area –Hoang Chau commune



These impacts are considered moderate and short-term, occurring at specific times and locations

during the construction of sluices, canal surfaces, and related structures on the Song Khe canal, branch canals No. 1, 2, and 3, and surrounding areas. Construction methods, along with appropriate solutions and response plans to address changes during the construction process, must be prepared to ensure the minimization of impacts on the livelihoods of aquaculture households and crop-cultivating farmers.

(iii) Impacts of disposal site of the subproject 7

Dredged materials of the subproject are disposed at the disposal site located in Chau Trieu village, Hoang Chau commune– with an area of about 1.5ha and storage capacity of 18,000 m³. Affected parties include nearby residents and surrounding natural areas, surrounding crop cultivation area. The impact level is assessed as low because: (i) The disposal sites have been approved in official document by the Provincial People’s Committee or agreed upon between the local authorities and the Thanh Hoa PMU of Construction Investment Works for Agricultural and Rural Development; (ii) The surrounding area of the disposal sites consists of crop land of households without people living in, buildings. The transportation distance is short, approximately 1 km, along sparsely trafficked inter-communal roads; (iii) The disposal transportation period is not long and not continuous; (iv) Impacts from disposal activities can be mitigated through appropriate management and technical measures.

(iv) Affected sensitive receptors – Subproject 7

Affected sensitive receptors of the subproject 07 are shown below:

Table 4-35. Sensitive receptors – Subproject 7

No.	Sensitive receptors	Distance to the site (m)	Description	Impacts
1	 Aquaculture pond	10	- Located 10m away from the subproject 7 area. - More than ten households engaged in aquaculture in the area, primarily farming shrimp. - Use water from canals for aquaculture.	- Impacts on the production, business of households - Increase the risk of traffic jams - Increase the risk of conflicts between workers and local people.

Affected sensitive receptors – Subproject 7

The aquaculture pond area is located in Hoang Chau commune. The affected group includes aquaculture individuals/households operating on the impacted land plots. During the construction process, these aquaculture areas, particularly ponds farming black tiger shrimp and white-leg shrimp, may be affected. However, the level of impact is assessed as low, due to the short-term and non-continuous construction activities. The works are carried out in segmented phases and using sheet pile and pontoons to support excavators while dredging the canal bed according to the design cross-section, allowing flow diversion through the existing drainage channel. These impacts can be avoided or minimized through appropriate technical and management measures.

Site-specific impacts of the subproject 8

Site-specific impacts of the Subproject 8 in Da Loc commune, Hau Loc district: Primarily the extensive aquaculture ponds located along the project route, as well as the irrigation land and buffer zones adjacent to the embankment. Thus, aquaculture households may be directly affected by temporary disruptions to water intake and drainage activities, impacts on livelihoods, and effects from the project’s disposal site. These impacts will arise within the investment scope of the main canal system that supplies water for aquaculture, combining water

intake and flood drainage functions for the area.

(i) Temporary disruption of water intake and drainage activities serving aquaculture operations

The dredging of irrigation and drainage canal system (The main canal with 1,256.13m long; Branch canal 1, 283.97m long; Construction of the new Ong Ninh sluice. These works serve a total drainage and aquaculture area of approximately 246 ha. The construction method involves embankment works and flow diversion dredging. The dry season is from November to June, and the rainy season from July to October annually. These activities are expected to partially obstruct the existing flow, causing temporary disruption to water intake and drainage for aquaculture in the area.

However, water is fetched according to the farming schedule of local households, and successive construction method will be applied for each canal segment and with flow diversion (using sheet piles to isolate each segment, temporarily occupying only part of the canal surface). Therefore, the impact is localized and short-term (approximately 1–3 months per segment), and the level of impact is considered low. It can be mitigated through appropriate construction methods and combined with the aquaculture plans of local households.

(ii) Livelihood of local residents

In this area, 70% of aquaculture households practice extensive farming, with the farming season from February to October. The temporary land occupation for dredging and construction activities under Subproject 8 will impact the local ecosystem, affecting both the quality and quantity of aquaculture production. Aquatic species such as shrimp, crab, and mullet cannot relocate and may die due to their sensitivity to increased levels of TSS, dust, noise, vibration, and light. These factors negatively affect the health and growth of farmed seafood, leading to reduced productivity and quality. Consequently, this poses a threat to the livelihoods of local residents.

Additionally, during the rainy and stormy season (typically from July to October annually), drainage from the construction area may accumulate TSS on exposed surfaces, material/waste gathering area, leading to rainwater runoff into aquaculture ponds and causing damage to local farmers in rainy season.

These impacts are considered moderate and short-term, occurring at specific times and locations during the construction of sluices, canal surfaces, and related structures along the main drainage canal from Ong Ninh sluice to Quay Co sluice, as well as branch canals 1 and No. 2 extending toward the main route of the Len River. Construction methods, along with appropriate solutions and response plans to address changes during the construction process, must be prepared to ensure the minimization of impacts on the livelihoods of aquaculture households and local business activities, including trade and consumption.

(iii) Impacts of disposal site serving the subproject 8

Dredged materials of the subproject are disposed at the disposal site located in Hung Thanh village, Van Loc commune– with an area of about 1.0ha and storage capacity of 18,000 m³. Affected parties include nearby residents and surrounding natural areas, surrounding crop cultivation area (the South and the North). The impact level is assessed as low because: (i) The disposal sites have been approved in official document by the Provincial People's Committee or agreed upon between the local authorities and the Thanh Hoa PMU of Construction Investment Works for Agricultural and Rural Development; (ii) Surrounding is the crop cultivation land of local households, but this area is not affected. In the disposal site area, there are no residents and residential house. The transportation distance is short, approximately 1 km, along sparsely trafficked inter-communal roads; (iii) The disposal transportation period is not long and not continuous; (iv) Impacts from disposal activities can be mitigated through

appropriate management and technical measure.

(iv) Sensitive receptors in subproject 8

The subproject 8 covers one sensitive receptor – aquaculture pond – near the construction phase:

Table 4-36. Sensitive receptors – Subproject 8

No.	Sensitive receptors	Distance to the site (m)	Description	Impacts
1	 Aquaculture area	10	- Located near the subproject area, in Van Loc commune. There are some seafood aquaculture household (mainly shrimp farming). - Existing aquaculture area is 10m away from subproject 8 - About 20 aquaculture households in the area (shrimp farming). - Use water from canals for aquaculture.	- Impacts on the production, business of households - Increase the risk of traffic jams - Increase the risk of conflicts between workers and local people.

Affected sensitive receptors – Subproject 8 The aquaculture pond area is located in Van Loc commune. The affected group includes aquaculture individuals/households and aquatic species farmed in the impacted land plots. During the construction process, these aquaculture areas may be affected due to dust, rainwater runoff in heavy rainy, stormy days. The level of impact is assessed as low due to short-term and non-continuous construction activities. The works are carried out in segmented phases and using sheet pile and pontoons to support excavators while dredging the canal bed according to the design cross-section, allowing flow diversion through the existing drainage channel. These impacts can be avoided or minimized through appropriate technical and management measures.

Site-specific impacts of subproject 9

The specific impacts of Subproject 9 in Quang Trung Commune include disruptions to water intake and drainage activities for aquaculture areas, impacts on household livelihoods, and effects from the disposal site. These impacts fall within the scope of investment in the Ong Thuoc and Ong Vanh sluices located beneath the embankments of the Hoang and Yen Rivers, as well as dredging of the main drainage canal that supplies water for aquaculture, combining water intake and flood drainage functions for the area.

(i) Temporary disruption of water intake and drainage activities serving aquaculture operations

Dredging activities along the irrigation and drainage canal system (The main canal from Ong Thuoc to Ong Van sluice, about 1,273 m long, construction of two new sluices to supply water into the canal. These works are designed to ensure both drainage and water supply for the aquaculture area, covering a total of 145 hectares. The construction method involves embankment works and flow diversion dredging (The dry season spans from November to June, and the rainy season from July to October annually), so these activities are expected to partially obstruct the existing flow, causing temporary disruption of water intake and drainage operations serving aquaculture in the area.

However, water is fetched according to the farming schedule of local households, and successive construction method will be applied for each canal segment and with flow diversion (using sheet piles to isolate each segment, temporarily occupying only part of the canal surface).

Therefore, the impact is localized and short-term (approximately 1–3 months per segment), and the level of impact is considered low. It can be mitigated through appropriate construction methods and combined with the aquaculture plans of local households.



Current status of aquaculture land bordering Yen river – Ong Vanh sluice

(ii) Livelihood of residents

Dredging of the main and branch irrigation and drainage canals, along with embankment, upgrades and construction of operation and management roads will follow the alignment of existing infrastructure. Therefore, no residential land or housing along the route will be affected. However, most aquaculture pond areas are located along the canal route and within irrigation land and buffer zones adjacent to the embankment, so the subproject's land acquisition will reduce the aquaculture area available to local households and increase impacts due to changes in the living environment during the construction period, particularly affecting shrimp farming cycles—either during stocking preparation or active cultivation in ponds.

In this area, aquaculture households practice extensive farming, with the farming season from February to October. The temporary land occupation for dredging and construction activities under Subproject 9 will impact the local ecosystem, affecting both the quality and quantity of aquaculture production. Aquatic species such as shrimp cannot relocate and may die due to their sensitivity to increased levels of TSS, dust, noise, vibration, and light. These factors negatively affect the health and growth of farmed seafood, leading to reduced productivity and quality. Consequently, this poses a threat to the livelihoods of local residents.

Regarding the current canal surfaces and in-field irrigation canals, the transportation routes along the embankment, canal sections with concrete surfaces have deteriorated or remain as narrow dirt roads. In particular, the transport route of the aquaculture have been eroded, with small banks, making it difficulties for the transportation of aquatic products and daily travel of local residents. The implementation of construction activities under the Subproject 9 may further accelerate the degradation of these existing routes, thereby affecting trade, product distribution, and especially the consumption of aquaculture products in the area. This indirectly impacts the income and livelihoods of local residents. Although the construction period is short-term and non-continuous, mitigation measures are necessary to minimize these impacts on the community.

Additionally, during the rainy and stormy season (typically from July to October annually), the drainage from the construction area may accumulate TSS on exposed surfaces, material/waste gathering area, leading to rainwater runoff into aquaculture ponds and causing damage to local farmers in rainy season. This issue was mentioned in the public consultation and in depth interview with local residents in aquaculture area and local authorities.

These impacts are considered moderate and short-term, occurring at specific times and locations during the construction of Ong Vanh sluice (Yen river) and Ong Thuoc sluice (Hoang river), the canal surface as well as the main canal connecting these two sluices. Construction methods,

along with appropriate solutions and response plans to address changes during the construction process, must be prepared to ensure the minimization of impacts on the livelihoods of aquaculture households and local business activities, including trade and consumption.

(iii) Impacts disposal site serving the subproject 9

Dredged materials of the subproject are disposed at the disposal site located in Dung village, Quang Chinh commune with an area of about 0.5 ha and storage capacity of 10,000 m³. Affected parties include nearby residents and surrounding natural areas, surrounding crop cultivation area (the South and the North). The impact level is assessed as low because: (i) The disposal sites have been approved in official document by the Provincial People's Committee or agreed upon between the local authorities and the Thanh Hoa PMU of Construction Investment Works for Agricultural and Rural Development; (ii) The surrounding area of the disposal site is the temporary gathering areas for excess materials of Quang Chinh communal PC. In the disposal site area, there are no residential house, ditches along the road to the disposal site. The transportation distance is short, approximately 1 km, along sparsely trafficked inter-communal roads; (iii) The disposal transportation period is not long and not continuous; (iv) Impacts from disposal activities can be mitigated through appropriate management and technical measure

Subproject 9: The is no sensitive receptor within the scope and nearby area of the subproject 9.

4.5. ENVIRONMENTAL AND SOCIAL RISKS DURING OPERATION PHASE

Due to the specific characteristics of the subprojects, in this stage the assessment of environmental and social (E&S) impacts and risks will be conducted by group of subprojects as follows: (i) subproject 1 and 2; and (ii) subproject 3, 4, 5, 6, 7, 8, and 9, as presented below:

4.5.1. Impacts and risks during operation phase of subproject 1, 2

The Subprojects 1 and 2 are to upgrade and expand Hoang Hoa fishing port and Lach Truong fishing Port. The sources of environmental and social impacts and risks during the operation phase of these two ports arise from: (i) Operation of transportation vehicles such as ships, boats, and cargo trucks; fish and seafood loading and unloading activities; (ii) Activities of Port operators, fishermen at the port, boat/ship drivers, and port trader; (iii) Operations of fishing boats entering and existing the port and vessels sheltering in the port ; (iv) Operation of functional areas within the port (seafood receiving area, sorting area, storage area, etc.); (v) Operation of technical infrastructure systems such as the wastewater treatment plant, waste storage facilities, public toilets, etc.

The general impacts and risks during the operation phase of subproject 1, 2, including:

- Dust and emissions generated
- Noise
- Wastewater generated
- Solid waste generated
- Environmental risk incidents
- Traffic impacts and risks (waterway and roadway)
- Impacts on aquatic life and deterioration of surface water quality due to the concentration of vessels in the port area.

Detailed Impact Assessment is presented below:

4.5.1.1. Dust and Emissions Generated

Sources of dust and emissions from the operation of 02 fishing ports, especially in the fishery service areas, include:

- Dust and emissions from transportation vehicles such as ships/boats/trucks, and fish/seafood loading and unloading activities.

- Fishy odors generated from fishing vessels upon return to the port and from cold storage facilities used for seafood preservation.
- Odors and emissions (NH₃, H₂S, etc.) generated from the wastewater treatment system, solid waste storage facilities, etc.

Details of impacts from dust and emissions during the operation phase:

❖ ***Dust and emissions from transportation ships/boats/trucks, fish/seafood loading and unloading activities***

Dust and emissions of ships/boats/trucks are primarily generated from the operation of diesel-powered generators and vessel exhaust systems. The pollutants mainly include dust, CO_x, SO_x, NO_x, Hydrocarbons (HC), etc. The emission load from vessels entering and leaving the port is difficult to estimate and depends on the daily ships going in and out of the port, with an estimated number of about 100 vessels/day (subproject 1) and 70 vessels/day (subproject 2). The average berthing and departure time is approximately 2 hours. The fuel consumption rates of vessels under subproject 1 and 2 are 40.88 kg/h and 28.62 kg/h, respectively, equivalent to 81.76 kg/2h for subproject 1's vessels and 57.23 kg/2h for subproject 2's vessels.

According to statistics of the World of Health Organization (WHO - 1993), the emission coefficient per tone of diesel fuel (for internal combustion engine as follows: dust 4.3 kg; SO₂ 20S kg (0.05% S); CO 28 kg; NO₂ 55 kg. Applying the formula for calculating the pollutant load in exhaust gases arising from the operation of ships/boats:

$$\text{Pollutant load (mg/m}\cdot\text{s)} = \text{Pollution coefficient (kg/day)} \times \text{number of ships in a day} \times 1000 \\ (\text{average distance} \times 86,400).$$

Where: 1000 is the conversion factor from “km” to “m”; 86,400 is the conversion factor from “day” to “seconds”; the sulfur (S) content in DO oil is 0.05%; average travel distance: 1.56 km (Subproject 1) and 1.15 Km (Subproject 2). Based on the fuel consumption rates and the emission factors for diesel combustion in internal combustion engines, the pollutant loads are calculated as follows. The Sutton model was applied to calculate the diffusion of air pollutants from a continuous emission source. The calculation results of dust concentrations at several random points along the route, at a distance of 5m from the emission source, show that:

Table 4-37. Pollutant load from movement of vessels

No.	Pollutants	Fuel consumption (ton)	Volume of emission (kg)	Pollution load (mg/m.s)	Pollution concentration (mg/m ³)
Subproject 1					
1	CO	0.082	0.00230	0.0170	0.00073
2	SO ₂	0.082	0.00008	0.0006	0.00003
3	NO ₂	0.082	0.00451	0.0335	0.00144
4	Dust	0.082	0.00035	0.0026	0.00011
Subproject 2					
1	CO	0.057	0.00160	0.0119	0.00055
2	SO ₂	0.057	0.00006	0.0004	0.0000198
3	NO ₂	0.057	0.00315	0.0234	0.00109
4	Dust	0.057	0.00025	0.0018	0.00075

According to the forecast results of dust and exhaust gas dispersion from vessel movements, all parameters remain within the permissible limits.

The affected group at each of subproject 1 and subproject 2 is estimated at approximately 450–500 people, consisting mainly of about 350 fishermen engaged in port activities and operating fishing vessels entering and leaving the port; around 100–135 local residents engaging business and trading at kiosks within the port area; and approximately 15 port operation staff.

The impact level of this emission source is assessed as Low because: (i) the concentration is only greatest when all vessels gather at the port at once and only affect the area for a short time (according to general practice and procedures at fishing ports, the docking period can last from 30 minutes to 2 hours within 9-11 am, 15-15pm); (ii) this source of emissions will gradually decrease when ships cease operating; and (iii) this source of emissions gradually dilutes into the air with fairly ventilated conditions on a large port with strong wind blows.

❖ ***Fishy odor generated from fishing vessels upon arrival at the port***

The source of fishy odors mainly appears when fishing vessels carrying seafood that is caught and frozen onboard. The fishy odor composition is mainly from NH₃, Hydrocarbons (HC), generated from the decomposition of organic matters and refrigeration equipment. The load of NH₃ emissions arising from refrigeration equipment and fishy odors from fishing boats is considered low, as the aquatic products (shrimp, crab, seafood, etc.) are quickly loaded and unloaded, sorted, and delivered to the market for consumption or immediately put into cold storage. The main gases generated from the decomposition of organic matter include CO₂, NH₃, H₂S, CO, CH₄, and Mercaptans. In which, the main odor-causing gases are NH₃, H₂S and Mercaptan, discomforting fishermen, traders, and sellers/buyers in the port area.

This impact is long-term and continuous, and the impact level assessed as Medium, because: (i) the volume of aquatic products arrived at the port is localized, depending fishing vessels (hourly - early morning (from 4 a.m. to 6 a.m.) and afternoon (from 2 p.m. to 4 p.m.), seasonally - the peak fishing season is normally from June to September every year); (ii) The seafood decomposition contributes to an increase in fishy odor, adversely affecting the environment in the port area (accounting for about 5%–10%). Nevertheless, this impact can be mitigated through appropriate measures.

❖ ***Odors and emissions (NH₃, H₂S, etc.) from the wastewater treatment plant***

Each of subproject 1 and 2 will invest in the construction of a wastewater treatment plant with a capacity of 200 m³/day, applying aerobic treatment technology and designed with closed treatment tanks. However, odors and gaseous emissions (such as NH₃, H₂S, CH₄, etc.) are expected to be generated from the wastewater treatment facilities of the subprojects.

WWTP technology process: Wastewater from sources → Collection tank → with grease separation tank → Equalization tank → UASB tank → ANOXIC tank → MBBR tank → Biological settling tank → Disinfection tank → Treated wastewater meeting QCVN 40:2011/BTNMT – National Technical Regulation on industrial wastewater (Column B) → Receiving source (Lach Truong river).

According to this process, odors from the WWTP mainly arise from the collection tank, grease separation tank, equalization tank, reaction tank (UASB), Anoxic tank. Aerobic decomposition also produces odors but at a lower level. Gases generated primarily from anaerobic decomposition include H₂S, Mercaptans, CO₂, and CH₄, among which H₂S and Mercaptans are the main odor-causing substances.

Based on the aerobic treatment technology and the design of enclosed treatment tanks, the 200 m³/day wastewater treatment plant will significantly reduce odors generated from substances such as H₂S, CH₄, and NH₃. However, odor concentrations may still remain at low levels in cases where complete elimination is not possible. Typically, the concentration ranges of odor-causing substances (H₂S, CH₄, NH₃) in aerobic wastewater treatment systems with enclosed tanks fall within the following thresholds:

- **H₂S (Hydrogen Sulfide):** The concentration of H₂S in enclosed aerobic treatment tanks is typical maintained below **0.1 ppm**, and under ideal conditions, it can be even lower.

- **CH₄ (Methane):** The concentration of CH₄ in aerobic treatment tanks can range from **0.5 to 5 ppm**, however, this figure depends on the level of ventilation and emission control in the tank.
- **NH₃ (Ammonia):** The concentration of NH₃ in enclosed treatment tanks can be controlled within the range of 1–3 ppm, depending on the nitrification process and aeration system.

The groups directly affected by odors from the wastewater treatment plant and solid waste storage facility are plant operators and fishermen at the port (approximately 450-500 people in each fishing port of Hoang Truong and Lach Truong). Since the wastewater treatment plant use aerobic technology with closed treatment tanks, the odor is minimized. The decomposition process generates malodor but at a low level. In addition, the wastewater treatment plant of each Hoang Truong and Lach Truong fishing port will be built closely, (closed treatment blocks), so the odor generated will be minimized. Therefore, the impact level is assessed as Low and can be mitigated by appropriate technological and technical measures.

4.5.1.2. Noise

The source of noise arises mainly from vessels when docking, vehicles entering to purchase and transport seafood for consumption and from the service area.

The forecast of maximum noise levels (taking into account cumulative noise when multiple vessels arrive and depart simultaneously) for subproject 1 (Hoang Truong Fishing Port) and Subproject 2 (Lach Truong Fishing Port)—with an average of 100 and 70 vessels per day, and up to 500 vessels during storm events) is as follows: noise from vessels is expected to range between 80–85 dBA; noise from road traffic between 85–95 dBA; and noise generated from service areas between 75–79 dBA. Most motorized vehicles are equipped with mufflers; however, as these are often self-fabricated, their effectiveness in noise reduction is not fully ensured.

Noise mainly affects traders, workers working at Hoang Truong and Lach Truong fishing ports, and fishermen (about 450 - 500 people each). The affected area is typically within a radius of 10–20 meters around the receiving, sorting, and unloading areas. (According to standard practices and procedures at fishing ports, docking times last from **30 minutes to 2 hours** within 9-11 am and 15-16 pm).

However, field surveys at local existing fishing ports show that vessel docking, loading/unloading, and sorting activities do not always take place all day, usually within a month, the peak time of full-day operation is from the 8th to the 15th day of the lunar calendar. On other days, these activities take place in the early morning (4:00–6:00 a.m.) and afternoon (2:00–4:00 p.m.). Additionally, upon ship arrival, the engine will be turned off, the port space is wide towards the river, so the noise is also diffused quickly. Therefore, the impact level is assessed as **Low** and can be mitigated through appropriate measure.

4.5.1.3. Wastewater generated

For the subproject 1 (Hoang Truong fishing port) and subproject 2 (Lach Truong fishing port), the sources of wastewater generated from the operation include: domestic wastewater, wastewater from onshore service areas, and wastewater from vessels operating in the waters in front of the port. The wastewater volume is calculated based on the water supply volume (according to the wastewater discharge standard, taken as 100% of the water supply standard). The estimated wastewater flow for Hoang Hoa and Lach Truong Fishing Ports is 161.4 m³/day and 339.24 m³/day. Details are shown below:

Table 4-38. Water supply demand of subproject 1,2 in operation phase

No.	Items	Volume of water supply (m ³ /day)	Led to WWTP (m ³ /day)	Loss (m ³ / day)	Hazardous waste collection
A	Subproject 1		93.54	205.75	
I	Port logistics area – subproject 1				
1	Domestic activities	21.52	21.52	-	-
2	Cleaning of receiving house for seafood classification, processing, transportation.	1.50	1.50	-	-
3	Activities involving contact with seafood				
-	Ice production	65.75	-	65.75	-
-	Freshwater demand	140	-	140	-
II	Vessel berthing – subproject 1				
1	Domestic activities	70	70	-	-
2	Ballast water	14.4	Not discharge at the port area		
3	Bidle water (vessel/day)	0.05	-	-	0.05
B	Subproject 2		87.65	288.70	
I	Port logistics area – subproject 2				
1	Domestic activities	15.36	15.36	-	-
2	Cleaning of receiving house for seafood classification, processing, transportation.	2.29	2.29	-	-
3	Activities involving contact with seafood				
-	Ice production	138.24	-	138.24	-
-	Freshwater demand	140	-	140	-
4	Tree watering, road washing				
-	Tree watering	4.81	-	4.81	-
-	Road washing	5.64	-	5.64	-
II	Vessel berthing – subproject 2				
1	Domestic activities	70	70	-	-
2	Ballast water	17.3	Not discharge at the port area		
3	Bidle water (vessel/day)	0.05	-	-	0.05

The characteristics of each type of wastewater arising from the operation of Hoang Truong Fishing port – subproject 1 and Lach Truong fishing port – subproject 2 are as follows:

a. Domestic wastewater

Domestic wastewater arises from the working areas of staffs and employees in the service area and fishermen/traders at the port, the volume and pollution level of this waste source mainly depends on the number of workers at a port (about 450 - 500 people) and the amount of water used daily at the operational facilities and public toilets, garbage storage facilities, wastewater treatment plant. The domestic wastewater volume is estimated at 12.5 m³/day. The waste generated from this source is highly dirty, its composition mainly contains organic matters, nutrients, residues, suspended substances and pathogenic bacteria. Besides, it contains high organic content (BOD, COD), high solid content and many pathogenic bacteria. The above amount of wastewater, if not collected and treated appropriately, can cause the spread of pathogens, affecting coastal seawater sources in Lach Truong river, damaging the beautiful landscape in the surrounding areas.

The operation of subproject 1 – Hoang Truong fishing port, especially from fisheries service

area will generate wastewater, including domestic wastewater (untreated) as following:

Table 4-39. Predicted concentration of domestic wastewater during the operation phase of two fishing ports

No.	Parameters	Unit	Untreated	Treated by septic tank	QCVN 14: 2008/BTNMT (column A, K=1.0)
1	COD	mg/l	608	61-152	-
2	BOD ₅	mg/l	329	49-99	30
3	TSS	mg/l	713	36-178	50
4	Total N	mg/l	60	20-40	-
5	Total P	mg/l	17	3-10	-
6	Animal and plant fats and oils	mg/l	133	42	10
7	Total Coliform*	MPN/100ml	10 ⁶ -10 ⁹	104	3,000

Notes: The coefficient accounting for the project scale is $k = 1.0$ according to Table 2, QCVN 14:2008/BTNMT

Based on the above table, it can be seen that the concentration of organic substances in domestic wastewater after treatment with septic tanks is approximately and exceeds the permissible level by 1.0 to 2.0 times. TSS ranges from lower than to 1.8 times higher than that of permissible level. The content of animal and plant fats and oil is 2.1 times higher than permissible level. Therefore, wastewater treated by septic tanks needs further treatment at centralized water treatment facilities before being discharged into the receiving environment.

b. Production wastewater at each fishing port of Hoang Truong and Lach Truong

Wastewater of onshore service areas

When the fishery logistics service area comes into operation, it will be accompanied by a system of service and commercial facilities. The operation of these facilities will generate a significant volume of domestic wastewater. According to the standards for water supply for fishery services, they include:

$$Q_{\text{service}} = 2 \text{ l/m}^2 \times \text{supply area of } 10,700 \text{ m}^2 = 21,400 \text{ l} = 21,4 \text{ m}^3/\text{day.night.}$$

$$Q_{\text{washing}} = 10\% \times Q_{\text{service}} = 10\% \times 21.4 = 2.14 \text{ m}^3/\text{day.night.}$$

$Q_{\text{firefighting}} = 54 \text{ m}^3$ (1 fire within 3h). This volume of water is supplied together with the domestic water supply (service water, washing water, and fire-fighting water) through the main water meter, stored in an underground tank, and pumped to the respective facilities at the port according to the design.

Q_{berthing} - Demand of fresh water when vessels berth at the port is about $70 \text{ m}^3/\text{day}$.

Total water volume for domestic use and firefighting is $140 \text{ m}^3/\text{day.night}$ (calculate max coefficient $k=1.25$).

- The domestic wastewater generated from the logistics area and from vessels berthing at the fishing port when the subproject 1 comes into operation is approximately $21.4 + 2.14 + 70 = 93.54 \text{ m}^3/\text{day}$, equivalent to a total wastewater flow of about $94 \text{ m}^3/\text{day}$ at Hoang Truong port. After being collected in the treatment tank located on the western side of the project site, the wastewater will be treated to meet discharge standards before being conveyed to the Hai Tien urban wastewater treatment plant for complete treatment prior to discharge into the environment. This impact on the water supply for services is considered insignificant.

The domestic wastewater generated from the port logistics area and from vessels berthing at subproject 2 is approximately $15.36 + 2.29 + 70 = 87.65 \text{ m}^3/\text{day}$, equivalent to a total wastewater flow of about $88 \text{ m}^3/\text{day}$ at Hoang Truong port.

Production wastewater from seafood receiving facilities, seafood storage warehouse

The waste stream here mainly contains organic matter, animal fats and oils, and by-products (such as fish scales, discarded small fish, shrimp shells, etc.). If not properly collected and treated, these substances can easily decompose and cause foul odors in the surrounding area. Ice: It is estimated that about 60% of the total seafood passing through the port requires ice for preservation, with an average of 2 tons of ice needed per 1 ton of seafood. With an annual seafood catch of 15,000 tons, the corresponding freshwater demand for ice production is about 15,000 m³/year. The total freshwater demand for activities involving direct contact with seafood is approximately 124.423 m³/day, including:

$Q_{\text{ice water supply}} = 15,000 \text{ tons} \times 2 \text{ tons of water for ice production} = 83.33 \text{ (m}^3\text{/day)}$. The utilization rate is usually around 80%, corresponding to approximately 65.75 m³/day (subproject 1) and about 138.24 m³/day at (subproject 2). This portion is used for ice production to preserve aquatic products at the port and to supply fishing vessels engaged in catching and consuming seafood.

$Q_{\text{freshwater}} = 41.09 \text{ m}^3\text{/day}$. This wastewater mainly consists of seafood washing water (49.3 m³/day). After the removal of by-products such as fish scales, shrimp shells, etc., it is collected through branch and main pipelines into the wastewater treatment tank located on the western side of the project site, where it is treated to meet the required standards before being discharged into the receiving source as previously described.

Water from ship, mechanical, and vessel equipment repair workshops: The water supply for the maintenance and repair workshop is 2 m³/day-night. The main pollutants in the wastewater from the mechanical and equipment repair workshop are primarily oil and grease, and suspended solids. If this wastewater is not collected and treated before being discharged into the receiving source, it will increase turbidity, reduce the penetration of sunlight into seawater, and thereby decrease the photosynthetic capacity of aquatic plants, leading to a reduction in total biomass production. Oil and grease will also reduce the ability of oxygen to dissolve in water, thus affecting the respiration of aquatic organisms and lowering the oxidation capacity of organic and inorganic substances in the water.

Ballast water is the water pumped into the ship's specialized tanks (seawater). During the process of ballast water refilling, various species such as plankton, microorganisms, and larvae can be sucked into the water tank and move along the ship to other water bodies. The pumping of water into the ballast tanks of vessels under anaerobic conditions causes some microorganisms in the water to die and decompose, thereby affecting water quality. When vessels operate without cargo, it is mandatory to pump water into the dedicated ballast tanks, and when loading cargo, the ballast water is discharged. In the case, all vessels entering the port for import and export activities are required to discharge ballast water. The ballast water discharge volumes at subproject 1 and subproject 2 are specified as follows:

Subproject 1: The ballast water volume accounts for about 30% of the vessel's cargo capacity. With an estimated 15,000 tons of cargo passing through the port, this corresponds to 15,000 tons $\times$ 30% = 4,500 tons $\approx$ 4,500 m³/year of ballast water, or approximately 14.4 m³/day of ballast water. Ballast water contains numerous microorganisms, bacteria, eggs, small invertebrates, cysts, and larvae of various aquatic species. It is estimated that around 7,000 marine species are transported globally through ballast water. The discharge of ballast water can therefore be toxic to coastal marine ecosystem.

- Subproject 2: The ballast water volume accounts⁹ for about 30% of the vessel's cargo capacity. With an estimated 18,000 tons of cargo passing through the port, this corresponds to 18,000 tons $\times$ 30% = 5,400 tons $\approx$ 5,400 m³/year of ballast water, or approximately 17.3 m³/day of

⁹ Research, design and manufacture ballast water treatment system

ballast water. Ballast water contains numerous microorganisms, bacteria, eggs, small invertebrates, cysts, and larvae of various aquatic species. It is estimated that around 7,000 marine species¹⁰ are transported globally through ballast water. The discharge of ballast water can therefore be toxic to coastal marine ecosystems. A plan for the collection and treatment of ballast water at Lach Truong port is required in order to reduce the risk of toxicity to coastal ecosystems.

For small and medium-sized fishing vessels, the ballast water volume may fluctuate on average at about 14.4 m³/day (subproject 1) and approximately 17.3 m³/day (subproject 2). Fishing vessels may use ballast water to ensure stability when going offshore and during seafood catching, and it is often reused. Under normal operating procedures, ballast water does not need to be changed too frequently. Ballast water will be inspected periodically every 6 months to 1 year to ensure that no accumulation of impurities or invasive organisms (such as bacteria or marine species) occurs in the ballast water. Therefore, the amount of ballast water discharged is considered low.

Bilge Water: is the wastewater generated from cleaning and maintenance of equipment and machinery on board; leakages from fuel pipes and engine rooms; overflow from tanks; and incidents during vessel operation. Bilge water is collected in bilge wells on each vessel. The depth and number of bilge wells depend on the vessel's size, capacity, and the volume of bilge water generated.

Based on statistical data from the Thanh Hoa Maritime Administration from 2010–2018; and on the operational processes of several terminals in the vicinity of the Project such as the petrochemical refinery port area, specialized terminals, and the general cargo terminals of Nghi Son Port, the estimated bilge water generated by each type of vessel is as follows: (i) For vessels with a capacity of $\leq 10,000$ DWT: about 0.01 – 0.05 m³/day/vessel; (ii) For vessels with a capacity of 10,000 – 20,000 DWT: about 1 – 1.3 m³/day/vessel. (ii) For vessels with a capacity of $< 30,000$ DWT: about 1 – 1.5 m³/day/vessel. Accordingly, vessels entering the ports under subproject 1 and subproject 2, with a capacity of $\leq 10,000$ DWT, generate about 0.05 m³/day/vessel of bilge water.

The composition of this type of wastewater may contain oil, grease, and other pollutants. If this wastewater is not treated as hazardous waste before being discharged into the marine environment, it will cause water pollution, directly affecting the aquatic ecosystem along the coastal areas of Hoang Truong commune, Hoa Loc commune, and neighboring localities, and reducing the local food chain. The impact level is assessed as Moderate, with long-term effects if untreated, but it can be avoided or mitigated through appropriate vessel management measures.

Wastewater from vessel cleaning activities: Vessel cleaning water includes cabin washing water, deck washing water, and cargo hold washing water. For cabin and deck washing, river water is used; this type of wastewater cannot be collected and does not contain harmful substances, therefore it is permitted to be discharged directly into the receiving source, the Lach Truong River. In the case of cleaning cargo hold, the wastewater mainly contains sand, soil, and organic matter. However, due to the specific nature of the port handling only one type of cargo, this type of wastewater is generated infrequently. Oily wastewater is a liquid waste containing oil, originating from the bilge system in the engine room, cargo hold washing water from oil tankers, fuel tank cleaning water, waste oil, oil sludge, oil leaks, ballast water mixed with oil, and oily bilge water from cargo holds. The volume of this wastewater is not large, estimated at about 3 m³/day. This wastewater contains oil, grease, and other pollutants, and if not properly treated, it will cause adverse impacts on the receiving environment.

In general, the impact level from wastewater sources generated during the operation of the two

¹⁰ Louis Vuitton 4/21-2009

fishing ports, Hoang Truong and Lach Truong, is assessed as long-term, continuous, and at Moderate level, because the fishing ports have been renovated and upgraded with integrated functional subdivisions that take into account operational efficiency in terms of environmental sanitation; moreover, the receiving source, the Lach Truong River, has a relatively large flow capacity. This impact can be mitigated by appropriate measures (the fishing port will be equipped with a separate wastewater collection system and one centralized wastewater treatment station with a capacity of 200 m³/day-night, ensuring collection and treatment of all wastewater generated at the port as calculated above).

c. Stormwater runoff

In addition, there is also a volume of stormwater runoff from the anchorage areas, carrying pollutants directly into the Hoang Truong sea without passing through a treatment system. The total stormwater runoff generated, calculated according to formulas [CT13] and [CT14], is approximately 7,211 m³/day at subproject 1; and the total stormwater runoff generated is about 15,255 m³/day at subproject 2.

The composition of stormwater contains a high level of suspended solids, while also carrying substances washed off from the port surface and materials spilled during operations. During heavy and prolonged rainfall, widespread or localized flooding may occur; accumulated pollutants may decompose, generating foul odors, creating favorable conditions for the rapid growth of microorganisms and bacteria, and consequently leading to the proliferation of flies and mosquitoes, which can easily result in the spread of infectious diseases. However, the project area is enclosed by boundary walls and equipped with drainage channels around the site, allowing water to flow from higher areas through these channels and follow the natural terrain slope. The stormwater drainage system has been fully invested in, ensuring the collection into the drainage network and discharge to the outside, thereby guaranteeing adequate collection and drainage capacity for the area and preventing localized flooding. Therefore, the impact of stormwater runoff on the Hoang Truong fishing port and the Lach Truong fishing port is considered insignificant and controllable.

4.5.1.4. Waste generated

The sources of solid waste generated during operation include: (i) Domestic waste from approximately 15 staff members working at the service area and administration building, and from 70–100 fishing vessels docking daily; (ii) Waste from the sorting and trading of seafood; (iii) Hazardous waste. The forecasted waste generation load for the subproject 1 – Hoang Truong fishing port and subproject 2 – Truong fishing port is as follows:

- For domestic waste:

The waste generation rate is estimated at 0.9 kg/person/day (based on QCVN 01:2021/BXD – National Technical Regulation on Construction Planning). However, at the project site, staff work 8 hours/day and have one meal per shift. Therefore, the solid waste generation rate for staff at the project is 0.3 kg/day/person. With approximately 15 staff members, the amount of solid waste generated is 0.3 kg/person × 15 = 4.5 kg/day from the port logistics area, and from vessels docking at the port (70–100 vessels/day, equivalent to 35–50 kg/day). Thus, the total solid waste generated per day is about 54.5 kg/day at subproject 1 and 39.5 kg/day at subproject 2. This waste is collected daily by the local municipal solid waste collection unit. Therefore, the impact of domestic solid waste from staff at Hoang Truong and Lach Truong fishing ports is considered insignificant.

- For waste from seafood classification, purchase and selling:

The seafood products spilled or discarded after the washing and freezing process for the subproject 1 are estimated at about 0.1% (15,000 tons of seafood × 0.2% = 3 tons/year = 8.3 kg/day). This type of solid waste is rich in nutrients, therefore it decomposes easily, produces

odors, and can cause serious environmental pollution. Currently, this solid waste is collected in a designated area of the port and is locally reused by residents, such as composting for animal feed or processing into feed for nearby aquaculture farms. Therefore, this type of waste is considered to have no significant impact at the Hoang Truong fishing port area.

The seafood products spilled or discarded after the washing and freezing process for the subproject 2 are estimated at about 0.1% (18,000 tons of seafood $\times$ 0.2% = 3.6 tons/year = 10 kg/day). This type of solid waste is rich in nutrients, therefore it decomposes easily, produces odors, and can cause serious environmental pollution. Currently, this solid waste is collected in a designated area of the port and is locally reused by residents, such as composting for animal feed or processing into feed for nearby aquaculture farms. Therefore, this type of waste is considered to have no significant impact at the Lach Truong fishing port area.

In addition, there are also several other types of ordinary solid waste generated from the operation of the two fishing ports, as summarized in the following table:

Table 4-40. Volume of ordinary solid waste in operation phase– Subproject 1,2

No.	Type of waste	Volume	Norm	Solid waste
I	Subproject 1			
1	Waste from seafood passing through the port	15,000 tons/year	0.02 %	3 tons/year
2	Operation of environmental protection work			
-	Sludge discharged by WWT system	163.02 m ³ /day	0.01%	8.9 tons/year
-	Waste sludge from culvert dredging, sludge from septic tank	-	-	2 tons/year
II	Subproject 2			
1	Waste from seafood passing through the port	18,000 tons/year	0.02 %	3.6 tons/year
2	Operation of environmental protection work			
-	Sludge discharged by WWT system	157.65 m ³ /day	0.01%	8.6 tons/year
-	Waste sludge from culvert dredging, sludge from septic tank	-	-	2 tons/year

Notes: Sludge from the WWT system – Based on the textbook “Wastewater Treatment” by Assoc. Prof. Hoang Hue, Hanoi University of Architecture – Construction Publishing House, 1996, during a wastewater treatment process, regardless of the method applied, a considerable amount of sludge is generated (equivalent to 0.01 – 0.03% of the total wastewater flow).

According to forecasted data, the volume of production solid waste generated is considerable; if not properly collected and treated, it may affect the beautiful landscape of the area. The project owner will take appropriate measures for collection, storage, and transfer the waste to ensure no environmental pollution occurs. Solid waste will be collected and transported to the regional waste treatment plant in Hau Loc by a licensed unit with the required capacity for transportation and treatment in accordance with regulations. Therefore, the impact of the generated solid waste is considered insignificant.

- Hazardous waste when operating the subproject 1, 2

Generation source: (i) Office activities: batteries, etc. (ii) Production activities: oil-contaminated rags, waste oil, etc. The volume estimated is as follows:

Table 4-41. Hazardous waste volume generated in operation phase – subproject 1,2

No.	Waste	Status	Mass (kg/year)	Code
<i>I</i>	<i>Subproject 1</i>			
1	Activated carbon	Solid	150	12 01 04
2	Used batteries and accumulators	Solid	2	16 01 12
3	Waste engine oil, gearbox oil, and synthetic lubricants	Liquid	50 (l/year)	17 02 03
4	Absorbents, filter materials, and hazardous waste-contaminated rags	Solid	15	18 02 01
<i>II</i>	<i>Subproject 2</i>			
1	Activated carbon	Solid	150	12 01 04
2	Used batteries and accumulators	Solid	2	16 01 12
3	Waste engine oil, gearbox oil, and synthetic lubricants	Liquid	60 (l/year)	17 02 03
4	Absorbents, filter materials, and hazardous waste-contaminated rags	Solid	17	18 02 01

Impact level:

- Liquid hazardous waste: These wastes are toxic upon skin contact and harmful to the health of staff and local residents who are directly exposed. The project's liquid waste mainly consists of used oil from machinery lubrication processes. These substances are highly flammable and may easily cause fire and explosion incidents. At the same time, this type of hazardous waste has rapid impacts on the environment through bioaccumulation, potentially hindering photosynthesis and respiration of organisms, and even causing the death of aquatic species and damage to the local ecosystem.

- Solid hazardous waste: These wastes have a strong impact on the environment if burned. Unless being properly recovered, they will be released into the environment, causing soil and water pollution.

If not collected and treated, these types of solid waste will cause air pollution (due to foul odors), surface water pollution along the river near the port area, and negatively affecting the urban landscape of the port area. However, since investments are being integrated in technical infrastructure (waste collection, domestic wastewater collection and treatment, etc.), and the locality already contracted with a sanitation team for collection, transportation, and treatment of both general and hazardous waste, the impact from solid waste generated by the fishing port is assessed as Low and controllable. Moreover, before the Thanh Hoa subproject comes into operation, the Project Management Unit (PMU) will be required to obtain an environmental permit, ensuring this impact is controllable.

4.5.1.5. Disturbance to road traffics

At subproject 1– Hoang Truong fishing port:

When the project comes into operation, it will handle a large volume of aquatic products through the port, which will affect road traffic activities. The transportation of seafood from the port to consumption areas within the province, especially during peak hours, may cause localized congestion along major transport routes such as NH1A, PR510, and the Hoang Truong

– Hoang Yen inter-communal road. This situation could disrupt the daily traffic of local residents in Hoang Truong commune and surrounding areas, and may also lead to traffic accidents, posing risks to people living along the routes as well as road users.

Affected receptors: Road transport vehicle owners (cars, motorcycles, bicycles, handcarts, etc.), residents living along the transportation routes, and road users traveling on these routes.

The level of impact is assessed as low because: (i) fishing vessels usually return in the early morning or early afternoon, so the transportation, sorting, and distribution of products do not coincide with local commuting hours; traffic volume only increases during off-peak times, (ii) the sorting is carried out directly at the fishing port and organized before vehicles arrive, thereby reducing congestion and waiting time for cargo loading, (iii) coastal residents, who have long been engaged in traditional fishing, possess extensive experience in coordinating product handling and preservation at appropriate times for transportation, (iv) the transportation routes are clear and convenient, allowing smooth circulation to markets, collection centers, and consumption areas both within and outside the province. Therefore, the impacts on traffic congestion or accidents are considered low and can be minimized through appropriate management measures.

At subproject 2–Lach Truong fishing port:

When the project comes into operation, it will handle a large volume of products through the port, which will affect road traffic activities. The demand for parking spaces specifically for seafood loading vehicles from the port or fish market is calculated based on 2-5 ton trucks, transporting 100% of the seafood volume through the port. The estimated demand for vehicles passing through Lach Truong fishing port is approximately 18 trucks/day.

The transportation of seafood from the port to consumption areas within the province, especially during peak hours, may cause localized congestion along transport routes leading to Hoa Loc fish market, Hoa Loc industrial cluster, Minh Loc fish market, and local seafood restaurants. This situation could disrupt the traffic activities of residents in Hoa Loc commune and surrounding areas, and may also result in traffic accidents, posing risks to people living along the transportation routes as well as road users.

Affected receptors: Road transport vehicle owners (cars, motorcycles, bicycles, handcarts, etc.), residents living along the transportation routes, and road users traveling on these routes.

The level of impact is assessed as low because: (i) fishing vessels usually return in the early morning or early afternoon, so the transportation, sorting, and distribution of products do not coincide with local commuting hours; traffic volume only increases during off-peak times, (ii) the sorting is carried out directly at the fishing port and organized before vehicles arrive, thereby reducing congestion and waiting time for cargo loading, (iii) coastal residents, who have long been engaged in traditional fishing, possess extensive experience in coordinating product handling and preservation at appropriate times for transportation, (iv) the transportation routes are clear and convenient, allowing smooth circulation to markets, collection centers such as Hoa Loc fish market, Hoa Loc industrial cluster, local restaurants both within and outside the province. Therefore, the impacts on traffic congestion or accidents are considered low and can be minimized through appropriate management measures.

4.5.1.6. Disturbance, impacts on aquatic species and reduction of surface water of river, canal due to concentration of vessels at the port

The quality of surface water in the Lach Truong River and De canal may deteriorate due to the operation of vessels entering and leaving the port and the storm shelter area during the operational phase (approximately 70–100 vessels/day and about 400 vessels sheltering in the De canal) due to: (i) leakage of oil and grease caused by accidents such as vessel collisions or grounding, or by the discharge of oily residues; (ii) ballast water mixed with oil and engine

cooling water containing oil and grease, along with domestic wastewater, solid waste, and hazardous/toxic waste (*as previously forecasted and assessed in the sections on “wastewater” and “solid waste” generation*).

The surface water quality of Lach Truong River and De canal is degraded due to increased turbidity, higher concentrations of suspended solids, and traces of oil and grease, leading to a reduction in dissolved oxygen levels and a decrease in the photosynthetic capacity of algae and aquatic plants.

In general, the impact on the surface water quality of the Lach Truong River and De canal from the operation of Hoang Truong and Lach Truong fishing ports is long-term and continuous but at a low level because: (i) Hoang Truong and Lach Truong fishing ports have been upgraded and modernized, and managed by the existing port management board, which has prior experience, ensuring that the activities of vessels entering and leaving the ports are environmentally controlled; (ii) the receiving capacity of the river/canal is relatively large. This impact can be mitigated through appropriate measures (the fishing ports are equipped with a separate wastewater collection system and a WWTP with a capacity of 200 m³/day-night, ensuring that all generated wastewater is collected and treated before being discharged into the receiving sources — the Lach Truong River and De canal).

The impact on the aquatic ecosystem of the Lach Truong River and De canal from the operation of Hoang Truong and Lach Truong fishing ports is long-term and continuous but assessed at a Low level because: (i) the port operation area is localized only to the waters in front of the berths (subproject 1: 10 m wide, with a total berth length of about 600 m; and subproject: 12 m wide, with a total berth length of about 200 m); (ii) there are no rare, endangered, or threatened aquatic species in the Lach Truong River and De canal area: plankton in the area mainly consist of copepods, cladocerans, and rotifers; benthic organisms mainly include snails, mussels, clams and; aquatic plants are mainly water hyacinth and algae. At the same time, the project area is not a habitat for any protected or high-value species. This impact can be mitigated through appropriate measures.

4.5.1.7. Environmental risks and incidents during the operation phase

❖ Fire and explosion incidents:

Causes: As being analyzed and forecasted above, the environment in the area contains fuel vapors, so the potential of fire incidents is high when exposed to high heat sources or electrical short circuits.

The power supply system for machinery, technical equipment, and electrical systems in auxiliary facilities, cargo yards, and the administration building may experience short circuits, fires, or explosions, causing damage to people and property. Additionally, the area containing fuel vapors used for refueling vessels is prone to considerable risk of fire incidents when exposed to high heat sources or electrical short circuits. A fire or explosion at Hoang Truong port may cause human life and property loss. Such incidents may lead to fire spread to warehouses, causing significant economic damage and threatening the safety of the port staff.

Affected group: People and property within the project area may be affected. However, as the neighboring residential area is located over 150m away and separated from the port, it is less likely to be affected.

Impact level: Assessed as Low because (i) functional areas are all designed with fire protection measures and on-site fire-fighting equipment, such as fire extinguishers; (ii) The arrangement of products and materials for the fishery service is allocated to specific zones with instructional signage, and dedicated personnel responsible for management and compliance with operational procedures; (iii) No incidents of electrical short circuits or fires have been recorded in the port area or surrounding residential zones; (iv) Such incidents are considered controllable, as the

port management board undergoes regular trainings on fire prevention and response; and (v) The port area is landscaped with greenery, and water supply infrastructure has been designed with a fully equipped fire protection system. Therefore, the impact level is assessed as Medium and controllable.

❖ ***Waterway traffic accidents:***

Cause: During vessel operations, serious accidents such as shipwrecks, vessel collisions, or fires may occur.

On average, the number of vessels entering and leaving Hoang Truong fishing port is relatively high, with a maximum frequency of about 70–80 vessels/day; the number of vessels entering and leaving Lach Truong fishing port is even higher, with a maximum frequency of about 100 vessels/day. When a storm hits the mainland, each port has recorded the presence of fishing vessels operating nearshore (450 vessels), midshore (32 vessels), and offshore (103 vessels).

During the operation of ships, shipwrecks, ship collisions, or severe fire incidents may occur. The transportation of products through the port will increase the waterway traffics in the channel in front of the port, greatly affecting the load-bearing capacity of the channel, obstructing visibility. Such increase in waterway traffic density is expected to lead to a higher risk of maritime accidents and oil spills, significantly affecting surface water quality and the ecosystem in the sea waters in Hoang Truong commune, Hau Loc commune and vicinity. In addition, dirty water and domestic solid waste, ballast water from vessels navigating the channels, in cases of collision where waste is not properly collected or treated may leak and overflow into the sea and port areas. This will increase pollutant levels and negatively impact the surrounding ecosystems along the navigation routes.

Impact scope: When there is a waterway traffic accident, depending on severities, oil spills may occur, affecting local soil and surface water quality, causing damages to property of fishermen and the port management authority, and economic damages to local communities who bear the costs of recovery after such incidents.

Affected receptors: Depending on the severity, oil spills may occur, impacting the marine environment in the Hoang Truong and Lach Truong port areas and surrounding waters; affecting the health of people involved in waterway traffic; and causing damage to the assets of fishermen and local communities who must deal with the consequences of such waterway traffic accidents.

The impact level is assessed as Moderate because: (i) The design for the upgrading and expansion of Hoang Truong and Lach Truong fishing ports has been calculated based on actual operational needs, port planning requirements, and future development trends in order to consider the growth rate of offshore, midshore, and nearshore fishing vessels; (ii) port management staff already have prior experience in port operations, therefore when operating on an expanded and upgraded scale, there will have effective coordination and procedures in port exploitation; (iii) there is always macro-level management and coordination from the authorities and relevant agencies such as the Thanh Hoa Maritime Administration, ensuring that the port can respond promptly, efficiently, and safely throughout its operation; (iv) appropriate management measures and mitigation measures can minimize the risk of waterway accidents.

❖ ***Oil spill incidents:***

For subproject 1 – Hoang Truong fishing port and subproject 2 – Lach Truong subproject, an oil spill incident may occur due to: (i) Vessel capsizing; (ii) waterway traffic accidents; (iii) spillage or leakage of oil and grease from fishing vessels entering or leaving the port; and (iv) storms, winds, low pressures and other extreme weather events.

Once an oil spill occurs, an oil-water mixture is quickly formed and spread after about 3-6 hours. The oil gradually dissipates through weathering related to various of physical and

chemical processes, such as natural dispersion by wind and currents, sedimentation, evaporation, or the formation of oil suspensions floating on the water surface. This spill will harm the natural environment and economic activities in the area. Specifically:

- Part of the oil products will sink and decompose on the seabed, polluting the water and sediment, while another part may float with air bubbles from the seabed. Oil residue on the seabed is a source of water pollution, affecting benthic organisms that are a food source of fish.
- When the water source is contaminated with oil, the decomposition oil products reduce the water source's ability to clean itself because the plankton and benthic organisms involved in the process die or decrease in number.
- When oil is spilled into water sources, the level of dissolved oxygen decreases because oxygen is consumed during the oxidation of oil products; Oil slicks hinder the aeration process of the water surface.
- In addition to affecting the aquatic environment, oil spill incidents also pose a serious risk of soil pollution. Even a very thin layer of spilled oil on the ground can cause the soil substrate and soil organisms to die.

Vessels passing through Hoang Truong fishing port have engine capacities ranging from 20 – 250 CV, with fuel storage volumes ranging between 0.964 – 12.045 tons of DO. Vessels passing through Lach Truong fishing port have engine capacities ranging from 90 – 400 CV, with fuel storage volumes fluctuating between 0.152 – 16.188 tons of DO.

The impact is assessed as Medium because: (i) the port area is arranged with a docking station in the form of anchorage, suitable for each type of ship with different capacity, length as well as purposes as required by vessel owner. The length and width of the berths are configured to support cargo handling operations and ensure convenient access to services such as loading, unloading, and other port-related activities for vessels arriving the port; (ii) The navigation channel area and the turning area are designed to ensure appropriate width, channel depth, turning radius, and maneuvering space, thereby reducing the risk of congestion, collisions, and inconvenience during vessel berthing and service use at the port. (iii) Coordination is based on years of experience in managing and operating the existing port, along with strict regulations governing vessel entry and exit (iv) Shipowners who drive ship to enter and exist the port regularly, have long practical experience, so there are insignificant risks of collision, overturning, leakage of materials as well as adapting to changes in weather and climate in the Hoang Truong and Lach Truong sea areas; (v) Strictly comply with port regulations and vessel operation procedures, and equip the port with standby oil containment booms/absorbent socks to enable prompt response to oil spills at the port... these measures can minimize the risks of oil spill incidents..

To minimize and manage potential oil spill incidents, the project owner must develop a vessel operation management plan and establish an emergency response plan for oil spills.

❖ Occupational accident incidents

During the operation phase, there will be 15 operators in Hoang Truong and Lach Truong fishing ports. Some risks and occupational accidents may occur, particularly in the complex working environment with multiple activities such as seafood unloading, transportation, and operation of mechanical equipment. Occupational accidents may occur when operating Hoang Truong and Lach Truong 2 fishing ports, due to:

Accidents due to collisions and traffic accidents:

- Risk of collision between vehicles: With the involvement of a variety of vehicles (trucks, boats, forklifts, cranes, etc.) in the port area, collision accidents may occur, especially

when vessels operate under limited visibility conditions, or lack of proper separation and routing.

- Road traffic accidents: Vehicles transporting seafood between ports and the mainland can cause traffic accidents due to poorly prepared roads or careless driving behavior.

Accidents involving mechanical equipment (cranes, forklifts, etc.):

- Risks from lifting equipment, cranes: Using cranes and forklifts to load and unload seafood from ships ashore or from shore into storage warehouse can cause accidents if the equipment is not adequately maintained or operated incorrectly. Accidents may include falling heavy objects, snapped cables, or equipment malfunction.
- Risks from electrical equipment and machinery: The operation of heavy machinery such as pumps, generators, or other motorized equipment may lead to electric shock, fire and explosion accidents if safety regulations are not observed.

Accidents due to unsafe working conditions:

- Falls, trips, slips: Due to continuous movement on wet and slippery surfaces (caused by grease, seawater, or seafood waste), workers engaging in unloading and storage areas are at risk of slipping, falling.

Fire and explosion accidents:

- Risk of fire and explosion from flammable materials: Substances such as oils, fuels, chemicals used in seafood processing or storage may lead to fire and explosion unless being handled and stored properly. Additionally, the use of electrical and mechanical appliances may result in electrical shorts or sparks, increasing the risk of fire.
- Fire due to improper discharge: Flammable wastes such as oil, grease from boats, cranes, or from seafood processing may cause fires if not collected and disposed of properly.

Health-related accidents and illnesses:

- Risk of infectious diseases: Working in humid environments and exposure to seawater can lead to infectious diseases, especially those related to the respiratory tract, skin, or waterborne diseases.
- Respiratory diseases: Long-term exposure to dust from seafood or emissions from ships can cause respiratory diseases such as pneumonia, bronchitis, or other chronic diseases.
- Diseases caused by marine life: Exposure to marine life can lead to injuries, infections, or poisoning due to toxins from seafood or other marine life.

Accidents caused by environmental factors:

- Risks due to extreme weather conditions: Weather conditions such as heavy rain, storms, and strong winds can increase the risk of accidents for workers working outdoors, especially those working on docks.
- Risks from sea waves and surge: Working in conditions of high seawater or strong waves may expose workers to risks of being swept away or encountering accidents while operating on vessels or at the dock or piers.

In addition, other risks related to occupational accidents may occur due to working environment at the port:

- Fish holds containing miscellaneous fish which are sorted for long period at sea will generate toxic gases. The deeper the fish holds and the longer the voyage, the higher the risk of oxygen deprivation for fishermen working in the fish holds, leading to acute poisoning, fainting, or even death.

- In the receiving and sorting areas where washing activities are frequently carried out and seafood is handled, the floor is always wet, increasing the risk of slips and falls during the lifting and transporting of seafood containers and trolleys.
- Slip-and-fall accidents during the loading and unloading of seafood from vessels to the port, including incidents where seafood containers fall onto workers.

The risk level of occupational accidents at the port is assessed as **Medium** because: (i) these impacts are always potential to occur on the port at any time; (ii) The number of operation workers is relatively small (15 people/port); (iii) these risks may persist in extended period during the fishing port operation (iv) They can be mitigated through appropriate measures, such as occupational safety training before and during port operations and providing sufficient personal protective equipment (PPE) for all workers.

❖ ***Incidents of vessels docking beyond the port's design capacity***

When the Class II fishing port, Class III facility, comes into operation, incidents may occur in which vessels docking exceed the designed capacity, leading to the following potential impacts:

- Vessels waiting for their turn to unload may experience long delay, potentially resulting in disputes over docking priority and causing disorder.
- Although, conventionally, docking is organized in sequence, some ship owners may attempt to push ahead, or maneuver around others to dock or leave the port, leading to traffic safety issues and negatively affecting the port's loading and unloading capacity.
- Wastewater and solid waste generated in excess of the subproject's treatment capacity of the designed waste treatment plant (wastewater treatment plant, waste storage facilities).

Impact Assessment: This impact is considered to be Low, as the port facilities have been designed and calculated in accordance with technical standards to ensure operational sustainability. However, if such incidents persist over an extended period, they may pose risks of port infrastructure degradation, potentially leading to damage to docking facilities and resulting in certain losses. This impact can be mitigated by appropriate port operation management measures.

❖ ***Incidents of water supply and drainage pipelines broken and damage to wastewater treatment systems***

During the operation, water supply and drainage pipeline and wastewater treatment systems may encounter into the following incidents:

- Breakage or cracking of water supply pipelines due to unsafe construction materials.
- Water pipeline broken due to external force.
- Failures of the wastewater treatment system, such as malfunctioning treatment equipment, leading to untreated or inadequately treated wastewater being discharged into the environment.

Such incidents, when occurring, will lead to water wastage (for clean water supply) and discharge of environmental pollutants (for wastewater). However, the likelihood of these impacts is considered low, as the water supply network is installed in technical compartment, and water supply areas are equipped with a pressurized valve system to detect leaks in the pipeline system.

When the wastewater treatment system is broken, the level of air and water pollution will increase as assessed in the above sections.

In addition, the materials used for pipelines are fire-resistant, corrosion-resistant, and highly durable, resulting in a very low risk of breakage or leakage. Wastewater treatment plant are designed with independent operating modules, with backup system, and equalization tanks that

can be stored for up to 24 hours when all modules fail. Therefore, the impact from these incidents is minor and can be controlled through appropriate measures.

✓ ***Risks and incidents due to improper operation of wastewater treatment plant***

In addition to risks from vehicles and equipment operating wastewater treatment plant, there are also risks stemming from humans and funding sources in the operation and maintenance of wastewater treatment plant. These risks include but are not limited to:

- The wastewater treatment plant operators' failure to comply with the operating process instructions that have been developed for the wastewater treatment plant.
- The operators lack sufficient knowledge and qualifications to operate the WWTP.
- Poor capacity of human resource management during the operation of the WWTP.
- Infrequently periodic maintenance, replacement or repair of damaged machinery and vehicles.
- Improper frequency and volume of sludge collection, which may result in reduced treatment efficiency of the WWTP and failure to meet current national technical standards.

The above risks, if occurring, will reduce the wastewater treatment efficiency of the wastewater treatment and affect the quality of receiving water sources and the aquatic ecosystem in the port area. However, the risk is assessed as "Low" and can be minimized: (i) The operation of the WWTP is carried out by engineers who are knowledgeable and qualified in wastewater treatment technology; (ii) The operation will be arranged in shifts and always have staff on duty, operating in accordance with the regulated instructions; (iii) The WWTP is periodically inspected and maintained daily or immediately when an incident occurs; (iv) Replacement of machinery and means are always available in case of damages. (v) At the WWTP, an **emergency pond** is provided as a backup in case the WWTP malfunctions or becomes inoperable

Furthermore, before the wastewater treatment plant is officially put into operation, the subproject must register for trial operation and apply for an environmental license.

✓ ***Risk of falling into the river and drowning***

These cases are warned when going up or down the docks or when colliding with ships, people on board often lose their balance and may fall/fall/slide into the river. Although berths are often designed with barriers and warning signs, fishermen/boat drivers are at risk of accidents falling into the river due to slippery and drowning or in the rainy and flood season, traveling on boats/ships that are prone to slipping and slipping into the river. This affects the health and even the lives of participants, especially fishermen on the anchorage area. The design needs to be done to prevent threats to fishermen when using works at the port. Therefore, this impact is Low and can be minimized.

✓ ***Quality of supply water in the Subproject 2 – Lach Truong fishing port***

Upgrading, expanding the Bai Trung clean water supply plant at Lach Truong fishing port to a capacity of 1,000 m³/day-night. The plant sources raw water from the upgraded raw water supply facility located west of the De canal, drawing water from the De canal in Phu Loc commune, approximately 500 m upstream of the salinity control sluice and about 4.25 km from the water treatment site. The intake pipeline conveys water to the elevated water tower at Hoa Loc fishing port.

Risk of raw water contamination: During the extraction process, the raw water source from the De canal may be contaminated by external factors. Therefore, raw water should be monitored and tested on a shift/daily basis to ensure that the quality of the intake water meets the requirements of the designed treatment technology.

The lamella settling and filtration technology with an automatic backwash filter is applied. Treated water will be supplied as domestic water for Lach Truong fishing port. A plan for regular and periodic monitoring must be implemented to adjust chemical dosing and treatment processes when necessary, ensuring that the supplied water meets the standards for domestic water quality in accordance with QCVN 01-1:2024/BYT – National Technical Regulation on clean water quality for domestic use.

Affected receptors: Staff and workers employed at the port, as well as customers, vessel owners, and crew members docking and unloading at the Lach Truong fishing port.

The level of impact is assessed as moderate with long-term effects; there are risks of contamination of the raw water source as well as risks that treated water may not meet the requirements of QCVN 01-1:2024/BYT – National Technical Regulation on Clean Water Quality for Domestic Use. However, regular inspection and protection of the raw water source in the De canal, combined with water quality monitoring and adjustment of treatment processes, can effectively mitigate these impacts.

4.5.2. Impacts and risks during operation phase of subprojects 3,4,5,6,7,8,9

Impacts in operation phase of these 7 subprojects are mainly caused by:

- Subsidence and erosion of canal/irrigation routes after construction: Landslide incidents along canal routes are unavoidable; however, the severity depends on external impacts as well as the maintenance and repair process. Some impacts may also occur due to malicious acts, intentionally damaging public property for personal purposes, though such cases are not common. Regular inspection and monitoring of the canals, together with proper implementation of periodic maintenance plans and installation of warning signs at hydraulic works, will enhance the effectiveness and sustainability of these structures.
- Cracking and damages to surface of the operation management road may occur due to overloading during transportation, or fractures and cracks caused by geological changes, climate change, or other factors. These issues can affect the quality of the road surface and pose risks to users. Records of current conditions, geological and topographical data series, as well as consultations with local authorities and residents, have been incorporated into the approved design options. Regular monitoring and coordination with villages, hamlets, and local authorities are required to promptly address any incidents, ensuring the quality of the infrastructure in the aquaculture area to support socio-economic development of the local community. Therefore, these impacts are assessed as MINOR; if they occur, they may affect residents using the operation management road and services supporting the aquaculture area inside the canal, but the level of impact is not significant. Such impacts can be avoided through measures applied from the design stage, during management and operation monitoring of the dike road, and can be mitigated by technical solutions such as repairing and upgrading sections where fractures or cracks occur during the operational phase.

4.6. INDUCED IMPACTS

Induced impacts are environmental changes that do not occur directly from the project itself, but are the result of changes triggered by the project. In other words, these are indirect impacts, not the immediate outcome of project activities, but the consequence of subsequent changes, often in the form of chain reactions, that the project generates.

Overall, the project is expected to generate primarily positive induced impacts. (i) The investment in the “Sustainable Fishery Development Project in Thanh Hoa Province” is highly necessary to effectively utilize the region’s natural resources, climate, and water conditions to support agricultural production and broader socio-economic development. (ii) The project

contributes to improving both the material and spiritual well-being of local residents, fulfilling the aspirations of the people and local authorities. (iii) The investment ensures alignment with the district's long-term socio-economic development plans, while delivering high economic efficiency and positive social outcomes for the beneficiary communities. (iv) The implementation of the “Sustainable Fishery Development Project in Thanh Hoa Province” will enhance crop productivity, increase farmers' income, improve water drainage during the rainy season, and contribute to poverty reduction, rural development, regional economic growth, and national defense and security. Therefore, there will be no negative induced impacts, so they are not mentioned in this report.

4.7. CUMMULATIVE IMPACTS

Cumulative impacts are the incremental impacts of the project when combined with other related past, present, and reasonably foreseeable future development activities, including unplanned but predictable activities that may occur later or in different locations. This assessment aims to identify Environmental and Social (E&S) risks arising from overlaps, synergies, or interactions between subprojects under the SFDP and other ongoing projects in the region.

4.7.1. Ground and scope of the cumulative impact assessment

Spatial and temporal boundaries of the cumulative impact assessment

Spatial boundary. The study area of these cumulative covers 8 implementation area under 9 subprojects, because the 8 implementation areas are located in 07 communes — Hoang Tien, Hoang Chau, Nga Son, Tan Tien, Hoa Loc, Van Loc, and Quang Chinh — in Thanh Hoa Province.

Temporal boundary.

The temporal boundaries defined for this Cumulative Impact Assessment (CIA) include: (i) Construction phase – lasting 24 months, starting in 2026 and continuing through 2028. This phase temporarily covers all construction-related activities, including site preparation, excavation and dredging, construction of port infrastructure, and transportation of materials and waste to designated storage/disposal areas; and (ii) Operational phase, commencing in 2028, when the fishing port components, storm shelter area, canal systems, and operation management roads are put into use.

The project's pre-construction phase is not considered in the CIA, as no impacts are anticipated.

4.7.2. Identification of Valued Environmental Components (VECs), related projects, and natural factors affecting these components

1.7.2. Identification of Valued Environmental Components (VECs)

This ESIA considers whether the construction and operation of the project may contribute to cumulative impacts on valued environmental and social components (VECs) that may also be adversely affected by other current or future developments in or near the project area.

The identification of VECs in the CIA is based on the technical characteristics of the subprojects, the ecological and social sensitivity of the area, and the potential for interaction with other development activities. VECs are categorized by phase to ensure a comprehensive assessment of potential cumulative risks.

These VECs are also used as the basis for analyzing specific cumulative impacts in later sections of the report.

+ *Construction phase:*

- (i) Air quality (Total Suspended Particulates – TSP): Dust and emissions from construction

may combine with other emission sources in the area, affecting the environment and public health;

- (ii) Road and waterway traffic safety: Transporting materials by road and water increases vehicle and vessel density, creating a risk of collisions if not well coordinated.
- (iii) Social impacts in construction areas: Temporary labor and pressure on social infrastructure may accumulate if construction occurs near residential areas or other projects.

+ *Operation phase*: The main VECs assessed in the operation phase include:

- (i) Surface water quality in rivers/seas at the construction areas of fishing ports and storm shelter anchorage under 09 subprojects: Surface water quality in rivers/seas at fishing ports and anchorages, and aquatic life: Wastewater, solid waste, and oil leaks from vessels may affect estuaries, coral reefs, seagrass beds, and aquaculture zones;
- (ii) Waterway traffic safety – Subproject 1,2: Vessel density increases during peak fishing seasons or storms, posing risks of collisions and congestion in waterways;
- (iii) Coastal livelihoods and social infrastructure: Changes in production models, labor migration, and resource-use conflicts may put pressure on coastal communities.

Factors affecting VECs

During the construction and development process, the project's fishing port areas are undergoing rapid urbanization. This has revealed several limitations of the existing ports, such as a lack of integration and inadequate management mechanisms for fisheries-related infrastructure, supply services, and processing facilities. These ports are currently overloaded, posing risks of environmental pollution and making it difficult to meet the standards required for sustainable fishery development, especially in response to export demands and international integration.

The investment in infrastructure projects is being implemented based on the spatial urban development planning of the project areas. Among the plans, projects, and development activities of Thanh Hoa Province, several will be carried out within the project zones — specifically in the seven communes of Hoang Tien, Hoang Chau, Nga Son, Tan Tien, Hoa Loc, Van Loc, and Quang Chinh — and are scheduled to be implemented or operated within the temporal boundaries defined for this Cumulative Impact Assessment (CIA). These projects share overlapping areas of influence with the current project and therefore will contribute to cumulative impacts. It is anticipated that during the construction phase, no cumulative impacts will occur; cumulative impacts will be assessed during the operational phase.

Each subproject within the project listed above includes a number of investment items. This EIA only considers those factors that contribute to cumulative impacts within the spatial and temporal boundaries defined for this EIA. Below is a brief description of the relevant factors of each project involved.

Factors affecting VECs: including (i) natural factors and (ii) development factors.

(i) Natural factors: Strong winds, heavy rainfall during storms, and tidal surges are identified as natural factors that may affect the previously identified Valued Environmental Components (VECs).

- **Wind.** Prevailing wind directions in the project area vary seasonally. The average wind speed ranges from 1.0 to 1.5 m/s. Strong winds can promote the dispersion of **dust** in the air, expanding the areas affected by dust from construction sites and active roads. This potential impact mainly occurs during the dry season, from December to March of the following year, and affects coastal and riverside areas.

- **Storm** These events typically occur from May to October of the following year, with the heaviest rainfall in September. Heavy rain and strong winds during storms can significantly increase the risk of unsafe waterway transportation due to reduced visibility, slippery surfaces, and the potential for large objects to be blown away.
- On the other hand, abnormal heavy rainfall may increase the risk of erosion in coastal and estuarine areas, leading to elevated water turbidity, which negatively affects **both natural aquatic organisms and aquaculture activities** in rivers and canal systems. The respiratory capacity of certain aquatic species may be reduced due to increased turbidity caused by surface runoff. Aquatic organisms in the water bodies within the project area are expected to be most affected by natural stressors occurring in the region.

(ii) Development factors: Other planning schemes, development projects, and activities in the region — such as urbanization, coastal tourism, industrial development, and aquaculture — may generate synergistic or conflicting impacts with the subprojects.

4.7.3. Current status of Valued Environmental Components

Air quality. The ESIA for the Thanh Hoa SFDP project reports that current air quality in the project area is relatively good, with no signs of pollution. All measured indicators are below the limits set in the National technical regulation on ambient air quality QCVN 05:2023/BTNMT and the WHO Ambient Air Quality Guidelines (which are stricter than QCVN 05).

Waterway traffic safety: Although consultations have been conducted with relevant stakeholders such as Hoang Truong Border Guard Station — the unit responsible for managing and supervising fishing vessel activities in the area — the existing fishing port management board, and local fisheries communities, the information on traffic safety is limited in the existing documents of the above-mentioned projects. Therefore, water traffic density and vessel types are considered as additional indicators to assess risks related to waterway traffic safety.

Relevant plannings and projects

The related projects within the same geographical region with the subprojects have been considered for cumulative impact assessment and are presented in the table below. Among the eight subprojects, three have associated projects, specifically: (i) subproject 2 – Transportation Road connecting Bim Son Industrial Zone to the coastal road segment from Nga Son to Hoang Hoa, Thanh Hoa Province; (ii) Project 8 – Industrial cluster project at Hoa Loc fishing port; (iii) Subproject 9 – High-tech whiteleg shrimp farming project.

These associated projects have either been completed and are in operation, or is under construction prior to 2026 — the scheduled start of construction for the AoIs. Therefore, these related projects are not expected to generate synergistic, conflicting, or cumulative impacts during the construction and operational phases of the current project.

4.7.4. Assessment of cumulative impact during operation phase

The simultaneous implementation of subprojects during the 2026–2028 period brings about significant positive cumulative impacts at both the provincial and regional levels. The development of modern and well-integrated fishing ports and storm shelter areas, the dredging of canal systems, and the completion of operation management roads will enhance the efficiency of marine resource exploitation, reduce post-harvest losses, support offshore fishing activities, and promote the stable development of aquaculture zones. In addition, the project will strengthen fisheries inspection capacity and establish technical infrastructure to protect aquatic resources, thereby stimulating economic growth, creating employment opportunities, and improving fisheries management capacity in coastal and aquaculture-based localities. The coordinated investment in fishing port areas will contribute to the formation of an inter-regional

fishing port network, supporting value chain-based production and enhancing climate change resilience.

In addition to the aforementioned benefits, the simultaneous implementation of subprojects also presents potential cumulative impacts that must be identified and managed. During the construction phase, (i) the total emissions of dust, gases, and noise may increase significantly at the project-wide scale, especially if dredging, material transportation, and construction activities are conducted concurrently across multiple coastal areas, affecting health of local people and water environmental. (ii) Degradation of water and soil quality due to excavation and earthworks, affecting the ecosystems of rivers, coastal areas, canal systems, and aquaculture zones; (iii) Increased risk of landslides, subsidence, and erosion, especially during construction in the rainy and flood season; (iv) Obstruction of transportation- particularly waterway traffic - as well as disruption to local residents' daily activities and production, including impacts on aquaculture operations in active farming zones due to construction near these areas; (v) Pressure on the supply chain for materials, equipment, and technical personnel may also increase, potentially affecting the project's implementation schedule and overall efficiency.

However, due to the geographical separation of subprojects, with no direct hydrological connections or shared transportation routes, the spatial extent of cumulative impacts is limited. These impacts are primarily localized and can be effectively managed through decentralized local governance. The overall cumulative impact level is assessed as low, but it should be monitored and coordinated appropriately to ensure the long-term sustainability of the project.

Infrastructure investments under each subproject have been developed in accordance with the respective locality's urban spatial and sectoral development plans. Within the scope of this Cumulative Impact Assessment (CIA), several other local projects, plans, and development activities have already been, are currently being, or will be implemented within the same area and timeframe as the SFDP subprojects.

These projects may overlap in area of influence or have interactive impacts with the subprojects and therefore must be considered in the cumulative impact assessment. A list of related projects in the seven provinces/cities where the subprojects are being implemented is presented in the Table below, together with a brief assessment of the potential cumulative impacts.

Table 4-42. Related projects and cumulative impacts

Subproject	Commune	Basic information of related projects considered for cumulative impact assessment	Cumulative impacts
Subp1-Subp 4	Hoang Tien	None	None
Subp 2	Hoa Loc	Transport road from Bim Son industrial area to coastal road section from Nga Son to Hoang Hoa, Thanh Hoa province Length of 16.442km, passing Bim Son commune, Ha Trung district, Nga Son district. Project owner: Thanh Hoa Provincial Department of Transport	The project is expected to complete by the end of 2025, therefore the construction phase of the Subprojects (2026–2028) will not generate cumulative impacts associated with this project.
	Tan Tien	PMU: PMU No.2 for Transport Infrastructure Construction – Thanh Hoa province	
	Nga Son	Total cost: VND 900 billion and then increase to VND 1,089 billion due to cost adjustment at the implementation time.	

		Construction time: 2022 – 2024, due to delay of site clearance in some sections, expected to complete on 30/11/2025	
Subp 5, Subp 6, Subp 7	Hoang Chau	None	None
Subp 8	Van Loc	Hoa Loc fishing port industrial cluster, Project owner: Hanoi real estate investment JSC and BNB Hanoi Company Limited Construction time: 10/2017 – 12/2018, completed and put into operation: 12/2018.	The project is expected to complete by the end of 2018, therefore the construction phase of the Subprojects (2026–2028) will not generate cumulative impacts associated with this project.
Subp 9	Quang Chinh	high-tech whiteleg shrimp farming project with an investment area of 33ha (Previously, in 2018, an aquaculture model was implemented with an area of approximately 131.5 hectares). Project owner: Agri High-Tech Joint Stock Company Construction time: 1/2025 – 12/2025.	The project is expected to complete by the end of 2025, therefore the construction phase of the Subprojects (2026–2028) will not generate cumulative impacts associated with this project.

These impacts are forecasted and not precisely defined at the time of assessment but should be considered in environmental management and construction coordination. The main potential impact categories include:

Impacts on air quality

Air pollution in the subproject areas is expected to be cumulatively affected by various other development activities in the region, including tourism, urban expansion, and industrial projects — whether already constructed or planned for the coming years. Regardless of their specific locations within the project area, dust and emissions generated from earthworks, machinery operation, and vehicle movement associated with these projects may contribute to elevated levels of particulate matter and toxic gases in the subproject zones, especially if dust and emission control measures are not effectively implemented in accordance with standards. As a result, air quality across the nine subproject areas (during the 2026–2028 construction phase) is likely to be impacted by dust and emissions from concurrent construction activities of other projects in the vicinity.

However, baseline air quality data in the subproject areas indicate that air quality is currently good, and monitored parameters are well below regulatory limits. Therefore, cumulative impacts on air quality are assessed as low and manageable through the application of mitigation measures in the ESMP.

Cumulative impacts on waterway traffic safety

Cumulative impacts may arise when waterway transportation activities from other regional projects — such as seaports, industrial zones, riverside tourism developments, or technical infrastructure works — occur simultaneously or close to the construction period of the Subprojects. These risks are particularly heightened during peak periods, such as the fishing season, storm events, or when vessels gather for shelter anchorage, increasing the likelihood of cumulative effects. The transportation of construction materials will lead to a rise in vessel

traffic, resulting in greater environmental and social impacts, including dust and gas emissions, noise and vibration, and an increased risk of accidents and congestion on waterways. These factors may negatively affect fishermen's health, surface water quality, and aquatic life in the Lach Truong River, De Canal, and Hoang Truong coastal waters, which are used for transportation. In the subproject 1, 2 areas, there are from 70 to 100 boats per day, with port capacity accommodating vessels of 24–30 meters in length. The annual seafood throughput at these ports reaches 15,000–18,000 tons, and vessel density is particularly high during shore-landing periods, storm sheltering, and the fishing season (from late April to September), which accounts for up to 60% of the annual catch volume. Therefore, the implementation of marine safety measures for vessels involved in construction and transportation, along with coordinated waterway traffic management and strict adherence to construction safety protocols, will help minimize cumulative impacts.

Social impacts:

Some subprojects may face labor pressure, social infrastructure constraints, or land-use conflicts if religious, cultural, or technical infrastructure projects are implemented nearby. These factors should be monitored to ensure community safety and welfare.

Overall, cumulative impacts during construction at each subproject are expected to be low to moderate, localized, and manageable through schedule management, local coordination, and mitigation measures under the ESMP.

4.7.5. Assessment of cumulative impacts during the operation phase

(1) Upgrade fishing ports and establish an integrated marine infrastructure system associated with supporting industries and logistics services to enhance the efficiency of seafood exploitation, reduce post-harvest losses, and develop modern, regional-scale storm shelter areas for fishing vessels. These improvements will support offshore fishing, increase harvesting efficiency, reduce post-planning losses, contribute to maritime sovereignty protection, and help lift the European Commission's IUU yellow card. (2) Develop infrastructure and equipment for the fisheries inspection sector for strengthen effective and sustainable exploitation and protection of marine resources. (3) Boost management capacity for production organization to combat Illegal, Unreported, and Unregulated (IUU) fishing, and promote sustainable fishery resource management. (4) Reduce post-harvest losses, minimizing disease outbreaks, improving productivity, quality, and value of farmed shrimp products, while protect the environment and enhance climate change resilience. (5) Enhance fisheries sector governance capacity. (6) Promote regional and international cooperation and development in the fisheries sector.

In operation phase, Once the fishing ports and storm shelter areas become operational, the number of fishing vessels, logistics services, and fisheries inspection activities will increase in each locality. During peak periods, such as the fishing season or storm events, vessels from neighboring regions may converge at shelter points, leading to higher vessel density, increased risk of waterway congestion, vessel collisions, and deterioration of water quality due to oil spills and waste discharge.

Besides technical related impacts: (i) Conflicts in coastal resource use may arise between sectors such as fisheries, tourism, industry, and ecological conservation. (ii) Pressure on social infrastructure, with rising long-term operational and maintenance costs for transportation, water supply, fishermen's livelihoods and waste treatment, especially if infrastructure becomes outdated or is not properly maintained, leading to sharply increased repair costs over time. (iii) In the context of climate change, coastal Subprojects will face growing risks such as sea level rise, saltwater intrusion, and increased frequency of severe storms, which may affect storm shelter effectiveness, freshwater availability, aquaculture zones, and fishing activities. (iv) Environmental pressure from expanded farming areas and intensified long-term production

may lead to water pollution and biodiversity loss if not properly managed. (v) Higher risk of aquatic disease outbreaks due to high stocking densities and inter-regional movement, which can facilitate the spread of pathogens if not tightly controlled. (vi) Land and water resource conflicts may emerge from competing demands among aquaculture, agriculture, domestic use, and conservation. (vii) Dependence on a single production model, where farming areas rely on one or a few species or a specific market, increases vulnerability to market fluctuations or disease outbreaks.

The Subprojects are distributed across various communes in Thanh Hoa Province, which share similar ecological, hydrological, and waterway transport characteristics. As a result, while spatial cumulative impacts among the Subprojects are dispersed, they collectively form a clear inter-regional synergy, generating notable positive cumulative effects, including: (i) Improved and more stable aquaculture productivity and output, supported by enhanced infrastructure and effective environmental controls, leading to sustained and improved yields across production cycles. (ii) Local economic development, through job creation, increased household income, and stimulation of supporting services such as logistics, processing, and trade. (iii) Enhanced living conditions and social welfare, with improved transportation, water supply and drainage systems, electricity, and telecommunications infrastructure, contributing to better quality of life for local communities. (iv) Increased investment potential, as reliable infrastructure attracts interest from domestic and international enterprises, boosting capital inflows and facilitating technology transfer. (v) Strengthened climate change resilience, through infrastructure designed to adapt to extreme weather events and sea level rise.

However, the upgrading of fishing ports and storm shelter areas will lead to an increase in waterway traffic density, potentially introducing risks to waterway safety and declines in water quality. Aquatic species may be affected if surface water quality in rivers and coastal areas deteriorates due to oil leaks and waste discharge from vessels operating along navigation routes during the operational phase. These impacts are assessed as low and can be mitigated, with specific measures outlined below:

Increased waterway traffic density and marine unsafety risks in subproject 1, 2 areas

During the operational phase, once the fishing ports and storm shelter areas are completed and put into use, they are expected to stimulate the development of fisheries, urban areas, tourism, and industry, leading to a gradual increase in waterway traffic volume. During peak periods, such as the fishing season or storm events, vessels from neighboring regions may converge at the ports, resulting in higher vessel density along navigation channels. The peak cargo throughput period at the ports is forecasted to occur annually between May and September, accounting for approximately 12% per month over five months. Waterway traffic density in the Subproject areas during peak days and months has been forecasted as part of the SFDP feasibility study, with detailed statistical timelines to be supplemented as data becomes available.

This cumulative impact may lead to congestion, vessel collisions, and an increased risk of maritime accidents if an effective waterway traffic coordination system is not in place. The impact is assessed as low to moderate and can be mitigated through appropriate monitoring, guidance, and traffic regulation measures, especially during periods of high docking demand, such as storm events when vessels seek shelter anchorage.

Increased pressure on road traffics and coastal technical infrastructure – subproject 1, 2 areas

The transportation of fish, seafood, and logistics supplies from the ports to processing facilities, wholesale markets, or distribution centers will lead to increased road traffic density in port areas. The continuous operation of trucks, refrigerated vehicles, and personal vehicle may cause localized congestion, air pollution, and noise disturbances, particularly in Subproject 1, 2 areas,

when passing near residential areas. This impact may become cumulative over time if seafood throughput at the ports increases rapidly without corresponding infrastructure upgrades. However, the impact is assessed as minor, given that seafood arrivals at the ports are seasonal rather than year-round, and can be effectively managed through the implementation of mitigation measures outlined in the ESMP.

Increased amount of wastewater and coastal waste in subproject 1, 2 areas

The operation of fishing ports will generate wastewater from activities such as fish washing, ice production, preliminary processing, and daily activities by workers at Hoang Truong Fishing Port – subproject 1 and Lach Truong Fishing Port – subproject 2. Without an effective wastewater treatment system, these discharges may cause localized pollution, affecting surface water quality and aquatic organisms. In addition, solid waste such as plastic packaging, foam boxes, damaged nets, and discarded fishing gear may accumulate in port areas and drift into the sea, leading to degradation of coastal habitats. These impacts tend to be cumulative over time if not regularly managed. However, the impact is assessed as minor, as wastewater generated during port operations will be collected and treated through the Subproject's wastewater treatment systems, which comply with permitted environmental standards prior to discharge. Once the fishing ports are fully operational and properly managed, they will ensure the collection and treatment of solid waste, maintaining port beautiful landscape and space to support vessel docking and departure activities.

Conflicts of coastal resources use and social impacts

The operation of Hoang Truong and Lach Truong fishing port at subproject 1, 2 areas may lead to increased spatial competition among sectors such as fisheries, coastal tourism, industrial development, and ecological conservation. Certain areas may face conflicts between fishing activities and coastal tourism development. Additionally, there may be heightened pressure on social infrastructure, including transportation, water supply, waste management, and maritime safety, particularly during peak seasons. The modernization of fishing ports and enhanced IUU (Illegal, Unreported, and Unregulated fishing) control may also affect the livelihoods of small-scale fishermen, potentially leading to shifts in traditional production models, labor migration, or changes in community structures. Overall, resource-use conflicts and associated social impacts related to port operations in subproject 1, 2 are expected to be localized, temporary, and limited in scope. These impacts can be effectively managed and mitigated through: Rational coastal spatial planning; intersectoral coordination mechanisms, upgrades to social infrastructure, livelihood support policies for fishing communities. Therefore, the impact level is assessed as minor, with no significant negative effects on regional socioeconomic development or coastal environmental conservation.

Risks of climate changes on the operation of fishing port and aquaculture area

Coastal Subprojects 1, 2, along with aquaculture areas (subproject 3 through 9) will face increasing risks from climate change, including: (i) Sea level rise, which may inundate port areas or reduce the effectiveness of storm shelter infrastructure. (ii) Saltwater intrusion, affecting both domestic water supplies and aquaculture water sources in subproject 3 through 9. (iii) Higher frequency and intensity of storms, disrupting fishing operations and port activities at Hoang Truong (subproject 1) and Lach Truong (subproject 2). Without adaptive design features and flexible operational planning, these impacts may accumulate over time, affecting the long-term sustainability of each subproject. Although climate change poses significant risks to the operation of coastal fishing ports and aquaculture zones, these impacts are predictable and can be integrated into infrastructure planning and design, and mitigated through appropriate technical and management solutions. Therefore, the impact level is assessed as minor, with no significant threat to the overall sustainability of the project, provided that necessary adaptation measures are implemented.

Degradation of water quality and impacts on aquatic life

The ESIA for the SFDP Thanh Hoa estimates that, following dredging activities, it will take approximately 12 to 24 months for river and seabed sediments to recover. However, dredging is not expected to reduce aquatic biodiversity in riverine or marine environments. On the contrary, it is anticipated that species composition may increase, as connectivity with estuarine and coastal systems is enhanced through improved navigational channels.

During the operation phase, fishing port and shelter area are the places where seafood exploitation, primarily processing, storage and transactions occur. These activities generate wastewater with high content of organic matter, grease, oil and other pollutants from fish washing, ice production, vessel cleaning and domestic activities of workers. Aquatic species may be affected due to worsened river/sea water quality and wastewater discharged from vessels along the navigation in operation phase. If not being effectively treated, these waste sources may accumulate at the port, reducing coastal surface water quality. However, this impact can be controlled by the compliance of regulations in operation of vessels, ships entering and existing the port, helping to reduce cumulative impacts of oil leakage, wastes on water quality and local aquatic species.

This impact may directly affect aquatic life, particularly in sensitive ecosystems such as estuaries, seagrass beds, coral reefs, or nearby aquaculture areas. Water quality degradation can reduce reproduction, increase disease and mortality in aquatic species, affecting fishery and aquaculture productivity. Without control and regular monitoring, these impacts could accumulate, causing localized marine environmental degradation and affecting coastal livelihoods. However, the impact is assessed as minor and not significantly harmful to marine environments or local community livelihoods if managed with appropriate ESMP measures.

4.8. CLIMATE CHANGE ISSUES

4.8.1. Impact of climate change on the project

The project will be negatively impacted by climate change. As Chapter 2 has shown, the strong impacts of climate change will affect each subproject area. According to meteorological data and climate forecasts in Thanh Hoa sea areas¹¹:

- There is a fairly high frequency of storms and tropical depressions in September and October.
- Rainfall is concentrated in the rainy season from May to October (the highest rainfall measured is 300 mm/day with the average 137 rainy days/year measured at Nga Son hydrometeorological station, mainly from September to October).
- The average wind speed in the project area is 1.0 - 1.5 m/s. The highest wind speed measured during the storm was 40 m/s in the coastal area.
- This area is affected by sea level rise at an average level from 51cm to 106cm, with the RCP 8.5 scenario, the level is forecasted about 77cm (according to the Climate Change Scenario of the Ministry of Natural Resources and Environment).
- There is a possibility of prolonged heatwave and strong winds, affecting the safety of outdoor construction.

The trend of increasingly complicated climate change negatively affects living conditions of people in the subproject affected area. Specifically, the impacts on fishing ports and aquaculture areas are presented in the table below.

¹¹Thanh Hoa Province Statistical Yearbook - Nga Son Hydrometeorological Station 2018 ÷ 2023

Table 4-43. Summary of related projects and cumulative impacts

Climate events	Impact on fishing ports/ aquaculture areas	
	Construction phase	Operational phase
Subproject 1,2		
Storms and strong winds	- Damage to wharves, workshops, and service areas during construction; - Increase the risk of line breakage, vessel capsizing in the berthing area - Storms cause disruption of construction activities which coincide with peak of harvest, processing, sorting, transporting and trading time of local residents and private enterprises at the port.	- Damage to wharves, workshops, and vessel mooring systems - Increased risk of mooring line breakage and vessel capsizing near docking zones and storm shelter areas - Disruption of construction activities which coincide with peak of harvest, processing, sorting, transporting and trading time of local residents and private enterprises at the port.
Extreme heavy rain	- Flooding of construction zones, material storage areas, machinery, and worker camps - Wash away of waste in construction site into rivers, canals, and coastal waters. - Cause local congestion and flooding may occur in and around the construction site. - Cause port shoreline erosion, damage to piers, and safety risks for workers.	- Flooding in warehouse, repair workshop, primary processing area; - Wash away by-products, waste into river and sea - Risk of vessel collision during docking and departure, collision in the area in front of the port
Rising sea levels and high tides	- Deep inland flooding in riverside/coastal construction zones, affecting people, equipment, and materials and on-going construction works. - Damage to machinery and infrastructure exposed to seawater. - Increased shoreline erosion and land loss around ports, impacting construction quality, increasing contractor's time and costs.	- Deep flooding extended into cold storage facilities, workshops, and fishery service areas, and ship repair workshop at the fishing port, despite elevation levels having been designed with climate change adaptation considerations. - Increased risk of shoreline erosion and land loss around the port, with potential long-term impacts on the structural integrity of the port's foundation and embankments.. - Damage to port infrastructure during frequent tidal surges and sea level rise
Flow variations at estuaries and coastal areas	- Affect the existing channel due to sedimentation, and increasing dredging volumes at required elevation - Cause difficulties and differences in surveys, positioning and selection of appropriate solutions, measures	- Cause changes in natural channels, sedimentation in estuary, difficulties and disruption for vessels to go in or out of the port - Increase need for regular dredging and maintenance to

Climate events	Impact on fishing ports/ aquaculture areas	
	Construction phase	Operational phase
		facilitate port operations and seafood logistics.
Heat wave	- Impact on the quality of frozen seafood and ice storage, especially during stormy conditions and ongoing construction. - Increase the frequency and number of vehicles, people in the ports, affecting the harvesting, sorting, primary processing, transportation and consumption of fishermen and traders at the port	- Impacts on the quality of frozen and stored aquatic products, as well as ice supplies, in the event of power outages or insufficient electrical load capacity. - Increased demand for refrigeration, along with higher costs for storage, maintenance, and routine servicing of fisheries service equipment and preliminary processing facilities at the port.
Impact on surface water and groundwater quality	- Increased infiltration of pollutants from construction activities into surface water and groundwater sources, posing a risk of water contamination due to construction processes and worker activities at campsites and work sites.	- Risk of pollution from fishing vessel cleaning activities and domestic water use by port staff and nearby residents..
Subproject 3 → Subproject 9		
Extreme heavy rain	- Flooding in construction areas, storage yards, and worker camps, affecting the movement of personnel and materials.	Extreme heavy rain Floods and storms
Heatwave	- Affect construction workers' health, potentially leading to exhaustion or other health issues due to high temperatures. - Reduced quality of construction materials, such as concrete and asphalt, when applied under extreme heat conditions.	- Impacts on the quality of harvested and stored fish in the event of power outages in aquaculture areas. - Increased demand for refrigeration and storage costs due to rising harvest volumes prior to transportation.
Impact on surface water and groundwater quality	- Increased infiltration of pollutants from construction activities into surface and groundwater sources, posing a risk of water contamination from both construction processes and domestic activities of workers at campsites and along canal routes.	- Risk of pollution from aquaculture operations and domestic water use by workers in aquaculture zones and nearby residents.

The level of impact during the construction and operation phases is assessed as low because: (i) The project area has a very low frequency of storms and floods (about 1%, corresponding to historical flood events estimated to occur once every 100 years); (ii) Since 2018, rainfall in the project area has remained relatively stable; (iii) Technical measures and operational management and maintenance strategies have been incorporated into the design to control these risks; (iv) The embankments and port infrastructure have been designed with standardized foundations to ensure structural sustainability. Aquaculture areas have been planned with appropriate timing and location for farming activities, and have adopted adaptive design

features, materials, and facility characteristics to withstand changing weather and climate conditions, including potential extreme events.

In general, climate change impacts are unavoidable during the implementation and operation of the project. This requires preventive and adaptive measures, along with specific response plans to respond effectively to changing and extreme weather conditions, in order to proactively minimize potential damages and risks

4.8.2. Project impact on climate change

a. Construction phase:

During construction of the project, greenhouse gas (GHG) emissions will be emitted due to the use of fossil fuels. The most common fossil fuels used for construction equipment at the project sites are Diesel Oil (DO) and electricity. GHG emissions from diesel combustion on construction equipment are calculated based on the estimated diesel fuel demand table (Chapter 3 – Impacts from construction machinery emissions) and the 2014 emission factors for GHG inventories published by the United States Environmental Protection Agency (EPA).¹² Furthermore, GHG emissions are typically expressed in terms of carbon dioxide equivalent (CO₂e). To convert individual gases into CO₂e, their respective global warming potentials (GWP) must be multiplied by the quantity of each gas. The emission factors calculated for the project have not yet been converted into CO₂e. To perform this conversion, the emission quantities must be multiplied by the corresponding GWP values listed in the tables below.

The results of greenhouse gas emission calculations for the use of fuels such as DO oil and electricity are shown in the tables below:

¹²https://www.epa.gov/sites/production/files/2015-07/documents/emission-factors_2014.pdf

Table 4-44. Calculated greenhouse gas emissions from diesel oil (DO) usage during the construction phase of the project - construction phase

Subproject	trips/day	DO oil (liter/day)	DO volume/day (tons)	Calorific value (TJ)	DO emission factor (ton/TJ)			Emissions (tons/day)			CO _{2e} (tons/day)
					CO ₂	CH ₄	N ₂ O	CO ₂	CH ₄	N ₂ O	
Subproject 1	43	356	306	13	77.4	0.003	0.0006	1,017.70	0.04	0.007889165	1,021.0
Subproject 2	140	854	734	32	77.4	0.003	0.0006	2,443.05	0.09	0.018938346	2,451.0
Subproject 3	10	64	55	2	77.4	0.003	0.0006	183.04	0.01	0.001418923	183.6
Subproject 4	20	73	63	3	77.4	0.003	0.0006	208.46	0.01	0.001615952	209.1
Subproject 5	9	8	7	0	77.4	0.003	0.0006	22.98	0.00	0.00017817	23.1
Subproject 6	9	7	6	0	77.4	0.003	0.0006	21.24	0.00	0.000164635	21.3
Subproject 7	11	20	18	1	77.4	0.003	0.0006	58.53	0.00	0.000453745	58.7
Subproject 8	8	9	8	0	77.4	0.003	0.0006	26.28	0.00	0.000203686	26.4
Subproject 9	9	12	10	0	77.4	0.003	0.0006	33.46	0.00	0.000259378	33.6
Total											4,027.9

Source: (*) Emissions Greenhouse Gases Inventory 2014 (EPA).

Note:

- Calorific value of DO oil, GJ/t: 43
- DO density (kg/liter): 0.86

Table 4-45. Calculated GHG emissions of the project for the use of electricity as fuel during the construction phase

Subproject	Electricity (kWh/day)	Electricity emission factor 2024 (kg/kWh)	CO ₂ e emissions from electricity use
Subproject 1	248,307.40	0.6811	169.12
Subproject 2	54,556.70	0.6811	37.16
Subproject 3	18,284	0.6811	12.45
Subproject 4	2,720	0.6811	1.85
Subproject 5	2,720	0.6811	1.85
Subproject 6	2,720	0.6811	1.85
Subproject 7	2,720	0.6811	1.85
Subproject 8	2,720	0.6811	1.85
Subproject 9	2,720	0.6811	1.85
Total			229.85

Source: (*) Emissions Greenhouse Gases Inventory 2014 (EPA).

Table 4-46. Greenhouse gas emission calculation results - construction phase

Subproject	CO2e emissions from electricity use	CO2e emissions from oil use	Total CO2e emissions – construction phase (tons/day)
Subproject 1	169.12	1,021	1,190
Subproject 2	37.16	2,451	2,488
Subproject 3	12.45	184	196
Subproject 4	1.85	209	211
Subproject 5	1.85	23	25
Subproject 6	1.85	21	23
Subproject 7	1.85	59	61
Subproject 8	1.85	26	28
Subproject 9	1.85	34	35
Total	229.85	4,028	4,258

Source: (*) Emissions Greenhouse Gases Inventory 2014 (EPA).

Note:

Potential global warming and corresponding CO₂e of N₂O and CH₄ equivalents.

Table 4-47. Greenhouse gas emission conversion factor - construction phase

No.	Greenhouse gases	100-year GWP ¹³ - CO ₂ e (tons)
1	CH ₄	29.8
2	N ₂ O	273
3	CO ₂	1

Overall, GHG emissions during the construction period for the project are estimated to be small, equivalent to 4,258 CO₂e (ton/day). Of which, the largest amount of greenhouse gas emissions are from subproject 2 -Lach Truong fishing port (about 2,488 tons/day), followed by subproject 1 - Hoang Truong fishing port with about 1,192 tons/day and the lowest is from subproject 6 with 23 tons/day.

b. Operation phase:

During the operation phase, greenhouse gases stem from two main sources: (i) DO, electricity (Generating CO₂) powered fishing vessel and fishing ports (ii) From seafood handling/processing activities (generating CO₂, CH₄ and N₂O).

Table 4-48. Calculated greenhouse gas emission - operational phase

Emission sources	Main greenhouse gas	Impacts on climate change
Diesel engines on fishing vessels	CO ₂ , N ₂ O	Contribute to increased greenhouse gas emissions in coastal areas
Vehicles for transporting and processing fish and machinery in the port	CO ₂ , CH ₄ (Be leaked)	Increased direct emissions
Harvesting and transportation equipment powered by electricity or gasoline	CO ₂ e	Increased indirect/direct emissions

The project's operational design parameters are as follows:

Table 4-49. Design parameters of operational fishing port - operational phase

No.	Subprojects	Unit (turns)	Number of trips (trips/day)	Aquatic product output (tons/year)
1	Subproject 1 – Hoang Truong fishing port	Vessel/day and night	70	15,000
2	Subproject 2 – Lach Truong fishing port	Vessel/day and night	100	18,000

With the design parameters of the subproject and fuel consumption calculation standards as follows:

¹³ GWP100 - 100-year global warming potential at <https://ghgprotocol.org/sites/default/files/2024-08/Global-Warming-Potential-Values%20%28August%202024%29.pdf>

Table 4-50. Fuel consumption rate - operating phase

Parameters/ Contents	Value
Seafood output through the port (according to project design)	<i>See summary table above</i>
Average fuel consumption	50 liters of diesel oil/1 ton of fish exploited (according to Vietnam & FAO standards) ¹⁴
Diesel CO ₂ emission factor	2.68 kg CO ₂ /liter of diesel (IPCC 2006, Ministry of Natural Resources and Environment) ¹⁵
Percentage of seafood processed and preserved at the port	60% (common assumption for class I fishing ports) ¹⁶
CO ₂ emissions during processing – cold storage	40 kg CO ₂ /ton of fish (including electricity, ice, water, by-product treatment...) ¹⁷

By applying the greenhouse gas (GHG) emission factors and calculation formulas mentioned above during the construction phase, the estimated GHG emissions for the operational phase are as follows:

¹⁴https://www.switch-asia.eu/site/assets/files/3527/vietnam_seafood_guideline_en_1_11_22.pdf?utm_source=chatgpt.com

¹⁵ https://thuvienphapluat.vn/van-ban/Tai-nguyen-Moi-truong/Quy-dinh-2626-QD-BTNMT-2022-cong-bo-he-so-phat-thai-phuc-vu-kiem-ke-khi-nha-kinh-532253.aspx?utm_source=chatgpt.com; https://www.ipcc-nggip.iges.or.jp/public/2006gl/?utm_source=chatgpt.com

¹⁶ https://thuysanvietnam.com.vn/bao-cau-cua-vien-kinh-te-va-quy-hoach-thuy-san-ve-nghien-cuu-nang-cao-nang-luc-quan-ly-nha-nuoc-ve-thuy-san/?utm_source=chatgpt.com

¹⁷ A study by Hanoi University of Science and Technology estimated total CO₂ emissions at a seafood export processing facility in Vietnam during the period from March 2022 to March 2023.

Table 4-51. Calculated greenhouse gas emissions of the project due to the use of DO oil as raw material - operation phase

Subprojects	Trip/day	DO oil (liter/day)	DO volume/day (tons)	Calorific value (TJ)	DO oil emission factor (ton/TJ)			Emissions (tons/day)			CO _{2e} (tons/day)
					CO ₂	CH ₄	N ₂ O	CO ₂	CH ₄	N ₂ O	
Subproject 1	70	5723	4,922	212	77.4	0.007	0.002	16,380.67	1.48	0.42327308	16,540.2
Subproject 2	100	5423	4,664	201	77.4	0.007	0.002	15,521.99	1.40	0.40108508	15,673.2
Total											32,213.4

Source: (*) Emissions Greenhouse Gases Inventory 2014 (EPA).

Note:

- Calorific value of DO oil, GJ/t: 43
- DO density (kg/liter): 0.86

Table 4-52. Calculated GHG emissions of the project due to electricity use - operation phase

Subprojects	Electricity (kWh/day)	Electricity emission factor 2024 (kg/kWh)	CO _{2e} emissions due to electricity use in operation phase (ton/day)
Subproject 1	196.7	0.6811	0.1341
Subproject 2	189.7	0.6811	0.1292
Total			0.2633

Source: (*) Emissions Greenhouse Gases Inventory 2014 (EPA).

Table 4-53. Calculated greenhouse gas emission - operation phase

Subprojects	CO _{2e} emissions due to electricity use	CO _{2e} emissions due to oil use	Total CO _{2e} emissions in operation phase (ton/day)
Subproject 1	0.1340	16,540.22	16,540.35
Subproject 2	0.1292	15,673.18	15,673.31
Total	0.2632	32,213.40	32,213.67

Source: (*) Emissions Greenhouse Gases Inventory 2014 (EPA).

Overall, greenhouse gas (GHG) emissions during the operational phase of the project are estimated to be relatively low, totaling approximately 32,213.67 tons of CO₂ equivalent (CO₂e) per day. The majority of emissions are concentrated at subproject 1 – Hoang Truong fishing port (around 16,540 tons/day) and subproject 2 – Lach Truong fishing port (approximately 15,763 tons/day). Subprojects 3 through 9 are considered to have no significant GHG emissions. This level of emission is considered small compared to medium- and large-scale fishing ports. However, the volume of emissions may increase if: (i) a increase in production output in the future, or (ii) Lack of technological improvements. During the operational phase, the management boards of the fishing ports will carry out detailed GHG inventory services (if required to compliance or in preparation for port expansion in the future).

Therefore, the project will **inevitably contribute a modest amount of greenhouse gas (GHG)** emissions, stemming from activities such as fishing, transportation, cold storage, primary processing, and preservation of aquatic and seafood products. Without effective control and adaptive measures, these fishing ports may gradually evolve into sources of adverse impacts on both regional and national climate change efforts.

Additionally, during the project's operational phase, a certain amount of greenhouse gas (GHG) emissions will be generated from the combustion of fossil fuels, such as gasoline, diesel oil, and biodiesel, used by vehicles entering and exiting the port area. Due to the variety of fuel types and the diversity and number of vehicles traveling along access roads to the port, calculating the exact volume of GHG emissions is typically difficult. However, these emissions are considered minimal, as the access roads are existing infrastructure designed for motorcycles, small vehicles, and trucks. These roads have already been upgraded and currently accommodate a relatively low volume of traffic. Therefore, GHG emissions from this source is considered to have no significant impact on climate change or greenhouse effect.

CHAPTER 5. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

5.1. Measures to minimize environmental and social impacts

5.1.1. Proposed mitigation measures for FS and detailed design

5.1.1.1. For construction items involving dredging canals/rivers/seas

- Conduct consultations with communities and stakeholders (such as the provincial Departments of Agriculture and Environment, the management boards of existing fishing ports/storm shelters, Lach Truong ferry operators, local residents, etc.) regarding the locations and peak periods when dredging activities should be minimized or avoided;
- Design of waterway traffic sign system to ensure waterway traffic safety during operation phase.
- Design the dredged channel properly to maintain the local people's access to river/sea water, especially to ensure aquaculture and fishing activities on rivers/sea.

5.1.1.2. For construction items of fishing port/anchoring wharf/embankment

- Design railing-equipped ladders along the embankment to maintain safe access to and use of the water for the local community while still ensuring access for boats entering and exiting the harbor/storm shelter;
- Design of wastewater collection and drainage systems for works at fishing ports/anchoring berths;
- Design slope protection measures using hard structures, engineering, ecological measures or a combination of measures as appropriate.
- Toilets, sinks, and showers will be provided in the operation building for staff to use after work. The administration building is designed to maximize natural lighting, and the water and electrical equipment will be of energy-saving types.

5.1.1.3. For auxiliary works to collect and treat wastewater and solid waste for the port

- The design of wastewater collection and drainage systems serving works at fishing ports/anchoring berths must ensure aesthetics, minimize odors and be easy to operate;
- The wastewater treatment facilities (WWTFs) in the fishing ports shall be arranged in compliance with the Vietnamese National Technical Regulation (QCVN 01:2021/BXD). This regulation requires that the WWTFs invested under Subprojects 1 and 2 (with a capacity of 200 m³/day) must include an ecological buffer zone of at least 15 meters. The wastewater treatment works applying mechanical, physico-chemical, and biological methods must be constructed as closed systems, equipped with odor collection and treatment systems. Specifically:

Table 5-1. Environmental safety distance for wastewater treatment plant

Work item	Minimum distance (m) from the wastewater treatment plant with a capacity of 200 – 5,000 m ³ /day
Wastewater pumping stations	20 m
Wastewater Treatment Plant (A treatment facility using mechanical, physico-chemical, and biological methods, constructed as an enclosed system with an	15 m

Work item	Minimum distance (m) from the wastewater treatment plant with a capacity of 200 – 5.000 m ³ /day
integrated odor collection and treatment system).	

- For wastewater pumping stations using submersible pumps installed in closed wells, no environmental safety distance (ATMT) is required; however, a ventilation pipe for odor release must be installed at an elevation ≥ 3 m above ground level, in accordance with the approved site planning. A green buffer zone with a minimum width of ≥ 10 m must be arranged around newly planned WWTPs and wastewater pumping stations.
- Within the environmental safety distance, only traffic roads, parking lots, power supply works, solid waste transfer stations, and other facilities of the wastewater pumping station or WWTP are allowed to be planned; no other civil structures shall be arranged.
- Subproject 1 and subproject 2 have selected biological treatment technology and designed closed treatment tanks to minimize odor generation and better control sludge from the WWTP. In addition, the subprojects have also proposed that the operation personnel at the Port Management Board/typhoon shelter area must have appropriate expertise/experience to meet the operational requirements of the waste treatment facilities of each subproject.
- Use Larsen sheet piles to reinforce and protect the slopes of excavation pits/trenches to prevent landslides and erosion when digging to depths of 3 meters or more for WWTPs and pumping stations if constructed underground.
- Prepare an Operations Manual and an Emergency Response Plan to address potential incidents/risks that may occur in the wastewater collection and treatment system of the fishing ports.

5.1.2. Mitigation measures in pre-construction phase

5.1.2.1. Mitigation measures due to land acquisition activities

A Resettlement Plan (RP) has been prepared for the project based on the preliminary design and ESIA report to provide specific measures for compensation, assistance and resettlement of affected persons. The RP also establishes mechanisms for project information disclosure, public consultation and participation, and a grievance redress mechanism (GRM). Compensation and assistance to affected households is based on the following principles:

- All affected persons who have assets on or residing within the project land area prior to the cut-off date will be compensated for their losses. Those who have lost income and/or livelihood will be assisted to restore their livelihoods based on eligibility criteria determined by the project in consultation with the project affected persons. If by the end of the project it is demonstrated that livelihoods have not been restored to pre-project levels, additional measures will be provided.
- The methods used to assess losses in WB-financed projects are based on full replacement costs. For this project, losses include losses to land, structures and other assets and these replacement costs will be assessed as follows: Full replacement cost of land includes the value of land determined at prevailing market prices plus management fees. For affected houses and other structures, the valuation is based on the market price of construction materials and labor costs to construct replacement houses of equal or better quality and area to the affected houses.
- Mitigate the unavoidable economic and social impacts of land acquisition or restriction of land use by: (a) providing timely compensation for loss of assets at replacement cost

and (b) assisting displaced persons in their efforts to improve, or at least restore, their livelihoods and standards of living, in real terms, to pre-displacement levels or levels prevailing prior to the commencement of project implementation, whichever is higher.

- To ensure that all complaints and grievances of affected persons on any aspect of land acquisition, compensation and resettlement are promptly and satisfactorily addressed, and that all possible avenues are available for affected persons to address their grievances, a clearly defined grievance redress mechanism should be established. All PAPs can submit any queries to the implementing agencies relating to their rights. PAPs are not required to pay any fees in connection with seeking redress of grievances.

Preliminary estimates of compensation and support costs for PAPs have been prepared and are included in the RP based on (a) current provincial regulations regarding compensation, assistance, and resettlement, and (b) a rapid replacement cost assessment conducted to support the process.

5.1.2.2. Mitigation measures for impacts from unexploded ordnance (UXO)

The measures to mitigate the impact of unexploded ordnance (UXO) on the project are as follows:

- Land clearance: Manual clearing of areas that are not minefields; machine surveying to depths of -0.3 m and -0.3 m to -3 m with a signal density of type 1.
- Underwater clearance: (i) Surveying for underwater mines and explosives up to a depth of 0.5 m, in water depths of 0.5 to 12 m; (ii) Surveying for underwater mines and explosives from 0.5 m to 3 m or up to 5 m, in water depths of 0.5 to 12 m; (iii) Marking underwater signals up to 0.5 m, 3 m, and 5 m from the bottom of the water, in water depths of 0.5 to 3 m; (iv) Diving to handle signals at depths of 0.5 m, 0.5 m to 1 m, and 1 m to 3 m, in water depths of 0.5 to 12 m.

The total cost for UXO clearance, both on land and underwater, is 2,308,750,237 VND, including approximately 48,394,466 VND for materials, 1,244,739,591 VND for labor, and 1,015,616,180 VND for machinery.

5.1.3. Measures to minimize impacts and risks during construction phase

The proposed mitigation measures for the Construction phase include: (i) Environmental and Social Code of Practice (ESCAP), (ii) Workers' Code of Conduct, and (iii) Labor Management Procedures (LMP). Specific impact mitigation measures will be presented for each subproject site and in the supplementary plans (in the annex).

5.1.3.1. General Impact Mitigation Measures – applicable to 9 subprojects

The ESCOP will be applicable to all civil works packages and will therefore be included in the relevant part of the construction contract and tender documents. Note that in addition to the ESCOP, the Construction Bidding Documents for each specific package will also include specific mitigation measures and sub-planning relevant to the nature and location of the civil works within that Package.

A. Environmental and Social Codes of Practice (ESCAP)

The following table lists mitigation measures, in the form of Environmental and Social Codes of Practice (ESCAPs), to address the list of common negative construction impacts below:

- i. Dust, exhaust,
- ii. Noise, vibration;
- iii. Wastewater management;
- iv. Management of regular solid waste and

- v. Hazardous solid waste;
- vi. Impact on biological resources;
- vii. Risk of erosion, landslides, flooding and sedimentation;
- viii. Traffic safety risks and traffic insecurity risks;
- ix. Impact on existing infrastructure and related services;
- x. Social impact;
- xi. Public health and safety;
- xii. Risks to the safety and health of workers;
- xiii. Impact on cultural and historic resources and procedures for seeking discovery opportunities;

Table 5-2. Environmental and Social Codes of Practice (ESCOPs)

In addition to the mitigation measures listed below, contractors are also required to use clean water, electricity, fuel and raw construction materials efficiently with the aim of meeting the requirements set out in the WBG ESHG and ESS3 on pollution control, energy efficiency and conservation of natural resources.

Socio-environmental issues	Mitigation measures	Regulations of Vietnam and the World Bank	Responsibility
1. Dust and gas emissions	<u>Avoidance</u> • Compliance with the law: Contractors must fully comply with Vietnamese regulations concerning ambient air quality and emission limits from vehicles and machinery. • Dust control planning: Before construction, contractors must develop a detailed dust control plan, including technical and organizational measures to ensure a safe working environment and avoid causing inconvenience to the surrounding community. • Approval of construction equipment: The list of equipment and construction vehicles must be submitted to the supervision consultant for inspection and approval before being brought to the site. • Advance notice: Inform the local community and fishermen about the construction schedule in advance. <u>Mitigation</u> <i>For construction and excavation activities:</i> • Conduct construction in phases and clean the site before excavation. • Spray water to reduce dust at least twice a day, increasing to three times daily in residential areas, schools, and temples during hot, dry weather. • Compact and water soil after filling to limit dust generation. • Transport excavation materials according to regulations; do not dump them indiscriminately. <i>For transportation activities:</i> • Cover all material and waste transport vehicles; do not overload. • Water along transport routes about 40 meters from the construction site at least twice a day on sunny days.	• Environmental Protection Law No. 72/2020/QH14 • Decree No. 06/2021/ND-CP dated January 26, 2021, detailing certain provisions on quality management, construction execution, and maintenance of construction works • Circular No. 82/2024/BCA dated November 15, 2024 of the Ministry of Public Security, stipulating certification of technical safety and environmental protection for motor vehicles, specialized motor vehicles, and motor vehicle parts in import, production, assembly, renovation, and inspection under the management scope of the Ministry of Public Security • QCVN 05:2023/BTNMT: National technical regulation on ambient air quality • TCVN 6438-2018: Road vehicles — Maximum allowable limits of exhaust emissions	• Implementation: Contractor • Supervision: PMU (Project Management Unit), Construction Supervision Consultant (CSC), Independent Supervision Consultant (ISC)

Socio-environmental issues	Mitigation measures	Regulations of Vietnam and the World Bank	Responsibility
	• Clean up any spilled soil and debris immediately. • Set up wheel washing stations at the entrance and exit of the construction area. • Enforce a maximum speed limit of 5 km/h within the construction site. • Avoid transporting materials and dumping waste on main roads during peak traffic hours (6–8 a.m. and 5–6 p.m.). <i>For material storage yards:</i> • Fully cover material storage yards with tarpaulins to limit dust spread by wind and maintain aesthetics at ports. • Locate storage yards away from prevailing winds and sensitive structures. • Burning of solid waste (e.g., wood, rubber, oily rags, empty cement bags, paper, plastic, bitumen, etc.) at the construction site is strictly prohibited. <i>For machinery and equipment:</i> • All vehicles/machinery must be inspected and have quality and environmental protection certification. • Regularly clean and maintain equipment. • Do not idle machines when not in use. <u>Mitigation Measures</u> • Deploy personnel and supporting equipment: Assign workers to collect materials and waste at the end of each workday or shift. Provide sufficient personal protective equipment such as masks or dust respirators when dust concentrations exceed permissible levels. • Limit construction to the site: Avoid extending construction activities into areas that could affect nearby residents or sensitive structures. <u>Remediation (if any)</u> • Environmental and health remediation: If dust affects public health or causes damage to property (e.g., trees, roofs, equipment), the contractor is responsible for remediation according to regulations.	• World Bank EHS Guidelines	

Socio-environmental issues	Mitigation measures	Regulations of Vietnam and the World Bank	Responsibility
2. Noise, vibration	<u>Avoidance</u> • Compliance with regulations: Adhere to Vietnamese laws on noise and vibration. • Construction planning: Prepare a reasonable construction schedule, avoiding night work in residential areas, temples, and schools. • Advance notice: Inform the local community and fishermen about the construction schedule in advance. <u>Mitigation</u> • Use low-noise equipment and install silencers or mufflers on engines and compressors. • Install soundproofing for noisy equipment enclosures and vibration isolators for mechanical devices. • Limit operating hours of noisy equipment. • Avoid simultaneous operation of high-noise and high-vibration machinery, especially during peak hours at ports or near existing residential areas. • Conduct construction primarily during daytime (6:00–18:00); if night work is necessary (21:00–6:00), notify local authorities and the community. • Provide full personal protective equipment (PPE) for workers operating noisy equipment (e.g., pile drivers, concrete sprayers, etc.). • If required or upon complaints regarding noise pollution, carry out noise and vibration monitoring to adjust construction methods and implement timely mitigation measures. <u>Remediation (if any)</u> • Coordinate with local authorities to address and provide support if construction activities significantly affect public health or living conditions.	• Environmental Protection Law No. 72/2020/QH14 • QCVN 24:2016/BYT – National technical regulation on noise — permissible exposure limits at the workplace • QCVN 27:2016/BYT – National technical regulation on vibration — allowable values at the workplace • QCVN 26:2010/BTNMT – National technical regulation on noise • QCVN 27:2010/BTNMT – National technical regulation on vibration • World Bank EHS Guidelines	• Implementation : Contractor • Supervision : PMU, CSC, Independent supervision consultant
3. Wastewater Management	(i) Domestic Wastewater <u>Avoidance</u> • Prioritize hiring local labor to reduce generation of domestic wastewater. • Provide septic toilets on-site, at least 200 m away from worker camps. <u>Mitigation</u>	• Environmental Protection Law No. 72/2020/QH14 • Decree No. 08/2022/ND-CP dated January 10, 2022, detailing certain provisions of the Environmental Protection Law,	• Implementation: Contractor • Supervision: PMU (Project)

Socio-environmental issues	Mitigation measures	Regulations of Vietnam and the World Bank	Responsibility
	• Install at least one mobile septic toilet or construct a septic toilet at each construction site; mobile toilets must be located at least 200 m from worker camps. • Wastewater from kitchens and washing areas in camps must be treated before discharge into the environment through drainage channels and sedimentation pits. • Regularly clean drainage ditches around the camps weekly. • Contract with qualified units for collection, transportation, and treatment of domestic wastewater according to regulations. • After construction, dismantle and reinstate the site, and properly treat the sanitation system. <u>Remediation</u> If domestic wastewater causes environmental pollution or affects the community, the contractor is responsible for remediation and compensation according to regulations. ii) Construction Wastewater <u>Avoidance</u> • Do not stockpile construction materials, waste, or mix concrete within 50 m of rivers, seas, or water sources. • Maintain construction equipment in designated areas to avoid hazardous wastewater generation. <u>Mitigation</u> • Wash water from vehicles, construction tools, and foundation pits must be settled before discharge into the environment. • Arrange temporary sedimentation pits at appropriate locations. • Waste oils and grease from equipment must be collected and treated as hazardous waste. • Store fuels and oils on impermeable surfaces, under a roof, and at least 25 m away from drainage flows. • Vehicle and equipment maintenance, including oil changes or greasing, must only be conducted in designated areas. Use trays to contain rags and materials used for	amended by Decree No. 05/2025/ND-CP dated January 6, 2025 • Circular No. 02/2022/TT-BTNMT dated January 10, 2022, providing detailed guidance on the Environmental Protection Law, amended by Circular No. 07/2025/TT-BTNMT dated February 28, 2025 • QCVN 08:2023/BTNMT – National technical regulation on surface water quality • QCVN 14:2025/BTNMT – National technical regulation on domestic and urban wastewater from concentrated residential areas (replacing QCVN 14:2008/BTNMT from September 1, 2025) • QCVN 40:2025/BTNMT – National technical regulation on industrial wastewater (replacing QCVN 40:2011/BTNMT from September 1, 2025) • World Bank EHS Guidelines	Management Unit), Construction Supervision Consultant (CSC), Independent Supervision Consultant (ISC)

Socio-environmental issues	Mitigation measures	Regulations of Vietnam and the World Bank	Responsibility
	maintenance; waste must be collected and disposed of according to hazardous waste regulations. • Wash water from vehicles entering and leaving the site must be collected into sedimentation tanks, then passed through sand and oil separation filters before discharge. • Regularly dredge drainage channels and sedimentation pits to ensure treatment efficiency. • Transport dredged materials and generated waste to sites agreed upon with local authorities. <u>Remediation</u> • If construction wastewater affects water sources or community living conditions, the contractor is responsible for treatment and compensation. iii) Rainwater Runoff <u>Avoidance</u> • Do not locate temporary material storage near rivers or seas. • Cover easily washed-away materials with geotextile fabric or soil/sand bags. <u>Mitigation</u> • Reinforce construction areas and internal roads with crushed stone or a proper drainage system. • Arrange drainage ditches and sedimentation pits on-site; regularly dredge pits (once a week or as needed) to prevent soil and waste from entering drainage systems and causing blockage or localized flooding. • Clean up spilled materials, oils, and grease to prevent runoff into the environment. • Limit or avoid excavation and earthwork on rainy days to prevent pollution runoff. <u>Remediation</u> • If rainwater runoff causes flooding or water pollution, the contractor must carry out remediation according to regulations.		
4. Convention al Solid	<u>Avoidance</u>	• Environmental Protection Law No. 72/2020/QH14	• Implementation: Contractor

Socio-environmental issues	Mitigation measures	Regulations of Vietnam and the World Bank	Responsibility
Waste Management	• Prepare a solid waste management plan before construction, including procedures for storage, classification, collection, transportation, and treatment. • Register and obtain all required waste treatment permits according to legal regulations. • Prioritize the use of environmentally friendly materials that are easy to recycle and reuse. • Calculate cleared area reasonably to limit waste generation from undergrowth and vegetation. <u>Mitigation</u> <i>For domestic solid waste:</i> • Provide classified trash bins (organic, inorganic, recyclable) in living areas, canteens, and sanitation areas. • Collect waste daily, especially organic waste, to avoid odor and pests. • Contract with qualified units for domestic waste treatment. <i>For construction solid waste:</i> • Reuse broken bricks, soil, and rocks as fill materials. • Sort steel and iron for scrap sale or recycling. • Stockpile in designated areas with hard surfaces and roofs to prevent dust dispersion or runoff. • Do not illegally dump construction waste; install warning signs and surveillance cameras if necessary. <i>For demolition and clearing waste:</i> • Allow local communities to collect valuable plants before clearing. • Collect and reuse inert waste (rocks, soil, broken bricks) for filling. • Do not bury or burn plant biomass on-site. <i>For dredged material and excess excavated soil:</i> • Precisely determine excavation areas to avoid removing topsoil in green areas.	• Decree No. 08/2022/ND-CP dated January 10, 2022, detailing certain provisions of the Environmental Protection Law, amended by Decree No. 05/2025/ND-CP dated January 6, 2025 • Circular No. 02/2022/TT-BTNMT dated January 10, 2022, providing detailed guidance on the Environmental Protection Law, amended by Circular No. 07/2025/TT-BTNMT dated February 28, 2025 • World Bank EHS Guidelines	• Supervision: PMU (Project Management Unit), Construction Supervision Consultant (CSC), Independent Supervision Consultant (ISC)

Socio-environmental issues	Mitigation measures	Regulations of Vietnam and the World Bank	Responsibility
	• Use excavated soil for site leveling or planting; do not transport off-site unless necessary. • Store excavated soil in designated planting areas, with a maximum height of 1.5 m. • Manage according to a separate plan to prevent environmental dispersion. Details in the Appendix – Dredged Material Management Plan. <u>Additional mitigation measures:</u> • Provide large-capacity (250 L) covered, water-tight bins with labeled waste classification on-site. • Sort waste at the source and concentrate it in temporary storage areas. • Contract qualified units for collection, transportation, and treatment in accordance with regulations. • Cover outdoor materials and provide temporary storage with roofs to prevent wind or rain dispersion. • Arrange material stockpile areas at each subproject, with each area approximately 100–200 m², impermeable surface, fencing, and signage. • Inspect and maintain equipment and machinery to ensure good condition and renew registration before expiry. • Major maintenance or repair of excavators is not permitted on-site; such activities must be conducted at specialized maintenance workshops. <u>Remediation</u> • If solid waste causes environmental or community impacts, the contractor is responsible for remediation and compensation according to regulations.		
5. Hazardous waste management	<u>Avoidance</u> • Legal compliance: The contractor must fully comply with Circular No. 02/2022/TT-BTNMT, amended by Circular No. 07/2025/TT-BTNMT, regarding hazardous waste (HW) management. • Hazardous waste treatment contract: Sign a contract with a licensed unit authorized to collect, transport, and treat hazardous waste according to legal regulations.	• Environmental Protection Law No. 72/2020/QH14 • Decree No. 08/2022/ND-CP dated January 10, 2022, detailing certain provisions of the Environmental Protection Law, amended by Decree No.	• Implementation: Contractor • Supervision: PMU (Project Management Unit),

Socio-environmental issues	Mitigation measures	Regulations of Vietnam and the World Bank	Responsibility
	• Training and communication: Organize training for workers on identifying, responding to, and handling hazardous waste, including emergency response procedures for chemical spills. • Safe chemical storage: Chemicals and fuels must be stored on impermeable surfaces, under roofing, with containment walls and warning signs, at least 20 m away from worker camps, and located downwind from prevailing winds. <u>Mitigation</u> • Equipment maintenance: Machinery and construction vehicles must be regularly maintained at workshops or maintenance centers off-site to minimize hazardous waste generation. • Control of hazardous materials: Do not use unapproved materials such as lead-based paint, asbestos, etc. Handling of materials containing hazardous substances must be performed by trained and certified personnel. <u>Hazardous waste storage and classification:</u> • Hazardous waste must be classified, clearly labeled, and stored in dedicated containers with lids (capacity 120 L). • Construct a hazardous waste storage facility of at least 10 m², with impermeable flooring, roofing, walls, and drainage channels. <u>Management of used oils and grease:</u> • Collect and store used oil and grease separately in sealed containers under cover, away from ignition sources. • Oil changes and filtration must only occur in designated areas. • Waste oil may be sold to licensed recycling units or returned to the manufacturer. <u>Mitigation Measures for Spills</u> Emergency response: • The person detecting the spill must ensure safety and immediately notify the supervising engineer and PMU. • Use sawdust, sandbags, or shovels depending on the scale of the spill.	05/2025/ND-CP dated January 6, 2025 • Circular No. 02/2022/TT-BTNMT dated January 10, 2022, providing detailed guidance on the Environmental Protection Law, amended by Circular No. 07/2025/TT-BTNMT dated February 28, 2025 • World Bank EHS Guidelines	Construction Supervision Consultant (CSC), Independent Supervision Consultant (ISC)

Socio-environmental issues	Mitigation measures	Regulations of Vietnam and the World Bank	Responsibility
	- Do not discharge chemicals into the drainage system; contaminated soil must be treated according to hazardous waste procedures. Incident reporting: - The contractor must prepare a detailed report on the cause, consequences, remedial actions, and preventive measures. - Submit the report to the Supervision Consultant, PMU, and Department of Agriculture & Environment (if required). Remediation (if any) Environmental damage remediation: If hazardous waste incidents cause environmental pollution or affect public health, the contractor is responsible for remediation and compensation according to regulations.		
6. Impact on biological resources	(i) Vegetation and Trees <u>Avoidance</u> - Minimize the area of disturbance, especially in locations with trees or vegetation cover. - Do not stockpile materials or waste in areas with trees or vegetation; only stockpile on bare soil. - Do not use chemicals to clear vegetation. - Do not cut down trees outside the approved construction area. - If the construction route interferes with trees, consider relocating them to another position for protection. - Do not burn waste in a way that damages vegetation. <u>Mitigation</u> - Reduce the area of clearing by proper planning; allow local communities to harvest valuable plants before construction. - Install temporary protective fencing to safeguard trees that need to be preserved before construction. ii) Wildlife	- Law on Environmental Protection No. 72/2020/QH14; - Law on Biodiversity No. 32/VBHN-VPQH dated 10/12/2018; - ESS6	- Implementation: Contractor - Supervision: PMU (Project Management Unit), Construction Supervision Consultant (CSC), Independent Supervision Consultant (ISC)

Socio-environmental issues	Mitigation measures	Regulations of Vietnam and the World Bank	Responsibility
	<u>Avoidance</u> - Do not hunt, trap, poison, feed, or harm any animals (birds, frogs, snakes, etc.). - Do not buy or sell wildlife for food. - Do not keep birds or animals in worker camps. - Do not burn waste in ways that damage or affect habitats. <u>Minimization</u> - Regularly monitor construction activities to detect and prevent risks to wildlife. - Identify and protect undisturbed areas throughout the construction process. Temporary protective fencing will be installed where necessary to effectively protect the project area's biological resources. <u>Mitigation Measures</u> - If wildlife is found within the construction area, coordinate with competent authorities for appropriate protection. - Organize training for workers on wildlife identification and resource protection. <u>Remediation (if any)</u> - If construction causes ecosystem damage or loss of biological resources, the contractor must coordinate with the owner and relevant authorities to assess the damage and implement compensation according to the Biodiversity Law and Environmental Protection Law.		
7. Sedimentation, erosion, landslides and flooding	<u>Avoidance</u> Inspection and improvement of drainage system: Before site leveling, thoroughly inspect the existing drains/ditches within and around the construction site to ensure effective rainwater drainage capacity. Proper stockpiling of materials: Construction materials and wastes must be neatly stockpiled at least 10 meters away from existing ditches or water sources to avoid the risk of infiltration into the drainage system. <u>Mitigation and Minimization</u>	- Law on Environmental Protection No. 72/2020/QH14; - QCVN 18:2021/BXD – National Technical Regulation on Safety in Construction Works; - QCVN 08:2023/BTNMT – National Technical Regulation on Surface Water Quality;	- Implementation: Contractor - Supervision: PMU (Project Management Unit), Construction Supervision

Socio-environmental issues	Mitigation measures	Regulations of Vietnam and the World Bank	Responsibility
	• Regular cleaning: Drains and culverts inside and around the construction site must be regularly cleared of soil, rocks, and waste to prevent clogging. • Frequent dredging: Periodically dredge existing drains/ditches to maintain drainage capacity. • Leveling and compaction: After depositing materials in temporary stockpiles, leveling and compaction must be carried out to limit the risk of materials being washed away by rainwater. • Reinforcement of deep pits/ditches: For pits or ditches deeper than 2 meters, shoring and reinforcement of walls/sides must be applied to prevent collapse and reduce risks of landslides and occupational accidents. <u>Remediation (if any)</u> • In the event of damages to the community, the contractor is responsible for compensating for losses caused by landslides that affect housing, agricultural land, or technical infrastructure works.	• TCVN 4447:2012 – Earthworks – Construction and Acceptance.	Consultant (CSC), Independent Supervision Consultant (ISC)
8. Traffic Management	(i(i) For Road Traffic <u>Avoidance</u> • Prepare a proper traffic coordination plan; avoid transporting materials during peak hours (7:00–8:00, 11:00–13:00, 16:00–18:00). • Identify transport routes that avoid sensitive areas such as schools, hospitals, markets, pagodas/churches (if any). • Use only vehicles with valid registration and certified technical safety. <u>Minimization</u> • Install traffic signs, fences, and signal lights at construction site entrances/exits. • Arrange convex mirrors and warning lights at the site gate for night safety. • Cover transported materials tightly; do not load higher than 10 cm above the truck sideboards. • Spray water to reduce dust; collect spilled soil and debris daily. • Provide designated pedestrian routes, with signage and temporary walkways if sidewalks/roadways are occupied.	• Law on Road Traffic No. 35/2024/QH15 dated June 27, 2024; • Law on Construction No. 50/2014/QH13 dated June 18, 2014, as amended and supplemented by Law No. 62/2020/QH14 dated June 17, 2020; • Decree No. 06/2021/ND-CP dated January 26, 2021 on detailed regulations on quality management, construction, and maintenance of construction works;	• Implementation: Contractor • Supervision: PMU (Project Management Unit), Construction Supervision Consultant (CSC), Independent Supervision Consultant (ISC)

Socio-environmental issues	Mitigation measures	Regulations of Vietnam and the World Bank	Responsibility
	- Place speed limit signs within 200 m of the construction site. - Avoid long parking or encroachment of vehicles onto the roadway. <u>Mitigation</u> - Assign trained staff (security guards or workers) to regulate traffic at busy intersections. - Ensure adequate lighting at night within the construction site and along transport routes. - Develop an emergency response plan in case of traffic accidents. <u>Remediation (if any)</u> - In case of accidents or damage to traffic infrastructure, the contractor is responsible for repair and compensation in accordance with regulations. (ii) For Waterway Traffic <u>Avoidance</u> - All waterway vehicles must be registered, have license plates, and valid operation permits. - Operators must hold valid boat/ship driving certificates. - No construction equipment shall be placed outside the project boundaries. <u>Minimization</u> - Provide sufficient signal lights, life buoys, firefighting equipment, and 24/7 VHF communication devices. - Install buoys and signal lights marking the construction boundary. - Carry out works within the inside edge of the boundary buoys, avoiding obstruction to existing waterway traffic. - Do not conduct construction during adverse weather conditions (thunderstorms, whirlwinds, fog, etc.). <u>Mitigation</u> - Develop a maritime safety plan and submit it to the competent authority for approval. - Coordinate in advance with local medical stations for emergency support.	- Circular No. 10/2021/TT-BXD dated August 25, 2021 of the Ministry of Construction, replacing all previous regulations on quality management of construction and maintenance of construction works; - QCVN 18:2021/BXD – National Technical Regulation on Safety in Construction; - ESS4 (World Bank Environmental and Social Standard 4).	

Socio-environmental issues	Mitigation measures	Regulations of Vietnam and the World Bank	Responsibility
	• Install warning signs and signal lights at dredging locations along the channel. • Prepare an emergency response plan for contractors in case of incidents or waterway traffic accidents. <u>Remediation (if any)</u> • In case of collision, sinking, or disruption to waterway traffic, the contractor is responsible for remediation and compensation.		
9. Impact on existing infrastructure and services	<u>Avoidance</u> • Coordinate early with infrastructure management units (water supply, electricity, telecommunications, internet, drainage, etc.) before commencement to: • Identify the location of existing underground systems (to avoid accidental excavation). • Prepare interruption plans in case of temporary shut-off/activation. • Establish a focal point for rapid incident response. • Assign a dedicated technical staff in charge of public utilities and infrastructure management at the beginning of the project. • Do not use heavy machinery (excavators, bulldozers) near underground systems unless directly supervised on site. • Require the project owner or design consultant to provide underground utility maps before construction. • Clearly stipulate the timing of coordination with infrastructure units (e.g., at least 30 days prior to commencement). <u>Minimization</u> • Use locating devices (detector or ground penetrating radar, if necessary) to precisely identify underground cables and pipelines before excavation. • Install protective barriers or temporary warning signs around excavation pits containing existing pipelines/cables, with nighttime flashing lights or reflectors. • Stop construction immediately if existing infrastructure is damaged. Identify the cause and propose remedial measures. • Prohibit untrained workers from performing tasks near technical infrastructure such as water supply pipelines, substations, or underground cables.	• Decree No. 06/2021/ND-CP dated January 26, 2021 on detailed regulations for quality management, construction, and maintenance of construction works; • Decree No. 144/2021/ND-CP on administrative sanctions in the fields of security, social order and safety; prevention and control of social evils; fire prevention and fighting; rescue and relief; and prevention of domestic violence; • QCVN 18:2021/BXD – National Technical Regulation on Safety in Construction; • World Bank Environmental, Health, and Safety (EHS) Guidelines.	• Implementation: Contractor • Supervision: PMU (Project Management Unit), Construction Supervision Consultant (CSC), Independent Supervision Consultant (ISC)

Socio-environmental issues	Mitigation measures	Regulations of Vietnam and the World Bank	Responsibility
	<u>Mitigation</u> • Develop a <i>Service Disruption Plan</i> for each type of service if shut-off is unavoidable, including: start–end time; affected areas; temporary or alternative supply measures (clean water, temporary Wi-Fi, generators, etc.); and contact points for incident handling. • Post public notices at community points (health stations, commune/ward People’s Committee offices, households, schools, etc.) at least 5 days in advance, in addition to direct notifications. • Provide alternative water supply to affected residents if service interruption lasts more than one day. • Assess the level of impact (number of households, healthcare facilities, schools, etc.) to prioritize support. • Clearly specify forms of notification (paper-based, electronic, loudspeaker, etc.). <u>Remediation (if any)</u> • Sign a tripartite agreement (project owner – contractor – infrastructure management unit) on responsibilities for compensation, repair, and restoration in case of damage to existing systems. • Maintain an incident logbook recording all damages to infrastructure, including: date and time; description of damage; cause; corrective measures; completion time of repair; confirmation minutes signed by the supervising engineer and infrastructure management unit.		
10. Public safety and health	<u>Avoidance</u> • Do not disturb or cause nuisance to the community during construction activities. • Restrict night-time construction, particularly near residential areas, schools, hospitals, pagodas/churches (if any). • Establish regular communication channels with local authorities and community representatives. • Coordinate with local health agencies to prepare a disease prevention plan for workers. • Provide information to the community at least 5 days in advance on construction schedules, service disruptions, detour routes, and blasting/demolition activities (if any).	• Decree No. 06/2021/ND-CP dated January 26, 2021 detailing a number of provisions on quality management, construction, and maintenance of construction works; • Decree No. 167/2013/ND-CP on administrative penalties for violations related to social security, order, and safety issues;	• Implementation: Contractor • Supervision: PMU (Project Management Unit), Construction Supervision

Socio-environmental issues	Mitigation measures	Regulations of Vietnam and the World Bank	Responsibility
	<u>Minimization</u> • Install fences, reflective ropes, and warning signs at excavation pits and open trenches; ensure adequate lighting at night on the construction site. • Limit vehicle speed within 200 m of the site to 20 km/h to reduce dust and noise. • Place noise-generating machinery away from residential areas, ensuring noise levels do not exceed 70 dBA. • Apply static compaction methods when working near residential areas or weak structures to minimize vibration. • Spray water to control dust and collect spilled materials on a daily basis. <u>Mitigation</u> • Maintain an information board at the site providing full contact details, construction schedule, and safety warnings. The board must clearly state the contact person's name, phone number, email (if available), and office hours for receiving community feedback. • Provide Vietnamese copies of ESCOPs and environmental safety documents to the community and workers. • Establish a Community Grievance Logbook, updated at least once a week. • Respond to community inquiries within 5 working days; if an extension is required, notify the reason and the new deadline. <u>Remediation (if any)</u> • If construction causes serious impacts on community health (e.g., dust, noise, disease outbreaks), the Contractor must coordinate with the Project Owner and local authorities to address and compensate in accordance with regulations.	• Decision No. 96/2006/QD-TTg on clearance of unexploded ordnance (UXO); • Circular No. 146/2007/TT-BQP of the Ministry of National Defense: Guidance on the implementation of Decision No. 96/2006/QD-TTg; • Circular No. 09/2019/TT-BXD: Guidance on Decree No. 18/2019/ND-CP on management of construction investment costs, including provisions related to UXO clearance costs; • Official Letter No. 5972/BQP dated November 13, 2006: Ministry of National Defense's guidance on the implementation of Decision No. 96/2006/QD-TTg in relevant localities and line ministries; • QCVN 18:2021/BXD – National Technical Regulation on Safety in Construction; • ESS4, ESS10.	Consultant (CSC), Independent Supervision Consultant (ISC)
11. Safety and health for workers	<u>Avoidance</u> • Organize training on Environment, Health and Safety (EHS), HIV/AIDS and communicable disease prevention, and prevention of gender-based violence (GBV) and sexual harassment within 2 weeks from the commencement date (applicable for contracts ≥ 6 months).	• Decree No. 06/2021/ND-CP dated January 26, 2021 on detailing a number of provisions on quality management, construction works execution, and	• Implementation: Contractor • Supervision: PMU (Project)

Socio-environmental issues	Mitigation measures	Regulations of Vietnam and the World Bank	Responsibility
	• Keep training records and workers' signed commitments for inspection and supervision purposes. • Provide workers with training on EHS rules before they start any contract work. • Require workers to sign a Code of Conduct committing not to cause public disturbance in the local area. • Establish an agreement between the contractor and local authorities to prevent social evils (alcohol abuse, prostitution, gambling, etc.). • Do not allow untrained workers to perform work near technical infrastructure or hazardous areas. • Implement security and access control measures for workers' camps. • Workers' camps must have a security fence at least 2 m high made of appropriate materials. • Control access to camps: allow only workers, camp staff, and visitors with work-related purposes. • Visitors must obtain prior approval from the camp manager before entering. • Ensure adequate lighting during both daytime and nighttime. <u>Minimization</u> • Provide adequate personal protective equipment (PPE) appropriate to each task: masks, hard hats, safety shoes/boots, gloves, safety glasses, etc. • Ensure safe electrical installations in offices and on site: no cables lying on the ground or in water; electrical ends must have plugs; outdoor electrical panels must be placed in protective enclosures. • Equip and periodically inspect fire-protection equipment, portable fire extinguishers, and first-aid kits (first-aid bags, medicine cabinets) at camps and site offices. • Workers' camps must have adequate clean water supply, electricity, and sanitation; provide at least one toilet compartment per 25 workers, with separate facilities for men and women. • Provide beds with mosquito nets to reduce dengue risk.	maintenance of construction works; • Decision No. 96/2008/QĐ-TTg on clearance of unexploded ordnance (UXO); • QCVN 18:2021/BXD – National Technical Regulation on Safety in Construction Works Execution; • ESS2 – Labor and Working Conditions; • World Bank's Environmental, Social, Health and Safety (ESHS) Guidelines	Management Unit), Construction Supervision Consultant (CSC), Independent Supervision Consultant (ISC)

Socio-environmental issues	Mitigation measures	Regulations of Vietnam and the World Bank	Responsibility
	- Keep camps, kitchens, bathing/washing areas, and toilets clean regularly; provide waste bins and ensure daily waste collection. Specify cleaning frequency (e.g., daily cleaning, weekly inspections). - Keep drainage ditches around camps cleared periodically. <u>Mitigation</u> - Suspend all construction activities in the event of storms, accidents, or incidents. - In case of chemical or fuel leaks: check injured persons, provide first aid and transfer to medical facilities; do not flush chemicals into the drainage system; contain/absorb spills using sawdust or sand, or remove contaminated topsoil if necessary. - Provide emergency-response training for workers, especially for fire/explosion, chemical incidents, and natural hazards. - After any incident, prepare a detailed report and submit it to the supervising engineer, the Project Management Unit (PMU), and relevant authorities if required. <u>Remediation (if any)</u> - If occupational accidents or incidents affect workers' health, the contractor is responsible for treatment, medical support, and compensation in accordance with law and labor contracts.		
12. Social Impacts	<u>Avoidance</u> - Notify the community at least 2 weeks prior to commencement of construction. - Register a complete list of temporary workers with the local authorities. - Prioritize the use of local labor for unskilled works to create employment and reduce potential conflicts. - Provide training for workers on environment, health and safety (EHS), as well as local culture. - Develop and require workers to sign a Code of Conduct compliance commitment. <u>Minimization</u> - Restrict nighttime construction; if night work or service interruptions (e.g., electricity, water supply) are unavoidable, notify the community at least 2 days in advance.	- Decree No. 144/2021/ND-CP on administrative penalties in the fields of security, social order and safety; prevention of social evils; fire prevention and fighting; rescue and relief; and domestic violence prevention. - Decree No. 167/2013/ND-CP on administrative penalties for violations related to social security, order, and safety.	- Implementation: Contractor - Supervision: PMU (Project Management Unit), Construction Supervision Consultant (CSC), Independent

Socio-environmental issues	Mitigation measures	Regulations of Vietnam and the World Bank	Responsibility
	• Install temporary covers (e.g., wooden planks) over open trenches/pits not yet reinstated to ensure safe passage. • Provide orientation for migrant workers on local customs and practices to avoid cultural conflicts. • Conduct training to raise road safety awareness among local residents. <u>Mitigation</u> • Establish a grievance redress mechanism to receive feedback from the community and respond within 5 working days. • Provide information in user-friendly language and appropriate formats (e.g., leaflets, community meetings). • Maintain notice boards at construction sites with contact details, construction schedule, and hazard warnings. • Cooperate with commune/ward police to conduct regular inspections of worker camps if violations are suspected. <u>Remediation (if any)</u> • If construction activities cause service interruptions or adversely affect community livelihoods, the contractor must coordinate with the project owner and local authorities to address the issue and provide compensation in accordance with regulations.	• ESS2 (Labor and Working Conditions) and ESS4 (Community Health and Safety). • World Bank's Environmental, Social, Health and Safety (ESHS) Guidelines.	Supervision Consultant (ISC)
13. Impacts on Cultural and Historical Properties and Chance Find Procedures	<u>Avoidance</u> • Prior to construction, review the area for potential cultural relics, archaeological remains, cemeteries, or isolated graves. • Select construction routes that avoid areas identified as having cultural or historical value. • Provide training for workers on recognizing signs of chance finds and the procedures to follow. <u>Minimization</u> • If relics are discovered during construction, the Contractor shall follow the procedure below: • Immediately stop all activities in the area of chance finds.	• Law on Cultural Heritage No. 28/2001/QH10. • Law on Amendments and Supplements to the Law on Cultural Heritage No. 32/2009/QH12. • Decree No. 98/2010/ND-CP on amendments and supplements. • ESS8 – Cultural Heritage.	• Implementation: Contractor • Supervision: PMU (Project Management Unit), Construction Supervision Consultant (CSC),

Socio-environmental issues	Mitigation measures	Regulations of Vietnam and the World Bank	Responsibility
	- Record a preliminary description of the location and existing status of the relics. - Secure the discovery site and assign guards if necessary. - Notify the supervising engineer, the project owner, the local authorities, and the competent agencies within 24 hours. <u>Mitigation</u> - Specialized agencies shall assess the value of the discovery based on criteria such as aesthetics, historical significance, scientific value, social and economic importance. - If the relics cannot be relocated or have high value, the project owner must adjust the design to ensure preservation. - Construction may only resume after written approval is obtained from the competent authority. <u>Remediation (if any)</u> - If construction causes damage to or loss of cultural–historical relics, the Contractor shall be responsible for restoration (if possible) and compensation in accordance with the Law on Cultural Heritage.		Independent Supervision Consultant (ISC)

B. Code of conduct for workers

The Workers' Code of Conduct shall address, but not be limited to, the following measures:

Compliance with laws and regulations

- All workers must comply with the laws and regulations of the Socialist Republic of Viet Nam.
- The list of workers must be registered with the local authorities in accordance with current regulations.
- Children under 18 years old are not permitted to work under the Project.

Civilized behavior and respect for the community

- Behave properly when interacting with the local community, respecting local customs, practices, and traditions.
- Do not cause disturbance, disorder, or engage in fighting (physical or verbal) within or near the community.
- Workers residing in temporary camps, when visiting local communities, must conduct themselves in a manner consistent with the Code of Conduct.

Prohibited behaviors and restricted items

- Prohibit the use or possession of illegal substances, weapons, and firearms (except for authorized security personnel).
- Prohibit pornography, gambling, and alcohol consumption during working hours.
- Prohibit hunting, fishing with explosives/chemicals, trading wildlife, or keeping animals (particularly birds).
- Prohibit cutting trees, collecting firewood, or harvesting plants beyond approved areas.
- Prohibit disturbing architectural/historical sites, burning waste, or clearing vegetation without authorization.

Hygiene, safety, and environmental protection

- Maintain personal hygiene and living areas to appropriate standards.
- Smoking is only permitted in designated areas.
- Do not wash clothes, clean vehicles, or maintain equipment in rivers/streams or unauthorized locations.
- Do not dispose of garbage or construction waste indiscriminately; prevent the spread of pollutants such as oil or grease.
- Toilets must be used only in designated places.
- Do not work without personal protective equipment such as boots and helmets.

Disciplinary measures

- Any violation of the Code shall be subject to disciplinary action, ranging from a warning to termination of the labor contract, depending on the severity of the violation.
- Any construction worker, office staff, contractor's employee, or any other person involved in the project found violating prohibitions shall be subject to disciplinary measures, which may range from a simple reprimand to dismissal, depending on the severity of the violation.

C. Labor management process (LMP)

A Labor Management Procedure (LMP) was developed as a stand-alone document for addressing the impacts on and of labor and working conditions of the project. The LMP identifies the main labor requirements and risks associated with the project and help the PMU and Contractor to determine the resources necessary to address project labor issues. The LMP will enable different project-related parties, for example, staff of the project management unit, contractors and sub-contractors and project workers, to have a clear understanding of what is required on a specific labor issue. The LMP is a living document, which is initiated early in project preparation, and is reviewed and updated throughout development and implementation of the project. The LMP has 12 chapters. Chapter 1 served as Introduction. An overview of labor use in the project is presented in Chapter 2. Key potential labor risks are listed in Chapter 3. Legislative Framework governing labor employment in Vietnam 2 is discussed in Chapters 4 and 5. Implementation Arrangements, Age Requirement, Policies and Procedures and Timing of labor requirements follows in the subsequent chapters. Grievance Redressal Mechanism and Contractor Management are presented in the last two chapters 10 and 11 respectively, while Chapter 12 relates to primary supply workers. *Details are presented in the Project's LMP.*

5.1.3.2. Mitigation measures for risks and incidents

a. Mitigation measures for fire and explosion risks

- Install “No Fire” warning signs at fuel storage areas containing flammable and explosive materials.
- Equip 05 foam fire extinguishers (CO₂ type) at the workers’ camp area. Install a 10 m³ water storage tank at the camp to support fire prevention and emergency response in case of fire or explosion incidents.
- Equip the site with water pumps and fire hoses to prepare for potential fire or explosion incidents.
- Electrical equipment used during construction must comply with safety measures, such as using standard-certified electrical cables and ensuring that connections to intermediate devices are equipped with circuit breakers. These measures help minimize the risk of short circuits that could cause fire or explosion incidents.

b. Mitigation measures for occupational accidents and traffic incidents

- Construction material transport vehicles must comply with technical safety standards.
- Require material transport vehicle owners to comply with speed limits while traveling on roads; avoid concentrating material deliveries at a single time; and prohibit parking or stopping vehicles along roads near the project site.
- Install signs for transport vehicles entering and exiting the construction site.
- Urban road sections must be equipped with traffic lights at intersections (T-junctions and crossroads), and crossings with local access roads must be designed to ensure traffic safety.
- Require vehicle owners not to transport oversized or overloaded materials, and strictly prohibit the use of stimulants, drugs.

c. Mitigation measures for subsidence of road and adjacent structures

In the event of incidents such as house cracks or damage to roads, the project owner shall coordinate with the construction contractor to take the following mitigation measures:

- Use certified or registered construction equipment during the construction process;

- Construction equipment must be fitted with noise-reduction devices and undergo regular, periodic inspection and maintenance;
- Transport vehicles must not carry loads exceeding the permitted weight capacity;
- Provide compensation if construction activities cause vibration-related damage to buildings or infrastructure.

d. Mitigation measures for vessel collision risks during dredging

- The enterprise shall implement riverbank reinforcement measures to ensure riverbed stability, specifically by backfilling soil and embankments to prevent land subsidence.
- Regularly dredge navigation channels using cranes and remove sediment to ensure unobstructed water flow.
- Waste generated during dredging activities shall be managed in compliance with the enterprise's commitments. The enterprise commits not to dispose of dredged sludge illegally and will strictly follow the requirements of Thanh Hoa Provincial People's Committee and relevant departments/agencies.
- Construction machinery and equipment must operate within regulated working hours and undergo regular maintenance to avoid adverse impacts on the workplace environment and surrounding areas.

e. Mitigation measures for oil spill and leakage incidents

- Comply with the approved waterway traffic safety plan. Construction vehicles must provide a daily work schedule to inform local authorities and communities in advance, enabling proactive coordination.
- Watercraft used in construction must be equipped with oil containment barriers around fuel tanks, machinery, equipment, and maintenance areas where oil is used or may be released on deck. Vessels must be fully equipped with minimum response facilities for oil spill incidents, fitted with oil pollution prevention systems, and provided with absorbent devices in accordance with equipment registration requirements, in order to minimize oil discharge, as stipulated in Decision No. 12/2021/QĐ-TTg.
- Vessels must strictly follow designated navigation channels and signaling systems to prevent collisions. During dredging operations, grab buckets must be securely moored to avoid drifting; transport ships and barges must be anchored in compliance with regulations.
- Conduct regular inspections of fuel storage tanks and strictly control storage areas and transport vehicles to promptly detect oil leakage incidents. To minimize leakage risks, machinery and equipment must be frequently checked to ensure no oil seepage occurs. For spilled oil, direct washing is prohibited; instead, absorbent cloths must be used, and collected waste must be stored in designated containers. A rapid response team, consisting of both management and rescue staff, shall be established to take immediate action in case of accidents. Team members will be equipped with mobile phones to ensure constant communication.
- The project owner, together with the construction contractor, shall contact the competent local authority prior to construction to ensure readiness for oil spill response, thereby minimizing negative impacts on the environment and ecosystems in the project area.

- The project owner, together with the construction contractor, shall mobilize all available resources for self-response, prioritizing rescue of affected persons and environmental protection. Immediate measures must be taken to stop the source of the spill to minimize oil discharge into the environment. Strict monitoring of the risk of oil spreading to shorelines shall be conducted to determine priority areas and take protective measures for sensitive zones.
- In the event that an oil spill incident exceeds the self-response capacity of the project owner and construction contractor, local competent authorities shall be contacted for support to ensure the incident is addressed and remedied as quickly and effectively as possible.
- Identify the source of oil waste, its location, and the cause of the spill. Immediately notify leaders and the designated oil spill response unit to obtain timely guidance.
- Mobilize equipment, vehicles, and materials promptly to implement oil spill response activities. For incidents involving less than 20 tons of oil, oil containment must be deployed within one hour. Be prepared to mobilize additional resources to cooperate in response and remediation as required by competent authorities. Coordinate with the regional Maritime Search and Rescue Coordination Center to simultaneously rescue affected persons and vessels.
- Competent authorities shall promptly mobilize vessels and equipment to participate in rescue activities and oil spill response, while coordinating with relevant agencies to supervise rescue and spill response activities.

f. Drowning incidents mitigation measures

- During construction, the project owner shall provide life jackets and lifebuoys for workers. The site supervisor is responsible for instructing all personnel working along riverbanks, on boats, and barges to wear life jackets while performing tasks, in order to prevent falls and drowning incidents in waterway construction areas.
- The site supervisor shall remind construction workers to exercise caution while working in underwater areas and along riverbanks.

g. Mitigation measures for bored pile construction incidents

- The inclination of the drilling rod must also be checked, although it largely depends on the drilling tower and the rotary head. After drilling is completed, inclination should be measured using a BIT-Piletest device. This equipment can be attached to the drilling bucket to monitor and control borehole inclination during the drilling process.
- If borehole wall collapse is caused by inadequate slurry quality, the general corrective measure is to pump new slurry with higher density into the bottom of the borehole and flush out the old slurry. Only after this step should soil excavation and borehole cleaning be carried out. If, during concrete pouring, reinforcement cages are found to be lifted upward, concrete placement must be stopped immediately. The casing should then be carefully shaken, moved up and down, or rotated in one direction to release the entanglement between the reinforcement cage and the casing;
- To minimize the impact of casing rotation, it is recommended to use temporary reinforcement bars connected to the main reinforcement that extend above the casing, and suspend the entire reinforcement cage during concrete pouring. This method helps to significantly reduce the pressure of the reinforcement cage against the casing.

h. Mitigation measures for pipeline rupture or embankment failure at waste disposal sites.

According to assessments, pipeline ruptures and embankment failures or overflows at dredged material disposal areas may arise from various causes and can have negative impacts on the environment. To prevent and respond to such incidents, the project owner, in coordination with the construction contractor, shall implement the following measures:

- The project owner shall require the construction contractor to use high-quality pipelines for dredging and hydraulic filling. The pipeline used to pump sand to the disposal site is approximately 350 meters long and consists of brand-new 100% HDPE D200 pipes. Pipe segments are connected with couplings and steel bolts to ensure safety during pumping operations.
- The pipeline is arranged to float, with 1-meter-wide walkways along both sides from the barge to the disposal site, allowing workers to move conveniently and to easily observe and make adjustments when necessary.
- Strictly comply with procedures for pipeline installation and embankment construction at dredged material disposal sites. After installation and construction, the entire system must be inspected to ensure safety before dredging commence.
- Daily, before suction or pouring, the pipeline system must be inspected and monitored—particularly at connection points—before and after each work shift to detect leaks early and promptly implement corrective actions.
- In the event of leakage, pipeline rupture, or embankment overflow/failure, pumping operations must be stopped immediately to allow corrective action. Any dredged slurry or sand spilled outside the disposal area must be collected and transported disposed sites.
- Thoroughly eliminate the causes of incidents by replacing leaking or broken pipeline sections, repairing damaged embankments, and collecting all dredged material spilled due to pipeline rupture or leakage, ensuring that it is returned to the designated disposal site.

i. Mitigation measures for incidents of embankment or cofferdam failure during culvert construction.

To prevent and respond to incidents of embankment or cofferdam failure during culvert construction, the project owner, in coordination with the construction contractor, shall take the following measures:

- Arrange and schedule construction activities appropriately, with temporary suspension of subprojects related to the construction and upgrading of aquaculture infrastructure during the rainy season months. During construction, in cases of heavy rain, storms, or flooding, measures must be taken to halt construction.
- Assign personnel to monitor the locations of embankments and cofferdams to ensure timely response plans in case of incidents.

k. Mitigation measures for risks and incidents caused by storms and natural disasters

- Monitor and update weather forecast from the Provincial Flood and Storm Control Committee and mass media (radio, newspapers) to ensure appropriate measures for storm and rain preparedness.
- Coordinate with local authorities to promptly take preventive actions and remedial measures.
- Construct and clear drainage culverts and channels to ensure effective rainwater runoff.

- Before the storm and rainy season, machinery and equipment must be inspected and relocated to safe positions to prevent damage caused by storms.
- Use water pumps to enhance drainage during heavy rainfall and address low-lying areas in case of flooding, focusing on locations where intervention is most critical.
- Storms and natural disasters may affect the project area through incidents such as landslides, flooding, impacts on disposal sites and material storage areas, and safety risks during construction, including soil spillage and slow drainage. In the event of storms or natural disasters, construction activities at the project site will be temporarily suspended, which may affect the project schedule. The project owner, in coordination with the construction contractor, must develop a serious response plan and mobilize workers to accelerate construction progress during favorable weather conditions.
- During construction, technical staff must determine the daily construction volume and regularly update weather forecasts to plan the transportation of materials to the project site, avoiding the delivery of excessive quantities at once that are not immediately used. Materials already transported to the site and exposed to adverse weather conditions such as rain or storms must be protected by measures such as covering with tarpaulins or surrounding loose materials with formwork to reduce the impacts of runoff which may cause sedimentation.
- Suspend all construction activities at subproject sites in the event of floods, storms, natural disasters, or tsunamis.
- For Subprojects 3,4,5,6,7,8, and 9, prior to construction, procedures for obtaining approval to cut embankments and permits for construction works within the dike protection zone must be carried out in accordance with existing legal regulations.

5.1.3.3. Specific mitigation measures for construction impacts

A - Specific mitigation measures for construction impacts of Subproject 1 and Subproject 2:

The specific construction impacts of the subprojects include: (i) Disturbance to the operations of the existing Hoang Truong fishing port; (ii) Deterioration of water quality in the Lach Truong River due to dredging activities; (iii) Impacts on aquaculture activities in the Lach Truong River; (iv) Impacts from the disposal/stockpile sites serving the subprojects; (v) Impacts on sensitive receptors. The mitigation measures for these specific impacts are presented below:

(i) *Mitigation measures for impacts disrupting the operation of the existing Hoang Truong, Lach Truong fishing port*

Upgrading the fishing port may affect the operation of the existing port. However, consultations with stakeholders indicate that the locality has experience in arranging upgrading and dredging activities simultaneously with maintaining the safe operation of fishing vessels and port facilities. The key mitigation measures include:

- *Consultation and inter-agency coordination prior to construction.* The project owner/contractor will consult with stakeholders such as the waterway police, port management board, sub-department of fisheries, and local communities to fully understand port operations and coordinate suitable construction activities.
- *Public disclosure, grievance mechanism, and risk communication.* Information on construction scope, schedule, and grievance mechanism will be posted at easily accessible points within the fishing port to ensure transparency and timely resolution of emerging environmental and social issues. Weather updates and disaster warnings will

be broadcast regularly through the port's public address system to help fishermen proactively respond.

- *Access management and port security.* Control entry into the construction area, particularly where it adjoins berthing and cargo handling activities of fishing vessels. Vessels or organizations that do not comply with port regulations will not be allowed to access the construction area.
- *Phased construction and spatial separation.* Construction will be implemented in phases, with clear barriers separating construction zones from fishing port operation areas both onshore and offshore.
- *Signage and identification signals.* Install signs, flags, and lighting in movement and mooring areas so that fishermen, traders, and residents can recognize construction boundaries, especially at night.
- *Post-construction restoration.* Conduct appropriate restoration of completed areas before moving on to subsequent construction phases to minimize prolonged impacts on the environment and surrounding communities.
- *Maintenance of waterway traffic:* Coordinate with maritime authorities to provide updates on channels, buoys, and wharves to ensure safe vessel access to the port throughout the construction period.
- *Environmental incident monitoring and response.* Maintain on-duty staff, hoist warning signals in the event of storms or tropical depressions; respond immediately to accidents or environmental pollution incidents occurring within the port area.

(ii) Mitigation measures for impacts on sensitive receptors

For areas with PCRs:

Avoidance

- Early consultation and notification: the contractor must inform local communities at least 2 weeks before commencing construction near pagoda sites.
- Awareness raising and worker training: implement compliance with the Code of Conduct (COC) for workers, with particular emphasis on appropriate behavior and language when working near spiritual or religious sites.
- Appropriate site planning and scheduling:
- Do not stockpile materials, waste, or construction equipment within a 100m radius of memorial sites.
- Avoid construction activities on the 1st and 15th days of the lunar month and during holidays/festivals to prevent disruption of spiritual or community events.

Minimization

Control of dust, noise, and waste:

- + Spray water to reduce dust during hot and dry conditions.
- + Restrict noisy activities and construction during ceremonies or religious service hours.
- + Minimize the volume of materials and waste temporarily stored near the pagoda.

Traffic management and access:

- Install warning signs and assign traffic controllers at the entrance to memorial sites when necessary

- Provide safe access routes for people visiting the pagoda.

Remediation

- Reinstate, clear, and clean the site after construction is completed.

For schools along the main transportation routes:

Avoidance

- **Appropriate construction scheduling:** arrange construction activities outside of school hours to minimize noise, vibration, and traffic disturbance. Adjust construction and transport schedules to avoid peak school hours (7:00–8:00, 11:00–11:30, 13:00–13:30, 16:30–17:30).
- **Adjustment of construction schedule:** for special school events such as examinations, opening ceremonies, or school activities, the contractor must reschedule construction and transport to avoid interference.

Minimization

- **Limiting truck traffic during peak hours:** reduce the number of trucks departing construction sites during times when students are arriving or leaving school.
- **Information sharing with schools:** regularly update schools on construction progress, transport changes, and emergency response measures.
- **Driver training:** organize training for drivers on traffic safety around schools, including limiting horn use, reducing speed, and exercising caution when passing school gates.
- **Traffic management and speed control:** deploy personnel to guide traffic at intersections near schools during peak hours (7:00–7:30, 11:00–11:30, 13:00–13:30, 16:30–17:30), and install speed limit signs and reflective barriers along school areas.

Mitigation

- **Strengthened communication:** promptly inform schools of emergency response measures and schedule changes.
- **Support for students and schools:** in case of student health issues or traffic accidents, provide adequate medical and financial support mechanisms.

Compensation

- **Repairing school facilities:** if construction damages school property (fences, gates, trees, etc.), the contractor is responsible for repair or compensation as agreed with the school.
- **Supporting affected students:** in cases where students are injured or experience health impacts due to traffic, the contractor must provide medical and financial support.

For the ship repair workshop near the port

Avoidance

- **Early notification and coordination:** The contractor shall notify the ship repair workshop at least 2 weeks prior to the commencement of construction, allowing them time to adjust their production and operations accordingly.

Minimization

- **Worker awareness raising:** Conduct training sessions for workers on proper conduct regulations, particularly emphasizing the avoidance of disturbances or conflicts with workers at the ship repair workshop near the construction site.

- **Traffic coordination and port safety:**

- o Arrange a system of warning signs, direction signs, and traffic guides within the existing fishing port premises to ensure safety for both construction activities and the operation of the workshops.
- o Assign workers to clean up spilled materials daily on internal roads within the port to avoid obstructing the transportation of materials to the ship repair workshop.

- **Noise and dust control:** install barriers to reduce noise and dust; schedule construction activities to avoid peak production and goods-handling hours of enterprises.

Mitigation

- **Worker behavior monitoring:** Train and closely supervise the behavior of construction workers to avoid disturbances and impacts on the ship repair workshop workers.

Compensation

In case construction activities affect production operations or cause damage to the ship repair workshop, the contractor shall be responsible for repair or compensation in accordance with agreements with the workshop owner.

For nearby seafood processing facilities

Avoidance

- **Early notification and coordination:** The contractor shall notify nearby facilities/enterprises at least 2 weeks prior to the commencement of construction, allowing them time to adjust their production and operations accordingly.

Mitigation

- **Awareness raising and worker training:** Conduct training sessions for workers on proper conduct regulations, particularly emphasizing the avoidance of disturbances or conflicts with workers at nearby processing facilities.
- **Traffic coordination and safety within the port:**
 - o Arrange a system of warning signs, direction signs, and traffic guides within the existing fishing port premises to ensure safety for both construction activities and enterprise operations.
 - o Assign workers to clean up spilled materials daily on internal roads within the port to avoid obstructing the transportation of raw materials and products of the processing facilities.
- **Noise and dust control:** Install noise and dust barriers; arrange reasonable construction schedules to avoid peak hours of production or cargo handling of the enterprises.

Mitigation

- **Worker behavior monitoring:** Train and closely supervise the behavior of construction workers to avoid disturbances and impacts on workers of nearby facilities/enterprises.

Compensation

- **Support to processing facilities:** In case construction activities affect production operations or cause damage to seafood processing facilities, the contractor shall be responsible for repair or compensation in accordance with agreements with the enterprises.

(iii) Mitigation measures for water quality degradation in the Lach Truong River caused by dredging activities

Avoidance

- Dredging activities must be carried out sequentially in small sections within the port. Soft barriers using buoys and warning signs must be installed around the dredging area.
- Suspend dredging operations at night and during adverse weather conditions. When dredging is suspended, dredging equipment such as suction dredgers, barges, etc., must be moved to a designated nearshore area of the port to avoid obstructing vessel navigation (this area must also be equipped with warning signs and nighttime lighting).
- Conduct monitoring and supervision of river water quality, dredged material, and biological characteristics within and outside the port area to track the growth and development of aquatic species, thereby enabling appropriate preventive measures.

Minimization

- Use appropriate dredging equipment to avoid excessive rock fragmentation and bottom sediment disturbance.
- Immediately load dredged materials onto barges after lifting, avoiding long storage in the basin
- Do not overload barges or transport vessels, ensuring safety and avoiding spillage.
- Do not store oil/lubricants on barges or dredging equipment; oil-contaminated materials must be collected and handled by licensed entities.
- Dredging operators must be trained and certified, under supervision of the Construction Supervision Consultant (CSC).
- Provide full PPE to workers, especially life jackets for water-based activities; assign supervisors per shift for emergency response.

Emergency Preparedness

- Establish emergency response plans for waterway incidents, including collisions, engine failures, capsizing, or oil spills. These plans must be approved by the competent authorities.
- Suspend construction and move equipment to designated safe nearshore areas during adverse weather; these areas must be equipped with warning signs and nighttime lighting.
- Conduct regular training for crew members on rescue, evacuation, and incident response procedures on the river.
- Notify and coordinate with border guards, fisheries surveillance, police, waterway traffic, and port authorities for timely support in case of incidents.
- Establish an emergency communication channel between transport vessels, project owner, contractor, and competent authorities to quickly handle abnormal situations.

Restoration

- Clean up and collect spilled materials and waste after each construction phase to ensure no residues remain that could affect water quality.
- Restore water quality and bottom environment by monitoring and adjusting construction progress if prolonged degradation is detected.

- Submit periodic environmental monitoring reports to the competent authorities.

(iv) *Mitigation measures for impacts on aquaculture activities in the Lach Truong River*

Avoidance

- Avoid passing through aquaculture areas: Transport routes for machinery must avoid river sections with shrimp and fish cages.
- Localized construction: Underwater works should only be carried out within the existing port area to limit wider impacts.
- Avoid gathering construction machinery near aquaculture areas.

Minimization

- Control oil and grease leakage; regularly maintain watercraft and equipment (barges, canoes).
- Equip oil spill response materials (containment booms, absorbent materials).
- Conduct construction in favorable weather conditions, avoiding heavy rains that may wash pollutants into the river.
- Utilize existing embankment/dike systems: Current embankments help reduce waves, erosion, and the spread of pollution to aquaculture areas.

Restoration

- Clean up and collect waste after construction, ensuring no residual materials or oil remain on the water surface.

(v) *Mitigation measures for environmental pollution risks at dredged material disposal sites*

- Disposal sites must be pre-identified in compliance with approved construction specifications. Sensitive receiving water bodies or areas near water sources must be avoided. Drainage ditches shall be constructed around the storage area to block wastewater.
- Retaining walls shall be installed around disposal sites where necessary.
- Retaining walls must be completed before dumping begins and regularly inspected during the construction process. The height of the retaining walls must be at least equal to the dumping elevation to prevent overflow, erosion, and to ensure the stability of dredged materials.
- Conduct regular monitoring at disposal sites to ensure materials are not washed away.
- Strictly comply with the approved Dredged Material Management Plan (DMMP), including requirements for transportation, storage, pollution control, and safety at disposal sites.

B- Specific mitigation measures for construction impacts of Subprojects 3 → 9:

The specific construction impacts of the subprojects include: (i) Temporary disturbance to water intake and drainage activities serving aquaculture; (ii) Impacts on local livelihoods; (iii) Impacts from disposal/stockpile sites serving the subprojects; (iv) Impacts on sensitive receptors. The mitigation measures for these specific impacts are presented below:

(i) *Mitigation measures for temporary disturbance of water intake and drainage activities serving aquaculture*

- *Consultation and coordination with local authorities and communities:* The project

owner/contractor shall conduct consultations with stakeholders such as the Commune People's Committee, the Commune Fatherland Front, and local communities to understand water intake and drainage activities for aquaculture and to coordinate construction accordingly.

- *Public disclosure, grievance mechanism, and risk communication:* Information on construction scope, schedule, and grievance mechanisms shall be posted at accessible locations to ensure transparency and timely resolution of emerging environmental and social issues. Weather forecasts and disaster warnings shall be regularly broadcast through the port's loudspeaker system to help local people respond proactively.
- *Phased and spatially separated construction:* Construction shall be implemented in stages, with clear separation barriers between construction areas and local aquaculture activities.
- *Signage and visual signals:* Install warning signs, flags, and lighting in movement areas to help residents recognize construction zones, especially at night.
- *Post-construction restoration:* Properly restore completed sections before moving to the next construction phase, minimizing prolonged impacts on the environment and community.
- *Environmental incident monitoring and response:* Establish on-duty teams, display warning signals during storms or tropical depressions, and handle on-site any accidents or environmental pollution incidents occurring within the port area

(ii) Mitigation measures for impacts on sensitive receptors

For areas with PCRs:

Avoidance

- Early consultation and notification: the contractor must inform local communities at least 2 weeks before commencing construction near pagoda sites.
- Awareness raising and worker training: implement compliance with the Code of Conduct (COC) for workers, with particular emphasis on appropriate behavior and language when working near spiritual or religious sites.
- Appropriate site planning and scheduling:
- Do not stockpile materials, waste, or construction equipment within a 100m radius of memorial sites.
- Avoid construction activities on the 1st and 15th days of the lunar month and during holidays/festivals to prevent disruption of spiritual or community events.

- ***Minimization***

Control of dust, noise, and waste:

- + Spray water to reduce dust during hot and dry conditions.
- + Restrict noisy activities and construction during ceremonies or religious service hours.
- + Minimize the volume of materials and waste temporarily stored near the pagoda.

Traffic management and access:

- Install warning signs and assign traffic controllers at the entrance to memorial sites when necessary
- Provide safe access routes for people visiting the pagoda.

Remediation

- Reinstatement, clear, and clean the site after construction is completed.

For schools along the main transportation routes:

Avoidance

- Appropriate construction scheduling: arrange construction activities outside of school hours to minimize noise, vibration, and traffic disturbance. Adjust construction and transport schedules to avoid peak school hours (7:00–8:00, 11:00–11:30, 13:00–13:30, 16:30–17:30).
- Adjustment of construction schedule: for special school events such as examinations, opening ceremonies, or school activities, the contractor must reschedule construction and transport to avoid interference.

Minimization

- **Limiting truck traffic during peak hours:** reduce the number of trucks departing construction sites during times when students are arriving or leaving school.
- **Information sharing with schools:** regularly update schools on construction progress, transport changes, and emergency response measures.
- **Driver training:** organize training for drivers on traffic safety around schools, including limiting horn use, reducing speed, and exercising caution when passing school gates.
- **Traffic management and speed control:** deploy personnel to guide traffic at intersections near schools during peak hours (7:00–7:30, 11:00–11:30, 13:00–13:30, 16:30–17:30), and install speed limit signs and reflective barriers along school areas.

Mitigation

- Strengthened communication: promptly inform schools of emergency response measures and schedule changes.
- Support for students and schools: in case of student health issues or traffic accidents, provide adequate medical and financial support mechanisms.

Compensation

- Repairing school facilities: if construction damages school property (fences, gates, trees, etc.), the contractor is responsible for repair or compensation as agreed with the school.
- Supporting affected students: in cases where students are injured or experience health impacts due to traffic, the contractor must provide medical and financial support.

(vi) Mitigation measures for impacts on aquaculture activities

Avoidance

- Notify local residents/aquaculture farm owners at least 2 weeks in advance of construction activities.
- The Project Management Unit (PMU) will closely coordinate with contractors, local authorities, and potentially affected households to optimize dredging operations — balancing technical dredging requirements while minimizing adverse impacts on local aquaculture activities
- Agree with local residents on the timing for allowing water intake into their aquaculture farms/areas, as well as the timing for stocking shrimp ponds. Farming seasons will be

arranged with local households to ensure that construction activities do not negatively affect shrimp farming operations — for example, ensuring that river water used for aquaculture is not turbid due to dredging. The National Technical Regulation on brackish water shrimp farming (QCVN 02-19:2014/BNNPTNT on veterinary hygiene, environmental protection, and food safety conditions) will be applied to monitor this arrangement.

- Avoid gathering construction machinery near aquaculture areas.

Minimization

- Control oil and grease leakage; regularly maintain construction equipment.
- Equip oil spill response materials (containment booms, absorbent materials).
- Conduct construction in favorable weather conditions, avoiding heavy rains that may wash pollutants into the water.

Restoration

- Clean up and collect waste after construction, ensuring no residual materials, oil, or grease remain on the water surface

(vii) Mitigation measures for environmental pollution risks at dredged material disposal sites

- Disposal sites must be pre-identified in compliance with approved construction specifications. Sensitive receiving water bodies or areas near water sources must be avoided. Drainage ditches shall be constructed around the storage area to block wastewater.
- Retaining walls shall be installed around disposal sites where necessary.
- Retaining walls must be completed before dumping begins and regularly inspected during the construction process. The height of the retaining walls must be at least equal to the dumping elevation to prevent overflow, erosion, and to ensure the stability of dredged materials.
- Conduct regular monitoring at disposal sites to ensure materials are not washed away.
- Strictly comply with the approved Dredged Material Management Plan (DMMP), including requirements for transportation, storage, pollution control, and safety at disposal sites.

5.1.4. Mitigation measures during the operational phase

5.1.4.1. Mitigation measures for impacts of Subprojects 1 - 2 during the operation of fishing ports

Measures to reduce odors, emissions and noise:

a) Dust and Air Emission Mitigation Measures

Control of dust and air emissions from vessels, trucks, and other vehicles transporting and handling aquatic products:

Avoidance

- Design parking lots and access roads to be wide and well-organized to avoid traffic congestion during peak hours.
- Install clear traffic instructions and regulations at the port, requiring drivers to disembark, switch off engines, and park only in designated areas.

- Vessels must travel at regulated speeds and dock properly to avoid disorder and negative impacts on water quality.

Minimize

- Fully pave all internal roads and arrange regular cleaning staff to minimize dust generation.
- Sweep and spray roads twice daily to control dust within the port area.
- All vehicles must comply with speed, traffic safety, and environmental sanitation regulations to reduce emissions and prevent congestion or disorder.
- Vessels and vehicles must comply with national technical standards on exhaust emissions (NO_x, SO_x, etc.).
- Encourage the use of low-sulfur fuels, alternative fuels, or less-polluting fuel blends.
- Conduct regular maintenance of vessels and vehicles to ensure operational efficiency and emission reduction.
- Minimize engine idling during loading/unloading operations.
- Reduce VOC emissions from fuel storage and transport activities by using suitable equipment.
- Install sprinkler systems in grass areas and gardens for irrigation, maintaining humidity and improving the local microclimate.

In addition, there are additional management measures for the 06 subprojects during operation:

- Ensure green space accounts for approximately 20% of the subproject area.
- Install sprinkler systems in green spaces to maintain humidity and improve the microclimate.

Control of Odors Generated from Fishing Vessels upon Arrival and from Cold Storage Facilities for Aquatic Products

Avoid

- Design and arrange new facilities rationally to minimize the transport distance from vessels to storage areas.
- Handle and unload aquatic products promptly upon docking to avoid prolonged storage that may cause fishy odors and emissions from decomposition.
- Use sealed containers or specialized covered vehicles for transporting aquatic products and waste to prevent odor dispersion into the environment.

Minimize

- Clean cold storage facilities regularly (1–2 times per day) to reduce odors generated from organic compounds and animal fats.
- Ensure proper ventilation of cold storage facilities to avoid odor accumulation from decomposition.
- Do not dispose of wastes such as fish scales, fish guts, shrimp shells, etc. into drains, rivers, or service areas, to prevent air and water pollution.
- Train staff to handle products quickly and properly in accordance with procedures to limit odor generation during operation.

Offset/Compensation

- Plant green trees to create biological barriers around the port area to absorb odors and improve the microclimate.

Odor Control from Public Toilets and Wastewater Treatment Plants:

Avoid

- Prohibit the disposal of spoiled aquatic products into drains, rivers, or the sea, as this causes pollution and degrades the port's landscape.
- Wastewater treatment plants must be constructed as closed systems with odor collection and treatment systems, and surrounded by a minimum 15-meter ecological buffer zone in compliance with QCVN 01:2021/BXD for mechanical, physicochemical, and biological treatment facilities.
- Design solid waste storage areas separately from main operational areas to limit odor dispersion.
- Wastewater pumping stations must be underground reinforced concrete structures with submersible pumps to minimize odors and maintain aesthetics.

Minimize

- Regularly collect generated solid waste, ensuring no accumulation at the port.
- Waste containers awaiting collection must have tight lids and be cleaned after each use.
- Regularly clean and spray deodorizing agents at waste collection areas.
- Apply biological agents to minimize odors and pests.
- Plant greenery to improve landscapes and limit odor dispersion to residential areas.
- Port management authorities must contract licensed companies for waste transport in accordance with regulations.
- Install tightly sealed manhole covers and regularly dredge sediment, maintaining related equipment.

Mitigate

- Immediately address incidents of wastewater leakage or waste overflow causing odors, combined with deodorization using chemicals or biological agents.
- Rehabilitate the collection and drainage system if prolonged odor generation is detected.
- Construct sludge treatment systems and equipment in accordance with approved designs to ensure effective operation.
- Conduct periodic air quality monitoring every three months to assess and control odor emissions.
- Install and operate two odor collection and treatment systems at the two WWTPs, specifically: Odor generated in the wastewater treatment system of subproject 1 and subproject 2 will be extracted by exhaust fans and directed to an activated carbon adsorption tower and a primary absorption tower containing Ca(OH)_2 absorbing solution

b) Noise Impact Mitigation Measures

Technical measures for equipment and vehicles

- All vehicles operating within the fishing port must undergo registration as required by

regulations; conduct periodic inspections and maintenance of equipment, vehicles, and machinery to ensure that their operation does not generate noise levels exceeding the permissible standards.

- Encourage ship owners and transport units to equip vessels and trucks with silencers, especially for large-capacity vehicles frequently operating at the port.
- Require that engines be switched off when vehicles are parked or vessels are moored at the port.
- Prioritize the use of low-noise equipment, install noise barriers, or situate noisy facilities far from sensitive areas.

Operational management measures

- Restrict operations during rest hours (midday and night).
- Require engines to be turned off when vessels dock and during cargo handling waiting times.
- Install traffic signs in the port to limit speed to 10 km/h and provide noise-reduction operational guidance.

Infrastructure design measures

- Locate reception, sorting, and service facilities away from existing residential areas to minimize noise impacts on local communities.
- Establish green buffer zones around port areas to absorb and reduce noise transmission to residential areas.
- Minimize intersections between transport routes and residential areas when vessels and vehicles enter or leave the fishing port.

Training and awareness raising

- Organize regular training sessions for fishermen, drivers, and port staff on noise impacts and mitigation measures.

c) Wastewater Impact Mitigation Measures

Control of domestic wastewater, wastewater from onshore service areas, and wastewater from vessels operating in the water area in front of the port

Stormwater runoff: At each subproject 1, 2:

- + The stormwater collection and drainage system is designed separately from the wastewater system.
- + The stormwater drainage system uses reinforced concrete pipes BTCT D800/BTCT D400, with inspection manholes and direct catch basins arranged along the route, at intervals of about 20–40 m/manhole.
- + The internal yards and roads are concreted, and project staff are assigned to clean the project premises to prevent waste from being washed away by rainwater.
- + Regular dredging and maintenance of the stormwater collection and drainage system are conducted.
- Domestic wastewater at each subproject 1 and subproject 2 (port logistics areas, docked vessels) → 3-compartment septic tank → centralized wastewater treatment system with a capacity of 200 m³/day-night → environment.
- Wastewater from the seafood receiving and sorting area is conveyed to the centralized

wastewater treatment system (200 m³/day-night) for further treatment.

- All wastewater generated during the operation phase of subprojects subproject 1 and subproject 2 is collected at the wastewater treatment plant of each subproject (200 m³/day-night capacity, with the option of 2 modules, each 100 m³/day-night). Treated wastewater must meet QCVN 11-MT:2015/BTNMT – National Technical Regulation on Seafood Processing Wastewater (Column B, K_q = 1.2, K_f = 1.1) before being discharged into the Lach Truong river at one discharge point with the following coordinates under VN2000 coordinate system, central meridian 107°45', projection zone 30: X(m) = 2187536.629; Y(m) = 594373.529.

Technological process:

Wastewater from sources → Collection tank → Oil and sand separator → Equalization tank → UASB tank → Anoxic tank → MBBR tank → Biological settling tank → Disinfection tank → Environment → Treated wastewater meets QCVN 11-MT:2015/BTNMT (Column B, K_q = 1.2, K_f = 1.1) → Receiving water bodies: the drainage canal along the southern road of Hoang Truong fishing port → Lach Truong River (subproject 1) and De Canal (subproject 2).

Ballast water mitigation measures (applied to all 2 subprojects)

- Require fishing vessels to install oil–sludge separation equipment before ballast water discharge, ensuring residues are collected and treated at the port.
- Establish ballast water reception facilities at the port and contract licensed companies for collection and treatment in accordance with Decree 58/2017/ND-CP and Circular 41/2017/TT-BGTVT.
- Conduct periodic ballast water quality checks on vessels (every 6–12 months) to detect and address pollutants and invasive species.
- Provide communication and training for fishermen on ballast water handling procedures, raising awareness of marine environmental protection.
- Encourage application of the Ballast Water Management (BWM) Convention requirements for large-capacity or inter-provincial fishing vessels.

d) Solid Waste Mitigation Measures

Management of ordinary solid waste:

Avoidance

On vessels

- Establish a system for collecting and handling solid waste generated from fishing vessels during operation, in accordance with national regulations.
- Food-related waste transported to the port must be managed under local regulations to protect human and animal health¹⁸.
- Strictly prohibit the discharge of solid waste from vessels while anchored at the port, in compliance with MARPOL and national regulations.

On land

- The Management Boards of the six fishing ports must strictly manage and minimize waste generated during sorting and receiving of fish, improving the environment at sorting houses

¹⁸ Countries have specific regulatory requirements for the handling of food waste originating from international voyages. The goal of most of these regulations is to prevent the cross-border spread of infectious diseases.

and across the port.

- Port operators must provide adequate facilities for wastewater and solid waste reception and management to meet the needs of the port and the vessels it serves.
- The provision of waste reception facilities must be coordinated with local authorities, in line with commitments under the MARPOL Convention by port states.
- Port operators must prepare environmental incident prevention, control, and response plans. Fuel suppliers must develop emergency response plans for oil spills to prevent large-scale dispersion that could cause significant harm to the natural environment and human health.

Mitigation (Minimization)

- Contract with licensed units with full competence to collect, transport, and treat all daily domestic solid waste at the 02 ports, in compliance with the Law on Environmental Protection and relevant guiding documents.
- Each subproject must designate a solid waste collection area with at least one day's storage capacity, ensuring compliance with technical requirements for waste storage facilities.
- Domestic solid waste at fishing ports (including from staff at the operation area and from fishermen/traders/visitors in public areas) shall be collected into 12 covered bins of 120 liters each, with mandatory segregation: food waste, recyclable/reusable waste, and other domestic waste.
- Sludge from wastewater treatment processes at the 05 wastewater treatment plants must be collected, transported, and treated by licensed contractors in compliance with regulations.
- Sludge from the drainage and rainwater systems at the 02 ports must be dredged, collected, and treated by licensed contractors every 6 months.
- Recyclable and reusable solid waste must be collected at designated places and handled once per week in accordance with regulations.
- Fishery by-products from the sorting process must be collected into 02 bins of 500 liters each. Traders must collect them daily and transfer them to processing units for animal feed production.

Hazardous waste management:

- The Port Management Boards must collect hazardous waste and periodically transfer it to licensed, competent units for collection, transportation, and treatment in compliance with regulations.
- Hazardous waste must be collected and stored in a designated hazardous waste storage warehouse within each subproject's waste collection facility. The warehouse must comply with current standards, with specific requirements as follows:
 - + Concrete floor, partitioned compartments, roof cover, and warning signs for hazardous waste areas.
 - + Raised curbs (10 cm) and a containment sump (40 × 40 × 40 cm) to prevent liquid spills.
 - + Equipped with full emergency response and fire prevention/firefighting equipment.

Collection and storage plan:

- Waste such as oily rags, broken neon lamps, used batteries, accumulators, and bottles/containers must be segregated in accordance with hazardous waste management

regulations. They must be stored in specialized containers within the hazardous waste warehouse.

Packaging waste from green space maintenance activities (fertilizers, pesticides) must be collected after use and stored in the hazardous waste warehouse.

e) Measures to Mitigate Impacts on Water Quality and Aquatic Life

Mitigating impacts on water quality:

- Implement ballast water control measures as described in section (c) above.
- Implement solid waste and hazardous waste control measures as described in section (d) above, to prevent their release into water bodies.
- Effectively operate wastewater treatment plants at each subproject, ensuring treated wastewater meets standards before discharge into receiving rivers/seas.
- Ensure seafood sorting and receiving areas are equipped with oil–grease traps and trash screens to prevent organic waste from entering water bodies.
- Particularly, rainwater runoff from areas with potential oil leakage or hazardous materials (fueling or fuel transfer points) must pass through oil separators for sedimentation and oil removal before discharge into receiving waters.
- Fishing vessel owners must comply with MARPOL and national regulations on oil, sludge, and wastewater management during operations. For example: oily waste and wastewater should be collected in barges, trucks, or centralized collection systems and tanks; wastewater with toxic chemicals from large-scale tank cleaning must be collected for onsite or appropriate treatment before discharge; incompatible wastes must not be mixed in the collection system; treatment methods must be based on wastewater characteristics.

Water quality monitoring:

- Establish a periodic surface water monitoring program in front of the port.
- Track indicators such as turbidity, suspended solids, oil and grease, dissolved oxygen, etc., for timely management adjustments.

Mitigating impacts on aquatic life:

- Limit fishing port operations to the designated water area in front of the wharf (36 m wide, 400 m long), avoiding widespread impacts on the river/sea ecosystems of each subproject.
- Prohibit direct wastewater discharge into rivers; all wastewater must be treated to meet standards before release into receiving waters.
- Control chemical use in preservation and cleaning activities to avoid impacts on aquatic organisms.
- Conduct awareness campaigns for fishermen and port staff on protecting water quality and aquatic ecosystems.
- Collect packaging and food leftovers from operations; prohibit indiscriminate littering into surrounding areas or rivers/seas.
- Raise awareness among local residents on vessel maintenance to prevent oil leakage into rivers/seas.
- Comply with fishery development planning and sustainable aquatic resource management of the project provinces.

e) Measures to Mitigate Impacts on Traffic at the Port Area

Ensuring road traffic safety

Avoidance

- Design port internal transport infrastructure rationally from the outset, including separate lanes for trucks, motorcycles, and pedestrians to avoid conflicts.
- Schedule operating hours for different vehicle types to avoid peak-hour congestion.
- Enforce vehicle weight checks for inbound and outbound cargo to prevent overloading, road damage, and ensure safety.
- License and strictly control cargo transport vehicles, ensuring they meet technical and safety standards.

Mitigation/Minimization

- Deploy traffic controllers at critical points (port gates, intersections of internal roads) during peak hours when fishing vessels land their catch (4:00–6:00 am).
- Organize awareness campaigns on road and waterway traffic laws for residents and vehicle operators.
- Require drivers to be trained in safe driving skills, especially those transporting cargo from the port.
- Provide organized parking and waiting areas to reduce disorderly parking that obstructs traffic.
- Enforce speed limits and install clear signage within the port area to minimize accident risks.
- Install CCTV surveillance at critical points (port gates, intersections of internal roads) to detect violations in real time.
- Conduct periodic inspections to assess traffic safety and promptly adjust management measures.
- Relevant authorities such as the Port Authority, Transport Inspectors, Police, and local government must closely coordinate in managing and ensuring traffic safety at the port area.

Ensuring waterway traffic safety

Avoidance

- Install appropriate waterway traffic signs at high-density traffic areas.

Mitigate/Minimize

- Raise public awareness of vessel maintenance. Raise awareness of safe seafood transport: strict compliance with waterway traffic safety, no overloading, etc.
- Clearly regulate waterway routes and operating schedules for different vessel groups to reduce conflicts.
- Conduct regular technical inspections of vessels operating at the port.
- Deploy waterway traffic control forces at complex intersections during peak hours.

f) Measures to Mitigate and Prevent Risks and Incidents

Possible incidents during fishing port operation include: traffic accidents, occupational accidents, environmental incidents, and natural disasters/extreme weather events. Mitigation measures for these incidents are presented below:

f.1. Traffic Accident Incidents

Measures to Mitigate Waterway Traffic Accidents

Avoidance

Measures to prevent traffic accidents from the outset:

- Provide formal training and issue professional certificates for all crew members and vessel operators, including rescue, emergency response, and safe navigation skills.
- Provide safety instructions for crew members on emergency situations such as fire, explosion, sinking, or storms.
- Install waterway traffic signs and signals in areas with high vessel density or complex hydrological conditions
- Establish coordination and traffic routing procedures at fishing ports and storm shelter anchorages to avoid congestion and collisions.
- Regularly maintain and inspect watercraft (fishing vessels, canoes, boats), especially engines, electrical systems, and safety equipment such as life buoys, life jackets, and firefighting tools.
- Equip vessels with modern communication systems such as VHF, radar, and GPS devices to monitor movement and avoid collisions at sea.

When a waterway traffic accident occurs at fishing ports or storm shelter anchorages, prompt and accurate response is essential to ensure safety and minimize damage. The following steps should be taken to mitigate and address such accidents:

Mitigation

- Check the condition of people and vessels: determine the number of injured, missing, or drowning-risk persons. Inspect the accident vessel to assess its condition and damage.
- Secure the accident area: establish a safety zone around the accident site to prevent additional hazards from passing vessels.
- Organize rescue: use rescue boats or canoes to bring injured persons safely ashore. Ensure sufficient life buoys, life jackets, and rescue equipment are available.
- Provide first aid on site: apply immediate measures such as artificial respiration, bleeding control, wound bandaging, and transfer to medical facilities if necessary.
- Notify relevant authorities immediately: contact rescue agencies, Port Authority, border guard forces, and other related bodies for timely assistance.

Remediation

- Record the situation: provide detailed accident information to investigators, including time, location, vessel, initial cause, and number of people affected.
- Identify accident causes: authorities investigate whether accidents stemmed from technical failures, human error, or adverse weather.
- Correct the incident: if the vessel is damaged (engine failure, hull damage), take temporary measures to tow it to a repair site.

- Evaluate the accident and improve procedures: review operational processes, safety systems, and crew training to prevent recurrence.

Measures to Mitigate Road Traffic Accidents

Avoidance

- Ensure access roads to fishing ports and storm shelter anchorages are built and maintained in good condition. Roads must be upgraded and regularly maintained to prevent deterioration and reduce accident risk
- Install clear, visible, and adequate traffic signs, especially for speed limits and high-risk areas (slopes, sharp curves)
- Set appropriate speed limits for each area, particularly around ports and storm shelters. Conduct regular inspections and strictly manage vehicles entering the area to ensure safety
- Provide safe driving training and road safety awareness programs for cargo drivers and workers.
- Design transport infrastructure with adequate visibility and turning radius, meeting technical standards to eliminate accident-prone spots.

Minimization

- Maintain designated parking areas for vehicles to prevent illegal parking, congestion, or traffic obstruction.
- Establish a traffic coordination system to prevent congestion, especially during peak periods when vessels dock or storms occur.
- Ensure risk mitigation measures during adverse weather, particularly storms or heavy rain, such as warning lights, anti-skid systems, and requiring vehicles to reduce speed.
- Develop emergency response plans for road traffic accidents, including rescue and relief procedures, to enable quick handling and damage reduction.
- Install traffic surveillance cameras at intersections and critical points to detect early violations and incidents.
- Conduct regular inspections of vehicle technical conditions, especially brakes, lights, and tires, for all vehicles entering the port.
- When a road traffic accident occurs near fishing ports or storm shelter anchorages, prompt and accurate handling is essential to ensure safety and minimize damage. The following steps should be taken for each case:

Mitigation

- Deploy rapid response teams at the port area to handle traffic accidents immediately.
- Stop vehicles at once: drivers must stop safely and activate hazard warning lights.
- Protect the accident scene: for serious accidents, use warning signs and hazard lights to halt traffic and secure the site, avoiding secondary accidents.
- Assess injury status: do not move victims unnecessarily. If spinal, head, or serious injuries are suspected, do not move them until professional rescue arrives—unless the site is unsafe.
- Provide first aid: basic measures such as bleeding control, keeping victims warm, or artificial respiration if needed.

- Call an ambulance and medical rescue team to transport victims to hospital promptly.
- Notify authorities: immediately call traffic police, port security, or other relevant bodies to handle the incident.
- Provide detailed information: report accurate location, time, vehicle conditions, and victim status to assist responders.

Remediation

Measures to address post-accident consequences:

- Investigate accident causes: authorities determine whether caused by driver error, technical failure, or road conditions.
- Record the accident: prepare reports with participation from relevant parties as a basis for further action.
- Clear the site: after investigation, remove damaged vehicles, repair or clean roads if necessary.
- Restore traffic: implement traffic flow control and guide vehicles safely.
- Evaluate the accident: reassess road safety measures, operations, and infrastructure to improve prevention.
- Update lessons learned: integrate findings into traffic management plans and regular driver/port staff training.

Risk of falling overboard and drowning for vessel operators/fishermen

Avoidance

- Vessels must have high stability: ensure vessels are designed for stability, especially when sailing in rough seas or high waves. Anti-capsize systems must be regularly inspected and maintained.
- Design vessels with clear and accessible emergency exits.
- Install handrails and guardrails: provide sturdy handrails or guardrails in hazardous areas to help fishermen move safely and prevent slips.
- Ensure dry, non-slippery decks by using anti-slip coating or rough surfaces to reduce fall risks during rain or waves.
- Provide spacious, unobstructed working areas on vessels, docks, and storm shelters for safe, easy movement.
- Establish pre-departure safety checks, including lifesaving equipment, communications, weather conditions, and crew health.
- Require voyage and safety logs to monitor unusual situations and improve operations after each trip.
- Assign tasks clearly and supervise closely, especially during bad weather or offshore trips.
- Update and monitor weather conditions, particularly storm seasons, to prevent sailing in dangerous situations.
- Provide regular training for fishermen and vessel operators on safety skills, vessel stability, and basic rescue techniques. Raise awareness on drowning risks and personal protective equipment.

- Equip vessels with early-warning systems for instability, such as horns, warning lights, or electronic devices suited to vessel type.

Minimization

- Life jackets: all crew, vessel operators, and fishermen must wear life jackets at all times while working on board, especially near ports or in bad weather.
- Safety harnesses: provide harnesses for crew working in hazardous conditions with strong waves or winds.
- Safety shoes and gloves: provide anti-slip footwear and gloves for safe movement and reduced fall risk.
- Adequate lighting: ensure full lighting in work areas on vessels and around ports at night to reduce slip and collision risks.
- Emergency communications: radios or satellite phones for contacting rescue agencies in emergencies.
- First aid/rescue stations near ports: maintain nearby stations or teams at fishing ports and storm shelters for quick response.
- Emergency transport: provide ambulances, lifeboats, and necessary medical supplies for injuries or drowning cases.
- Personal locator beacons (PLBs): supply for crew working alone or in dangerous conditions, especially offshore vessels.
- Individual first-aid kits: equip each crew member, especially offshore, with basic supplies for small injuries.
- Encourage installation of man-overboard alarms on large fishing vessels or enclosed cabins if technically and financially feasible.

Mitigation

Emergency measures to reduce harm when falling overboard/drowning occurs:

- Conduct regular rescue drills for fishermen and vessel operators, including rescue techniques, lifesaving equipment use, and basic first aid.
- Rescue victims: if someone falls overboard, use rescue boats/canoes or throw flotation devices for support.
- Establish rapid response procedures, including assigning rescuers, deploying flotation equipment, and contacting rescue forces.

Remediation

- Record and report incidents promptly for investigation and procedural improvement.
- Hold debriefings with crew after each incident to update safety protocols.
- Conduct periodic risk assessments and update safety management and protective equipment accordingly.
- Provide psychological support and health recovery for crew after serious accidents to restore working capacity and reduce long-term mental impacts.

Incident: Fishing vessels docking beyond the design capacity

Avoidance

- The technical infrastructure and environmental treatment facilities of the fishing port shall be designed to accommodate the maximum number of vessels on peak days in accordance with the approved design.
- The breakwaters shall be designed in segments based on the vessel capacity, ensuring minimization of vessel congestion when berthing.
- Develop a vessel traffic management plan based on fishing seasons and catch volumes, in order to forecast peak periods and adjust port operations accordingly.
- Designate additional temporary mooring areas or buffer zones outside the port to regulate vessels exceeding the design capacity.

Minimization

- The port management authority shall assign staff to guide vessels in and out during peak days, ensuring order and limiting delays or security issues.
- Establish a pre-registration system for vessels before docking, particularly during peak seasons, to control traffic flow and allocate berthing positions appropriately.
- Apply information technology (e.g., port management software) to monitor vessel arrivals in real time, supporting efficient coordination.
- Enhance communication and early warnings for fishermen through loudspeakers, SMS, or electronic boards at the port to prevent congestion.
- Organize vessel traffic by size, type of activity, and berthing time to optimize port space and usage.

Mitigation

- Deploy a rapid response team at the port, including security staff, coordinators, and technical support teams to handle emerging situations.
- Arrange for vessel rotation or temporary mooring outside the port, combined with announcements of estimated docking times to reduce immediate pressure.

Remediation

- Review and periodically update the vessel traffic management plan based on actual operations and catch growth trends.
- Collect and analyze data after each peak period to adjust designs, operational procedures, and vessel reception capacity in the future

f.2. Measures for Prevention and Mitigation of Occupational Accidents

Avoidance

- Develop a fishing port management regulation that enhances capacity on occupational health, safety, and community protection for the port authority, fishermen, service providers, and traders.
- The port's operation and maintenance system must include functions to respond to potential impacts on occupational health and community safety caused by air pollution, noise, fire, explosion, traffic accidents, port security, structural collapse, landslides, or subsidence due to extreme weather.
- Design a reasonable port layout, with clear separation between mechanized equipment operation zones and pedestrian zones to avoid collisions
- Establish a pre-shift safety inspection system, including checking equipment, work

areas, and worker health conditions.

- Provide clearly marked emergency exits, adequate safety signage, and arrange first-aid stations at strategic points within the port.
- Conduct regular occupational safety training, first-aid, and emergency response drills for all workers and port staff.

Minimization

Minimization measures for accidents caused by mechanized equipment such as cranes, forklifts, etc.)

- Ensure all workers operating mechanized equipment are properly trained and certified for safe operation.
- Conduct periodic inspection and maintenance of mechanized equipment.
- Use personal protective equipment (PPE): Operators must wear helmets, safety shoes, gloves, etc.
- Apply standard operating procedures (SOP): Workers must follow prescribed steps to avoid mistakes during operations
- Install warning systems when mechanized equipment operates near pedestrian areas.

Minimization measures for accidents caused due to unsafe working conditions

- Ensure safe working conditions: Work areas must be designed, constructed, and maintained safely, with adequate lighting, non-slippery floors, and no hazardous obstructions.
- Conduct periodic risk assessments to promptly detect and address potential hazards.
- Provide safety information and guidance: All workers must receive clear instructions on safe working procedures and safety signage at work sites.
- Establish a rapid feedback system when unsafe conditions are detected.

Minimization (for occupational health and disease risks)

- Conduct regular health check-ups for all workers to detect early occupational diseases and ensure workers are fit for duty.
- Provide adequate PPE suited to the port environment, including dust masks, gloves, anti-slip boots, waterproof and chemical-resistant clothing to protect workers from hazards such as dust, humidity, chemicals, and pathogens, thereby preventing diseases like pneumonia, poisoning, or dermatitis.
- Health education: Organize training sessions on health protection, disease prevention, and proper nutrition for workers.

Minimization (for environmental accident risks at the port)

- Maintain a clean, well-ventilated work environment, free of dust and harmful substances.
- Provide fire and explosion prevention equipment: Ensure that areas with risks (such as fuel or chemical storage) are equipped with adequate firefighting systems and are inspected regularly.
- Disaster prediction and response: Establish measures such as drainage systems, equipment protection, and evacuation plans in case of storms, high waves, or other disasters.

- Establish and implement a hazardous chemical and material management procedure at the fishing port, including classification, storage, transportation, and safe use of common substances such as:
 - + Diesel, FO/DO fuel oils, and lubricants for engines and mechanized equipment;
 - + Industrial detergents and disinfectants such as chlorine and formalin for cleaning ship holds and processing areas;
 - + Refrigerants such as ammonia or glycol used in cold storage systems;
 - + Industrial solvents such as acetone and xylene from ship repair activities;
 - + Flammable/explosive chemicals such as LPG and gasoline stored at fuel depots.

The procedure must ensure clear warning signs, safe isolation zones, adequate firefighting equipment, and regular staff training on chemical spill response and emergency handling.

Remediation

- Conduct regular rescue drills, including rescue techniques, use of life-saving equipment, and on-site first aid.
- Protect victims: use rescue boats, flotation devices, and mobilize local forces.
- Establish a rapid response team at the port to handle occupational accidents.
- Provide an internal emergency communication system for quick incident notification.

f.3. Measures for Environmental Incident Response

f.3.1. Oil Spill Response Measures

Oil spill response in fishing vessel operations must comply with Decision No. 12/2021/QĐ-TTg dated March 24, 2021 of the Prime Minister, supplemented with practical measures and international guidelines.

Avoidance

- Prohibit discharge of oily wastewater or oil-contaminated materials into rivers or receiving waters.
- Train fishermen in safe vessel operation to prevent oil leaks from engines and fuel systems.
- Conduct periodic inspection of fuel systems, engines, and oil tanks on fishing vessels to detect leakage risks.
- Prohibit use of old vessels that fail to meet fuel safety and environmental standards.

Minimization

- Develop, submit, and obtain approval of an oil spill response plan, and implement it effectively once issued
- Invest in equipment and materials to gradually improve self-response capacity of the port and waterborne transport.
- Organize annual training and at least biannual drills for staff and response forces.
- Sign agreements/contracts with competent agencies/units for oil spill response support.
- Equip each fishing vessel with a basic oil spill response kit (booms, absorbent materials, buckets, etc.). Equipment should be adapted by vessel type (e.g., offshore vessels with absorbents; nearshore vessels sharing equipment via fishing teams or the port).

- Organize oil spill response training specifically for fishermen, suited to their vessel conditions.
- Map coastal ecological sensitive areas for priority protection during oil spills.

Mitigation

- Proactively deploy response activities, mobilizing resources promptly and effectively when spills occur.
- Immediately notify authorities of spill location, scale, and cause, and begin on-site response:
 - + Ensure site safety; mobilize all available resources to contain oil; deploy booms to prevent spread.
 - + Use available means such as absorbents, buckets, etc., to collect oil.
 - + Mobilize local communities to assist in response.
 - + Pump remaining fuel in the affected vessel to another storage vessel to ensure safety during the response process. During the transfer, measures must be implemented to prevent any oil spillage

Compensation

- If it is determined that the port response is ineffective or the oil spill incident may cause more serious consequences, promptly report to the provincial/city People's Committee for direct response guidance.
- Coordinate with relevant local authorities to monitor and assess the effectiveness of oil spill remediation efforts.
- Temporarily store and safeguard the collected oil for reuse or to ensure compensation for damages caused by the spill. The handover of collected oil should be based on the agreed compensation amount with the vessel owner.
- Upon completion of remediation activities, report to the competent authorities on the situation and results of the incident response.
- Assess environmental damage after the incident in accordance with the guidelines of the Ministry of Natural Resources and Environment.
- Implement compensation for damages in accordance with the provisions of the Law on Environmental Protection.

f.3.2. Fire and explosion prevention and response

Prevention and response to fire/explosion incidents in fishing port and vessel operations must comply with current laws, particularly the Law on Fire Prevention and Fighting, Decree 136/2020/ND-CP, and national technical standards.

Avoidance

- Train fishermen and port staff in fire prevention and firefighting skills.
- Comply with national fire safety standards at fishing ports, landing sites, and vessels.
- Equip port warehouses, offices, and logistics facilities with fire/explosion prevention systems in compliance with national standards (fire extinguishers, fire alarms, hydrants, firefighting boats/canoes, etc.).
- Provide portable fire extinguishers suitable for fishing vessels (e.g., ABC powder, CO₂), ensuring capacity to handle initial incidents.

- Clearly designate no-fire, no-smoking, no-welding areas at the port and on vessels.
- Conduct periodic inspections of electrical, fuel, and flammable systems on vessels and at the port.

Minimization

- The fire water supply system includes both indoor and outdoor firefighting water systems (at offices and storage warehouses).
- For buildings within the fish port, fish wharf, or mooring areas with a volume > 5,000 m³, two fire hydrants must be installed in easily visible and accessible locations, with a water flow rate of 2.5 liters/second per hydrant. Additionally, warehouses should be equipped with foam fire extinguishers.
- Establish emergency response procedures in case of fire or explosion on vessels or at the port.
- Mobilize on-site personnel and coordinate with the local fire prevention and firefighting police

Compensation

- Assess environmental damage after fire/explosion.
- Compensate damages as required by the Law on Environmental Protection.
- Restore sites and manage waste generated after the incident.

f.3.3. Response measures for water supply, drainage, and wastewater treatment failures

Avoidance

- Develop a maintenance plan: There should be a plan for regular maintenance and inspection of the water supply, drainage, and wastewater treatment systems to promptly detect signs of damage or system degradation.
- Inspect the quality of pipeline materials: Use high-quality materials for the piping system, such as stainless steel or corrosion-resistant plastic that can withstand pressure and harsh environments.
- Inspect system structure: Ensure that joints, valves, and other system components are not loose, damaged, or corroded.
- Comply with all design, construction, operation, maintenance, and servicing requirements of the wastewater treatment system.
- Design the water supply and drainage systems clearly separate from the wastewater treatment system to prevent cross-contamination in case of incidents.
- Choose the locations for wastewater treatment stations and technical pipelines to avoid areas prone to erosion, flooding, or weak soil foundations.
- Train wastewater treatment operators on the system's operation and maintenance program.
- Design wastewater treatment plants for continuous operation; include shut-off valves at component tanks to increase storage capacity, ensuring maximum retention time in case of incidents.

Minimization

- Regularly monitor the operation of machinery and the condition of treatment tanks; prepare backup equipment for machinery prone to failure, such as wastewater pumps,

blowers, sludge pumps, etc.

- Arrange motors/pumps in all modules with one active unit and one standby unit (operating alternately) to ensure the system remains functional during incidents.
- Provide a backup power supply for the centralized wastewater treatment station.
- Assign personnel to operate and supervise the wastewater treatment system according to the trained procedures.
- Install leak or abnormal pressure warning systems on main pipeline sections.
- Establish rapid inspection procedures following heavy rainfall, high tides, or nearby construction activities.

Mitigation

- Design and arrange emergency tanks at each wastewater treatment station to temporarily store wastewater in case of emergency.
- In the event of equipment or machinery failure at the wastewater treatment plant, immediately close the discharge valve; wastewater shall be diverted to the emergency tank for cause and location identification. Only treated wastewater meeting standards may be discharged into the environment.
- When an incident occurs, the wastewater treatment station operator must notify the management unit, isolate the faulty module, and ensure that wastewater from the faulty module is not discharged into the environment. Wastewater generated from project activities shall be stored in the emergency tank, while treatment continues normally with the remaining modules.
- After the issue is resolved, all wastewater from tanks within the faulty module shall be pumped back to the equalization tank for further treatment until it meets standards before discharge.
- Prepare emergency supplies in advance, such as shut-off valves, replacement pipes, and water pumping equipment, to enable rapid on-site response.
- Establish a rapid response team at the fishing port to handle environmental incidents related to wastewater

Remediation

- Conduct rapid environmental impact assessments after incidents and report to authorities.
- Restore affected systems and areas, including sludge removal, disinfection, and water quality testing.

5.1.4.2. Mitigation measures for operational phase impacts of Subprojects 3-> 9

Incidents of canal/ditch bank erosion in Subprojects 3 -> 9

- Regularly inspect the drainage system (culverts) and embankment slopes along the routes to address erosion incidents that may cause soil and surface water pollution in the area.
- To minimize impacts from tidal surges, sea level rise, and seawater intrusion into inland areas, the management unit shall prepare a plan for periodic inspection of the entire embankment before the rainy and storm season. Any damaged sections will be immediately repaired; in urgent cases, sandbags, gabions, and tarpaulins shall be used to ensure the highest possible flood and tidal surge resistance.

- The works are designed to withstand level-12 storms. In the event of storms exceeding this level or tsunamis causing damage, after the storm the management unit shall mobilize forces to inspect the entire route, then develop a repair plan to submit to higher authorities for timely implementation to maintain the designed storm resistance capacity.
- Localized flooding management: Construct drainage culverts as designed to ensure optimal water discharge capacity, and inspect/dredge the creek system before the rainy and storm season.

Mitigation measures for dust and emissions at Subprojects 3 -> 9

- When the operation and maintenance (O&M) road is put into operation, vehicle traffic will become a source of air quality impacts. The following measures will be applied to mitigate these impacts:
 - Prevent architectural structures from encroaching on the road traffic corridor.
 - Vehicles must comply with load limits and maintain regulated speeds when traveling on the route.
 - The road management authority must install traffic signs in necessary locations.
 - Establish speed limits for vehicles traveling on the road.
 - Vehicles must undergo regular inspections to ensure compliance with quality standards; non-compliant vehicles shall be subject to corrective action.
 - Assign sanitation workers to sweep and clean the planned road once a week to minimize accumulated solid waste such as soil, gravel, and dust.
 - Establish a road maintenance and environmental monitoring team to regularly inspect road quality and promptly address issues such as potholes, surface peeling, or subsidence that could damage the pavement structure.
 - Construct speed bumps along the route, especially near intersections, road junctions, and sections transitioning from agricultural production areas to residential zones.

5.1.5. Minimize cumulative impact

- *Integrate climate change and sea level rise resilience into each content in the technical design phase for the Thanh Hoa province SFDP project.*
 - Increase concentrated and local permeable green space along canal/river/sea embankments, maintain and strengthen coastal protection forest systems or mangrove forests (if any), specific works suitable for the specific terrain of the natural drainage protection area; maintain water surface space, storm-resistant design, design of water retention basins for drought resistance and irrigation, flood-proof materials, permeable materials for water retention basins.
 - Technical preparation: Calculation of elevation and hydraulics must take into account climate change and natural drainage factors.
 - Proposing highly permeable materials and structures for construction of traffic works such as perforated concrete; Planting grass in parking lots on fishing wharves/ports, etc.
 - Improve the capacity of rainwater and wastewater drainage by calculating the elevation of drainage foundations, conditions, locations of key works, drainage directions, and highly reliable materials that can withstand climate change and harsh weather.
- **For project level construction phase:**

Coordinate with local specialized management units to:

- Raise fishermen's awareness of water/land use regulations and practices
- Monitor and comply with speed and driving/vehicle behavior,...
- Raise fishermen's awareness of socio-economic development opportunities and social issues related to risks through project programs and training in the area.
- Assign officers to regulate traffic in construction areas of ports/storm shelters.
- Raise public awareness of regulations and practices on the protection of aquatic life and aquaculture and fishing activities.
- Ensure that emissions from each individual project are minimal
- Regional/industry planning taking into account emissions, river/sea carrying capacity and pollution control requirements

• ***For the operational phase:***

Comply with the strategic planning for environmental protection of the project area, including:

- Environmental protection area, riverside/seascape, port/anchoring area construction area.
- Prohibited construction areas: Coastal protection corridors, inland waterway protection corridors in river/sea areas.
 - + Coastal protection corridor: According to the provisions of Clause 1, Article 79 of the Law on Marine and Island Resources and Environment No. 82/2015/QH13, since the promulgation of this Law, the status quo must be maintained, and no new investment or construction activities are allowed within 100 meters from the average tide of many years to the mainland or islands as determined by the People's Committee of the province or centrally-run city with sea according to the guidance of the Ministry of Natural Resources and Environment until the coastal protection corridor is established according to the provisions of this Decree, except for some enclosures as prescribed by law.
 - + Inland waterway protection corridor: The scope of inland waterway protection is specified in Clause 4, Clause 16. The scope of inland waterway protection corridor is specified in Clause 4, Article 16 of the Law on Inland Waterway Traffic, in particular: The scope of inland waterway protection corridor in case the waterway is not close to the shore level IV is 10m; The scope of inland waterway protection corridor in case the waterway is adjacent to the natural shore is at least 5m; in case the waterway is located in the city or town, the scope of the waterway protection corridor is the red line boundary in accordance with the planning approved by the competent authority.
- Area polluted by traffic and technical infrastructure activities.

5.1.6. Measures to address climate change issues

According to the Guidelines, the vulnerability of local communities to climate change may be due to the following causes, taking into account the probability of occurrence:

- Increased flooding in the area due to reduced permeable surface area
- Increased access to ecologically sensitive locations leads to environmental degradation and threats to buffer zones that provide flood or drought mitigation functions
- Degradation of domestic water supply and environment, ecosystems related to population growth along the proposed route alignment.

- Microclimate change

To set adaptation targets, the following aspects can be considered:

- Temperature changes: increase in ambient air temperature in hot season and decrease in cold season, maximum temperature or excessively hot time can affect construction progress, reduce the durability and life of road and bridge structures (deformation due to expansion of materials / connections under the influence of heat);
- Changes in rainfall (depending on the rainy season) lead to increased flow intensity, which can cause deeper and longer flooding, slow down construction progress, and increase the risk of erosion and landslides;
- Increased intensity and frequency of extreme weather events including flooding will affect drainage systems, damage embankments/wharfs, and disrupt waterways;
- Rising sea levels can increase the risk of flooding and inundation in coastal/riverside areas, reduce drainage capacity and increase saltwater intrusion. These affect coastal/river embankment structures, corrode steel structures and steel types in reinforced concrete structures. As a result, roads will soon deteriorate or be damaged.
- Stronger and faster currents may affect the abutments and piles of embankments/structures on harbours/wharfs, increasing the risk of river/seaside erosion.

5.2. Roles and responsibilities for ESMP implementation

5.2.1. Institution

The tables and figures below summarize the roles and responsibilities of key stakeholders and their relationships in the implementation of the environmental protection plan.

- The contractor is responsible for implementing mitigation measures. Measures will be included in the bidding documents and costs will be included in the construction bidding packages.
- CSC is responsible for day-to-day monitoring of the implementation of mitigation measures, and the costs that will be included in the service contract with CSC.
- The Independent Social Environment Monitoring Consultant (IESMC) is responsible for periodic monitoring of the social environment, including assisting PMU in environmental monitoring and monitoring, training on environmental and social safety implementation, and reporting on the implementation of environmental protection plans through monitoring reports.

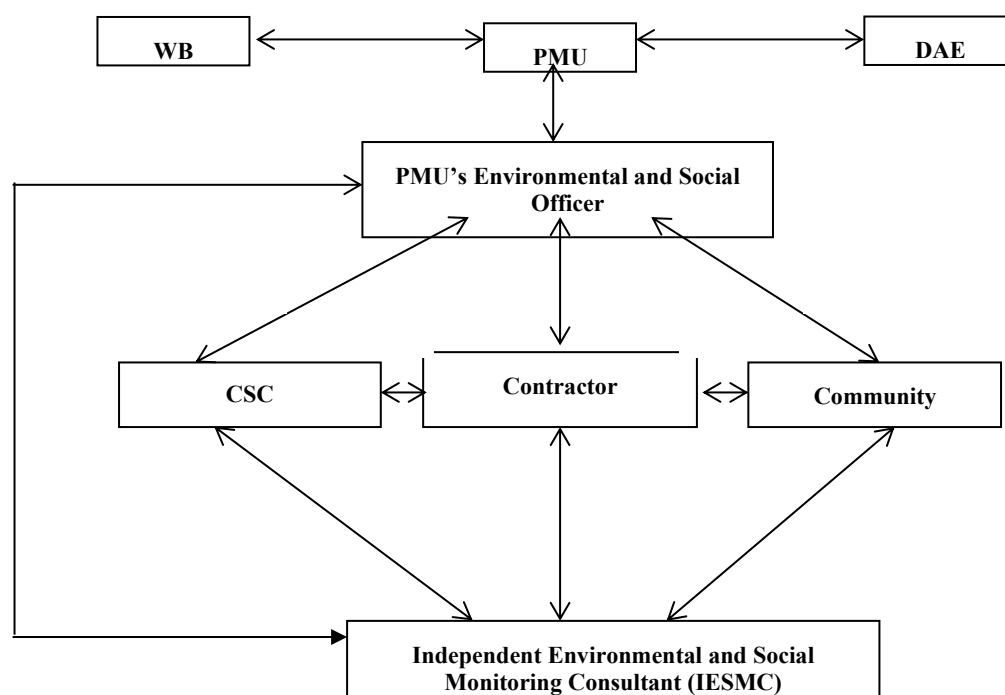


Figure 6.1: ESMP implementation organization chart

5.2.2. Roles and responsibilities

The roles and responsibilities of key stakeholders are outlined in the Table below.

Table 5-3: Roles and responsibilities of key stakeholders

Unit	Environmental and social responsibility
Investor/ Project Management Board	Responsible for overall supervision of the implementation of the Project, including compliance with regulations on social media. Concrete (i) Closely coordinate with local authorities in community participation in the implementation of the project; (ii) Ensure that the detailed design of the project adequately incorporates the environmental impact mitigation measures proposed in the ESMP; (iii) Supervise and inspect the full integration of ESMP contents included in bidding documents and contract documents (iv) Establish and effectively operate a social environment management system to support the implementation of ESMP (v) Acting as the focal point for coordinating and representing the implementation of the ESMP with the Department of Agriculture and Environment, the Ministry of Agriculture and Environment, and the World Bank. (vi) Implement and monitor measures and actions in the ESCP, and compile ESCP progress reports as part of project monitoring
Investor's Social and Environmental Officer (ESO)	Responsible for overseeing the implementation of the project's ESMP. Specifically, ESO will be responsible for: (i) Monitor the integration of ESMP requirements into detailed technical designs, construction and installation bidding documents, and contractual documents;

Unit	Environmental and social responsibility
	(ii) Monitoring the integration of ESMP and RP requirements into terms of reference, bidding documents for Construction Supervision Consultants (CSCs) and Independent Environmental-Social Monitoring Consultants (IESMC); (iii) Provide input and participate in the CSCs and ISEMC consultant selection process (iv) Review of professional reports submitted by IESMC and CSC (v) Monitoring, and recommending corrective action for violations, with the professional support of IESMC (vi) Field inspections, to confirm compliance or recommend corrective actions as necessary (vii) Coordinate with the Social Environment and Environment staff at each subproject to handle issues related to social mobility and resettlement of each subproject. (viii) Consolidate the content of the implementation of socio-environmental safety in the report to the relevant agencies (DAE) and the World Bank.
Contractors	The contractor is responsible for implementing environmental, social, health, and safety (ESHS) requirements in accordance with the ESMP and related documents. Specifically: - Appoint ESHS staff and designate a focal point for receiving and addressing grievances. - Prepare the Contractor's ESMP (C-ESMP) for each construction package and submit it to the PMU and CSC for review and approval prior to the commencement of construction. - Ensure all necessary construction permits are obtained in compliance with current regulations (e.g., traffic control permits, fire safety permits, etc.) before starting construction. - Implement mitigation measures identified in the ESMP, C-ESMP, bidding documents, etc. - Conduct training to ensure that all staff and workers understand the procedures and their responsibilities under the environmental management program. - Maintain effective communication with the community and local authorities to address issues related to construction and ESHS. - Report to the PMU, the Technical/Environmental-Social teams at each subproject, and the CSC on progress, challenges, incidents, and corrective actions. - Coordinate with competent authorities and stakeholders to handle E&S incidents if they occur.
Independent Environmental and Social Monitoring Consultant (IESMC)	IESMC is the independent monitoring unit, responsible for supporting the PMU in ensuring compliance with the project's environmental and social (E&S) requirements. Specifically: - Support the PMU in establishing and operating the E&S management system. - Organize training for the PMU, CSC, Contractors, and relevant stakeholders on the project's E&S management requirements, in order to raise awareness and strengthen implementation capacity. - Conduct regular field visits to assess compliance with the ESMP, RP, and LMP; and propose corrective and improvement measures when necessary.

Unit	Environmental and social responsibility
	- Monitor the implementation of recommended corrective measures to ensure that E&S issues are fully addressed and resolved on schedule. - Arrange and organize training sessions to raise awareness on Gender/Labor influx for all Contractors, CSC teams, and PMU staff. The cost of this training is included in the consulting service contract. - Carry out periodic environmental quality monitoring (as if) in accordance with the approved monitoring plan. - Prepare periodic consolidated monitoring reports on the implementation of the project's E&S requirements.
Construction Supervision Consultant (CSC)/ Environmental Supervisor (ES)	The CSC is responsible for regularly supervising the contractor's compliance with environmental and social (E&S) requirements during the construction phase. Specifically: - Assign qualified E&S officers to oversee the contractor's implementation of E&S mitigation measures and ensure compliance. - Support the PMU in reporting and maintaining close coordination with the local community. - Carry out daily on-site E&S monitoring, record emerging issues, and propose timely corrective actions. - Follow up and verify the implementation of recommended corrective measures to ensure that E&S issues are fully addressed in a timely and effective manner. - Prepare monthly E&S monitoring reports and submit them to the PMU.
Local Communities	- Participate in environmental and social monitoring activities on a voluntary basis.
Provincial Departments of Agriculture and Environment (DAE)	- Monitor compliance with government environmental requirements.

5.3. Environmental Compliance Framework

5.3.1. Environmental and social responsibility of PMU/Detailed design consultant

During the preparation of Terms of Reference (TOR) for consulting services and bidding documents for construction, the PMU will also work closely with consultants to ensure that: i) contract package division and cost estimates include the implementation of the ESMP, including independent safety supervision services, environmental sampling/monitoring and compliance monitoring, reporting, etc.; ii) ESCOP and relevant general as well as site-specific mitigation measures are incorporated into the bidding documents; iii) environmental monitoring and training are included in the scope of work assigned to the construction supervision consultant.

At the feasibility study / detailed design stage, the PMU will coordinate closely with feasibility study consultants and detailed design engineers to ensure that green/landscape, environmentally friendly solutions, and relevant mitigation measures proposed in the ESIA/ESMP are reviewed and integrated into the technical design where appropriate.

During construction, the PMU will work closely with the supervision consultant to monitor contractors' compliance and report to relevant authorities. The PMU will also instruct the supervision consultant and contractors on actions to be taken in case of issues, incidents, or accidents, etc.

The PMU will assign at least one qualified staff member as an Environmental Officer (EO) and at least one qualified staff member as a Social Officer (SO) throughout project implementation.

- The EO will monitor environmental issues and oversee the subproject's safety compliance. The EO will be supported by the independent environmental supervision consultant, dedicated ES officers at each subproject, environmental officers of the construction supervision team, as well as the contractors.
- The SO will monitor and coordinate the social/resettlement aspects of the Project. The SO will be supported by the independent resettlement supervision consultant, social officers of the construction supervision team, as well as the contractors.

5.3.2. Environmental Responsibility of Contractors

The contractor is responsible for implementing measures to control and mitigate adverse impacts arising from construction activities. The mitigation measures specified in the ESMP must be fully applied to prevent impacts on the local community and the environment throughout the construction phase.

When remedial measures cannot be effectively implemented during construction, the contractor must carry them out during the completion stage (and prior to issuing the completion acceptance certificate).

The contractor's responsibilities include, but are not limited to, the following tasks:

- Comply with relevant legislative requirements on environmental management, community health, and safety;
- Perform the work within the scope of the contract requirements and other bidding conditions;
- Assign a representative of the construction team to participate in site supervision organized by the Environmental Supervisor (ES) of the CSC;
- Implement remedial actions under the instructions of the Environmental Officer (EO), Social Officer (SO) of the PMU, and the Environmental Supervisor (ES) of the CSC;
- In case of non-compliance or non-conformance, conduct investigation and propose mitigation measures, as well as implement corrective actions to minimize environmental/social impacts;
- Suspend construction activities when they generate adverse impacts beyond the guidance provided by the EO and ES. Propose and implement corrective activities or apply alternative construction methods, if necessary, to mitigate environmental impacts. Failure to comply may result in suspension of construction or other penalties until the issue is satisfactorily resolved as required by the EO and ES;
- If the contractor proposes to use raw material sources not mentioned in the subproject ESIA, the contractor shall report to the CSC and PMU and coordinate with them to conduct an environmental assessment of these sources to evaluate their compliance with national environmental requirements. Only compliant sources may be used under this project;
- The contractor shall be responsible for implementing remedial measures at its own cost. The contractor will also be liable for paying damages arising from non-compliance with the ESMP and/or applicable environmental regulations.

5.3.3. Contractor's Environmental and Social Management Plan (C-ESMP)

Given the dispersed nature of the investment items, construction works are expected to be implemented through several contract packages, with multiple contractors responsible for

different sites. Each contractor shall be responsible for complying with the ESMP requirements applicable to the sites and works under its respective contract.

After signing the contract, the contractor will be required to prepare and submit a Contractor's Environmental and Social Management Plan (C-ESMP) for each contract package and submit it to the CSC and PMU for review and approval.

The objective of the C-ESMP is to provide guidance for environmental and social management of proposed works/activities at the Project construction sites. This is to ensure that contractors – as well as subcontractors (if any) – carry out their work with the minimum possible environmental impacts. The C-ESMP will detail how the contractor will mitigate impacts from construction activities and record the contractor's responses for inspection, supervision, verification, internal review, and corrective actions or improvements of environmental compliance conditions. The C-ESMP must be site-specific and include details of control measures to be implemented on-site to minimize any potential environmental impacts from proposed works/activities. If proposed works/activities in the C-ESMP are modified in the Contract, the contractor shall revise the C-ESMP to reflect such changes or modifications.

The contents of the C-ESMP must include the following:

- (i) Applicable policies/regulations, providing a definition of the contractor's environmental policy and a statement of commitment to implementing the C-ESMP.
- (ii) A brief description of the document; Date of issuance; Revision status; Distribution list; and details of staffing and access.
- (iii) Applicable laws and regulations related to the requirements in the Project ESMP. Identification of contractor permits, licenses, and approvals relevant to the C-ESMP.
- (iv) Details of how the environmental and social impacts identified in the subproject ESIA will be managed on-site, including: 1) specific measures to mitigate impacts during construction; 2) ESCOP; 3) the Contractor's ESMP to be developed after contractor selection and prior to construction commencement; and 4) the Contractor's Dredging Management Plan, which the contractor is required to prepare.
- (v) Detailed environmental and social training that all contractor staff (including subcontractors) must undertake. At a minimum, all contractor personnel working at project sites must: i) be familiar with and understand the C-ESMP for the works; ii) be aware of their environmental responsibilities and legal obligations on-site; iii) comply with the workers' Code of Conduct; and iv) participate in health, safety, and emergency response training.
- (vi) Specific capacities, support mechanisms, and resources necessary for adequate implementation of the C-ESMP. The detailed environmental responsibilities of all contractor staff, including subcontractors working on-site, with appropriate knowledge, skills, and training for specific tasks, shall be defined.
- (vii) The contractor shall be responsible for preparing monthly environmental–social reports, as part of the Progress Report required in the bidding documents, including ad-hoc reports if any, for submission to the project owner. The contents of these reports may include the following details:
 - Implementation of the Contractor's C-ESMP in compliance with the agreed program;
 - Difficulties encountered in implementing the C-ESMP and recommendations for future improvement;
 - Identification of non-compliances and non-conformances, with proposed corrective actions;

- Reports from subcontractors related to C-ESMP implementation, including minutes of meetings and discussions organized by the contractor.

5.3.4. Responsibilities of the Contractor's Safety and Environmental Officer (C-SE)

The contractor is required to appoint a qualified individual as the Contractor's Environmental and Safety Officer (C-ES) at the construction site. The C-ES must be trained in environmental management and possess the necessary skills to communicate environmental management knowledge to all relevant staff involved in the contract. The C-ES shall be responsible for monitoring compliance with the contractor's ESMP and environmental technical specifications. The responsibilities of the C-ES include:

- Conducting on-site environmental monitoring to assess the contractor's ESHS performance, equipment, and construction methods related to pollution control, as well as the adequacy of mitigation measures implementation.
- Monitoring compliance with environmental protection solutions, pollution prevention methods, control measures, and contractual requirements.
- Supervising the implementation of environmental impact mitigation measures.
- Preparing audit reports on environmental monitoring data and site environmental conditions.
- Investigating complaints and recommending corrective actions as required.
- Advising the contractor on environmental improvement, awareness, and proactive implementation of pollution prevention solutions.
- Proposing appropriate mitigation measures to the contractor in cases of non-compliance, and conducting additional monitoring as instructed by the PMU's ES/ESO and the CSC.
- Reporting environmental issues to the contractor, ESO and ES (from PMU and CSC), submitting the contractor's ESMP implementation reports to the PMU's ESO, CSC's ES, and other relevant agencies as required.
- Maintaining detailed records of on-site activities related to environmental matters.
- Utilizing or appointing qualified staff to implement required actions and measures to ensure labor-related issues are addressed, such as occupational health and safety (OHS) specialists to manage OHS matters.
- Preparing the Contractor's Labor Management Procedures (LMP) and Contractor's ESMP (C-ESMP), including OHS provisions, applicable to contracted workers under the project.
- Submitting the contractor's LMP and C-ESMP to the PMU/CSC for review and approval before mobilizing staff to the project site.
- Supervising subcontractors' works, including their compliance with the contractor's LMP and C-ESMP.
- Keeping employment records for contracted workers (including subcontractors), including documentation verifying minimum working age as stipulated in the LMP.
- Providing regular training for contracted workers on topics including, but not limited to, occupational health and safety, social risks such as GBV, SEA/SH, and the Code of Conduct to maintain good relations with local communities.
- Requiring primary suppliers to identify and address risks related to child labor, forced labor, GBV, SEA/SH, and OHS for their workers.

- Establishing and implementing a grievance mechanism for contracted workers based on the GRM outlined in this LMP, ensuring that worker complaints are addressed promptly, and reporting the status of grievances and resolutions to the CSC and PMU. This grievance mechanism shall be part of the contractor's LMP.
- Ensuring that all contractor and subcontractor workers understand and sign the Code of Conduct before commencing work.
- Taking all necessary measures to address risks of sexual exploitation and abuse (SEA) and sexual harassment (SH) as stipulated in the contractor's LMP/C-ESMP, and ensuring full compliance with these measures.
- Reporting incidents at the construction site and labor/OHS implementation status to the PMU in a timely manner.

Incident Reporting

Contractors shall notify the Construction Supervision Consultant and the Project Owner of any incidents listed below within the agreed timeframe:

- Any violation of national laws, regulations, or international agreements.
- Any serious accidents or fatalities.
- Significant impacts resulting in personal property damage, such as traffic accidents, damage to houses/roads, or other incidents.
- Severe surface water/groundwater pollution.
- Failures of dikes/embankments at temporary disposal sites causing serious environmental pollution.
- Forest fires linked to worker behavior or labor influx.
- Any complaints related to sexual harassment, child abuse, or other child-related incidents.
- Complaints received regarding pollution or damages.

5.3.5. Responsibilities of the Independent Environmental and Social Monitoring Consultant (IESMC)

Independent Environmental and Social Monitoring Consultant (IESMC) will be contracted by the PMU to provide several environmental protection training courses for relevant parties and to carry out environmental inspections. The IESMC will perform monitoring tasks, including:

- Providing support to the PMU in establishing and operating the environmental and social management system, coordinating with the CSC team to train Contractors on the Project's ESHS management requirements;
- Organizing training courses and implementing capacity-building activities for the PMU, CSC, Contractors, and relevant stakeholders on ESHS during Project implementation. This includes conducting training sessions to raise awareness on Gender/Labor Influx issues for Contractor staff, CSC staff, and PMU officers;
- Carrying out random field inspections to certify compliance or propose timely corrective/improvement actions;
- Conduct environmental quality monitoring sampling and prepare periodic environmental monitoring reports, including reports on the implementation status of the ESMP for the PMU and prepare environmental monitoring reports during the construction phase.

- Reviewing the Contractor's environmental compliance, including the implementation of mitigation measures and related documentation;
- Reviewing the compliance of the PMU and CSC with the ESMP;
- The IESMC will also provide guidance and technical support to the PMU and EO regarding environmental and social issues.

5.3.6. Responsibilities of Construction Supervision Consultant (CSC)

During the construction phase, the Construction Supervision Consultant (CSC), qualified as required by the PMU, will carry out environmental supervision. The CSC will assign Environmental and Social (ES) staff, who will be responsible for inspecting and supervising all construction activities to ensure that the mitigation measures set out in the ESMP are properly implemented and that the Project's adverse environmental and social impacts are minimized. The CSC will recruit a sufficient number of Environmental Supervision Engineers with adequate knowledge of environmental protection and construction project management to perform the required tasks and supervise the Contractor's implementation.

Given that the Project is expected to be implemented through multiple contract packages across dispersed sites, more than one CSC is expected to be engaged. Each CSC will supervise its assigned contract(s) in coordination with the PMU to ensure consistent ESMP implementation.

Specifically, the CSC's ES staff will:

- Review and assess, on behalf of the PMU, whether the construction design meets the requirements of mitigation measures and impact management under the ESMP;
- Review and approve the Contractor's Environmental and Social Management Plan (CESMP);
- Coordinate with the PMU's Environmental Officer (EO) in reviewing environmental compliance at proposed new material and quarry sites, and advise the PMU on whether these extraction sites qualify for Project use;
- Verify and confirm with the PMU's environmental monitoring procedures, including parameters, monitoring locations, equipment, and monitoring results;
- Supervise the Contractor's implementation of the CESMP, including enforcement, proposing timely additional measures to improve mitigation efforts, and providing corrective guidance;
- Prepare monthly reports on the Contractor's ESHS compliance status;
- Review payment requests related to environmental mitigation costs, if any.
- Carry out E&S supervision for the assigned contract(s), and coordinate with the PMU to help ensure consistent ESMP and CESMP implementation across different contractors and sites

5.3.7. Compliance with laws and contractual requirements

Construction activities will comply not only with the contractual requirements on pollution control and environmental protection but also with the laws on pollution control and environmental protection of the Socialist Republic of Viet Nam.

All reports on construction methods submitted by the Contractor to the CSC for approval will also be sent to the ES for review to determine whether pollution control and environmental protection measures are adequately included.

The ES will also review the progress of work items to check for any violations of relevant environmental laws, thereby preventing potential breaches.

The Contractor will periodically provide copies of relevant documents to the PMU's environmental and social (E&S) staff and the CSC. These documents shall at least include Construction Progress Reports, updated Construction Method Statements, applications for permits/registrations under environmental protection laws, and all valid permits/registrations. The Contractor's on-site E&S staff (C-ES) and the CSC's ES will also have the right to access the Site Logbook upon request.

Upon receipt of these documents, the C-ES and ES will advise the PMU's Environmental Officer (EO) and the Contractor on cases of non-compliance with laws and contractual requirements on environmental protection and pollution control, in order to guide subsequent actions. If the SEO and ES conclude that a permit/registration application or any preparatory work for pollution control and environmental protection may not comply with the method statement, or may potentially lead to violations of pollution control and environmental protection requirements, they will provide recommendations to the Contractor and the PMU.

5.3.8. Environmental complaints and the penalty system

The bidding documents will require the Contractor to arrange an Environmental, Social, Health, and Safety (ESHS) Performance Security in the amount of 1–3% of the contract value. In the event of serious non-compliance, environmental pollution, or social issues that the Contractor fails to remedy within the permitted timeframe, funds from the ESHS Performance Security will be used to pay a third party mobilized by the PMU to resolve these issues.

On the other hand, if CSC/ES/IESMC/PMU detect non-compliance by the Contractor with the ESMP and environmental regulations during site supervision, up to 2% of the Contractor's monthly interim payment will be withheld. The Contractor will be granted a grace period (determined by CSC / PMU) to correct the violation. If the Contractor satisfactorily implements corrective actions within the grace period (confirmed by CSC / PMU), no penalties will be applied and the withheld funds will be released to the Contractor. However, if the Contractor fails to carry out the necessary corrective measures within the grace period, the Contractor shall bear the costs of engaging a third party to rectify the damage (deducted from their payments).

In the event that IESMC/CSC/PMU fail to detect the Contractor's non-compliance with environmental regulations, these units shall be responsible for covering the costs of remedying the violations.

Based on this Environmental and Social Compliance Framework, which includes the penalty system, CSC will develop a detailed penalty system for environmental and social non-compliance and submit it to the PMU for approval and implementation.

5.3.9. Reporting mechanism

The Project Management Unit (PMU) is responsible for conducting internal supervision of the implementation of the reporting regime. In addition, the PMU will hire an independent monitoring agency (EMA) to carry out independent monitoring of the implementation of the Resettlement Plan (RP) and to assess the living standards of those affected during and after the completion of resettlement.

Both internal and independent monitoring will be regular (on a monthly basis for internal monitoring and six months for independent monitoring). A final project assessment of the implementation of the resettlement is mandatory and a report will be prepared to confirm whether the ESF's objectives are being achieved. Tools for monitoring and reporting on ESMP implementation are summarized in the Table below.

Table 5-4: Reporting mechanism

No.	Report prepared by	Submit to	Reporting frequency
1	Contractors	PMU	Once before commencement and monthly during construction
2	Construction supervision consultancy	PMU	Weekly, monthly
3	Community Monitoring	PMU	Upon receiving complaints regarding the implementation of the Project's safety instruments
4	IESMC	PMU	Every three months (quarterly)
5	PMU	WB	Every six months (semi-annually)

5.4. Environmental monitoring program

Based on Articles 111 and 112 of the Environmental Protection Law No. 72/2020/QH14, the project is not required to implement a periodic environmental monitoring program during the construction phase and the project operation phase.

However, due to the specific nature of the dredging activity with a large dredging volume, the project will carry out monitoring of the quality of dredged materials (sediment quality). The contractor will be required to sample and monitor the quality of the dredged material as proposed below:

- Location: Two samples at each subproject with dredging activity (subproject 1 – Hoàng Trường fishing port and subproject 2 – Lạch Trường fishing port) and one sample for the remaining subprojects (subproject 3 -> subproject 9).
- Monitoring parameters: Salinity (excluding subproject 3 --> subproject 9), As, Hg, Cd, Cu, Pb, Zn.
- Monitoring frequency: Every 6 months (2 times during the entire construction period) for subprojects 1,2 and once throughout the construction period for subproject 3 --> subproject 9.
- Comparison standard: QCVN 43: 2017/BTNMT.

5.5. Training and capacity building program on environmental management

The table below provides a sample training program on safeguard policies. The training programs will be developed and conducted by a Technical Assistance Group to implement safeguard policies for the PMU. The PMU/IESMC, with support from the Technical Assistance Group, will provide training for environmental and social staff of contractors, CSCs, and other groups.

- Trainee groups: PMU management staff and environmental-social officers, Construction Supervision Consultants (CSCs), construction contractors, PMU procurement officers, representatives of stakeholders, and local communities in the project area.
- Training schedule: Training will be organized at least one month before the implementation of the first construction contract. Subsequent training sessions may be adjusted to align with the construction schedule of project components.
- Training frequency: The basic training programs outlined in the table below will be delivered every 6 months, with content updated and tailored to the components under implementation. Training for PMU staff is expected to continue during the initial years of the Project. Three-day training sessions for CSCs and contractors are also expected

to be held twice a year for at least 2 years.

Table 5-5: Training program, capacity building in environmental management

I. SUBJECTS	PROJECT MANAGEMENT UNIT
Course Name	Environmental/social monitoring and reporting regime
Attendees	Managers, officials in charge of environmental and social issues;
Training Frequency	Immediately after the project takes effect, but at least one month before the first bidding package starts. The next course will be planned upon request.
Training Period	1 day
Training content	<i>General environmental/social management related to the project includes:</i> • Requirements of the World Bank and the Department of Agriculture and Environment. • Defining the roles and responsibilities of the PMU in environmental and social management. • Coordination with competent authorities and relevant stakeholders. • Reporting and decision-making mechanisms for arising environmental/social issues. <i>Environmental monitoring for the Subproject includes:</i> • Requirements for environmental and social monitoring. • Tracking and implementing mitigation measures. • Community participation in environmental and social assessment. • Guidance and supervision of contractors, CSC, and community representatives in carrying out environmental/social monitoring. • Templates used in the environmental/social monitoring process. • Risk response and control. • Guidance and supervision of contractors and CSC regarding grievance management. • Procedures for receiving and submitting grievance forms. • Mechanisms for monitoring and addressing complaints. • Other identified issues.
Implementation responsibilities	IESMC with the help of the Technical Support Team (as if) to implement safeguard policies and the PMU
II. SUBJECTS	CSC, CONTRACTOR, WARD/COMMUNE REPRESENTATIVE, COMMUNITY REPRESENTATIVE
Course Name	Implementation of impact mitigation measures
Attendees	CSC, construction engineer, construction area manager. Employees in charge of environmental and social issues, contractors; Representatives of local governments; Representatives of residential areas/neighborhoods
Training Frequency	Immediately after awarding the contract to the contractor with updated information on the requirements
Training Period	1 day of training for CSC and contractors, and 1 day of training for others
Training content	• Overview of environmental/social monitoring • Environmental/social monitoring requirements Regulations of the World Bank and Vietnamese legislation

	Compliance and performance evaluation criteria • Roles, responsibilities, coordination, and reporting procedures between the PMU, CSC, and contractors • Content and methods of environmental monitoring • Identification of risks and impacts; emergency response procedure • Introduction of monitoring forms (site diaries, incident reports, compliance checklists) and instructions on how to complete them • Instructions on proper storage and submission of reports • Grievance redress mechanism - Procedures for receiving, handling, and responding to grievances - Roles of contractors and CSCs in supporting grievance resolution on site • Preparation and submission of reports • Other identified issues
Implementation responsibilities	Independent Environmental and Social Monitoring Consultant (IESMC); with the help of the Technical Assistance Team for the implementation of safeguard policies and the PMU.
III. SUBJECTS	COMMUNITY/WORKERS
Course Name	Environmental safety and sanitation
Attendees	Representatives of workers (team leaders) working directly for the components of the project
Training Frequency	When appropriate
Training Period	One day of presentation and one day of presentation at the construction site
Training content	• Summary of safety issues and environmental overview ; • The main issues require the attention of the community and construction workers to reduce safety risks (roads, waterways, equipment, machinery, etc.) as well as reduce pollution (dust, emissions, oil spills, waste management...); Personal safety when working at high altitudes, near power sources, underwater, etc • Management of safety and environmental sanitation at construction sites and at workers' camps ○ Regulations on the use of labor protection (PPE), fire protection, first aid, etc ○ Occupational hygiene, garbage and wastewater treatment • Mitigation measures applied at construction sites and at workers' camps • Safety measures for electricity, mechanics, transportation, air pollution ; • Emergency handling methods: incident reporting process, escape diagram, emergency phone number • Rights and responsibilities of workers in environmental protection and occupational safety • Mitigation measure social impact and monitor the implementation of other issues once identified. • Contractor Code of Conduct

Implementation responsibilities	Contractors, for all workers before construction Independent Environmental and Social Monitoring Consultants (IESMC), during periodic monitoring sessions

5.6. ESMP IMPLEMENTATION COST ESTIMATION

5.6.1. Cost of independent environmental monitoring

According to the project implementation progress, it is expected that the construction works will be completed within 1-3 years depending on the investment scale of each subproject (from 2026 to 2028) and the requirement to periodically mobilize ISEMC. The cost of independent environmental and social monitoring (ISEMC) is estimated in the following table:

Table 5-6: Estimated cost of independent environmental monitoring

(Exchange rate: 1 USD = 26,090 VND)

TT	Content	Unit	Quantity	Unit price (VND)	Total amount (VND)	Total amount (USD)
1	Expert salary	Month_person	72	30,000,000	2,160,000,000	82,790
2	Accommodation, business expenses	Day_person	288	500,000	144,000,000	5,519
3	Travel expenses	Trip_person	288	500,000	144,000,000	5,519
4	Stationery and communications	month	8	10,000,000	80,000,000	3,066
	Total				2,528,000,000	96,895

Note: Independent environmental and social monitoring mobilisation experts need to be included in the environmental, social, gender fields to suit the environmental and social issues of the project.

5.6.2. Estimated training costs

According to the project implementation progress, it is expected that the construction works will be completed within 1 - 3 years depending on the investment scale of each subproject (from 2026 to 2028). The estimated cost for the training program on environmental/social monitoring and management capacity is presented in the following table:

Table 5-7: Estimated training costs

(Exchange rate: 1 USD = 26,090 VND)

Training content	Trained Objects	Unit of measure	Quantity	Unit price	Total amount	
				VND	VND	USD
A. Capacity building training program on safety policy (implemented by IESMC)						
I. Training on environmental reporting and monitoring						
PMU	Environmental officer; environmental manager	Course	4	As part of the cost for ISEMC		
II. Implement mitigation measures						
All construction items	Construction supervision consultant (CSC); construction engineer, site manager	Course	24	As part of the cost for ISEMC		

Training content	Trained Objects	Unit of measure	Quantity	Unit price	Total amount	
				VND	VND	USD
	(2 times/1 pack x 12 packs)					
III. Safety and environmental hygiene						
All construction items	Worker manager (Team leader/team leader) (2 times/1 pack x 12 packs)	Course	24	As part of the cost for ISEMC		
B. Training on Gender, GBV/Labor influx (conducted by IESMC)						
All construction items	Workers, CSC team and PMU staff (2 times/1 pack x 12 packs)	Course	24	30,000,000	720,000,000	27,596

5.6.3. Summary of ESMP implementation costs

The table below provides an estimated cost for implementing the Environmental and Social Management Plan (ESMP). The ESMP implementation costs¹⁹ will include: (i) costs for implementing mitigation measures by the contractor, (ii) monitoring costs by the CSC, (iii) costs for the Independent Environmental Monitoring Consultant (IEMC), (iv) costs for environmental quality monitoring (as if), and (v) costs for safety management training for the Project Management Unit (PMU), including technical support for implementing safety policies and training programs. The costs for implementing mitigation measures during construction will be part of the construction contract, while the costs for monitoring the contractor's Environmental and Social Management Plan (ESMP) by the Construction Supervision Consultant (CSC) will be included in the construction supervision contracts. Costs for PMU activities related to the ESMP are covered by the PMU's project management budget.

It should be noted that community participation in ESMP implementation is entirely voluntary, for the benefit of both the community and the project owner. Therefore, community members participating in ESMP monitoring will not receive wages.

The table below provides estimated costs for environmental-social quality monitoring and IEMC activities (in line with national practices) for reference purposes. However, final costs will be updated during the detailed design phase.

Table 5-8: Summary of ESMP implementation costs

Content	Project ESMP Implementation Cost	
	VND	USD
Mitigation during construction	As part of contracts	
Monitoring compliance with safety policies during construction	As part of the cost of hiring a Construction Supervision Consultant (CSC)	
Dedicated unit for environmental safety policies of the PMU	As part of the costs for the PMU	
Environmental quality monitoring (conducted by IEMC)	0	0

¹⁹Exclude costs for the implementation of the RP and independently monitor the implementation of the RP.

Content	Project ESMP Implementation Cost	
	VND	USD
Independent Environmental and Social Monitoring Consultant (IESMC)	2.528.000.000	96.895
Environmental and social training (implemented by ISEMC)	As part of the costs for ISEMC	
Training on Gender, GBV/Labor influx (conducted by IESMC)	720.000.000	27.596

5.6.4. Project-level grievance redress mechanism

Within the framework of Vietnamese law, citizens who make complaints have the right to protection. As part of the overall implementation of the project, the complaint resolution mechanism (GRM) will be developed by the E-O, SO of the PMU, according to the procedure, the responsible person and contact information will be prepared. It will be easy to access to ensure that complaints will be handled and resolved at the lowest level as quickly as possible. This mechanism will provide a framework in which complaints about environmental and safety issues can be handled, complaints can be resolved, and disputes can be resolved in a timely manner. The GRM will be launched before the start of construction.

During the development process, the Complaint Resolution Mechanism (GRM) will also be managed by contractors under the supervision of the CSC. Contractors will inform affected communities and communes of the availability of a complaint settlement mechanism to resolve complaints and problems related to the subproject. This will be done through a public consultation and information disclosure process under which contractors will regularly communicate with the affected community and relevant agencies. Meetings will be held at least quarterly, monthly, project fact sheets will be published, announcements will be posted in local media, and announcements of upcoming activities will be posted,... Contractors should provide contact information for any complaints when contractors communicate construction progress to the local community.

All complaints and corresponding actions taken by contractors will be recorded in the subproject's monitoring report. Claims and claims for damages can be made in the following ways:

- Verbally: directly to CSC and/or the contractor's security guard or representative at the regional office.
- In writing: by handing over or sending a complaint to specific addresses.
- By phone, fax, e-mail: to the CSC, security guard or the contractor's representative.

Upon receipt of the complaint, CSC and the Contractor's safety officer or representative will register the complaint in the complaint file and will record the facts related to the complaint thereafter, until the complaint is resolved. Immediately after receiving the complaint, it is necessary to copy the complaint in 4 copies. The original will be kept in the file, a copy will be kept by the contractor safety officer, a copy will be sent to CSC and the final copy will be sent to the PMU within 24 hours of receiving the complaint.

The information documented in the complaint will include:

- Date and time of complaint.
- The complainant's name, address, and contact details.
- A short description of the complaint.
- Actions are taken to resolve the complaint, including who to contact and detect at each stage of the complaint settlement process.

- The date and time when the complainant were contacted during the settlement process.
- Final decision of the complaint.
- The date, time and manner in which the complainant was notified.
- Signature of the complainant when the decision is issued.

Small complaints will be resolved within a week. Within two weeks (and weeks thereafter), a written response will be sent to the complainant (by hand, post, fax, e-mail) outlining the procedures to be carried out and the process by date.

The main goal is to solve the problem as quickly as possible by the simplest means, involving as few people as possible and at the lowest possible level. Only if the problem cannot be solved at the simplest level and / or within 15 days, other authorities will step in. Such a situation may arise, for example, when a claim for damages is made, the amount payable cannot be settled, or the causes of the damage are identified.

Complaint and complaint settlement procedures shall be carried out as follows:

Level 1 – People's Committee of commune/ward

The affected household shall submit its complaint to one of the officials of the commune/ward People's Committee, through the village/hamlet head or directly to the commune People's Committee, in writing or orally. The officer(s) of the commune/ward People's Committee or the village head shall notify the ward/commune People's Committee of the complaint. The People's Committee of the commune/ward will work directly with the affected households and will come up with a plan to settle the complaint within 5 working days after receiving the complaint. The Secretariat of the People's Committee of the commune/ward is responsible for making records and recording all complaints that are being resolved. After the People's Committee of the commune/ward issues a settlement decision, the household can continue to complain within 30 working days. In case the second decision has been issued and the above-mentioned household is still not satisfied with that decision, such household may lodge a complaint with the provincial-level People's Committee.

Second level – Provincial People's Committee

Upon receiving complaints from households, the Provincial People's Committee will have 30 working days to resolve the case. The Provincial People's Committee is responsible for compiling and archiving records of all complaints sent. After the Provincial People's Committee issues a decision, households can complain within 45 working days. In case a second decision has been issued but the household is still not satisfied with that decision, it has the right to lodge a complaint with the People's Court within 45 working days. After that, the Provincial People's Committee will have to deposit the compensation money into an account.

Third Level - Courts

In case the complainant initiates a lawsuit to the commune or provincial People's Court and the Court shall settle in favor of the complainant. The complaint settlement decision must be sent to the complainant and related parties and publicly posted at the head office of the relevant People's Committee. The complainant will receive such decision after 3 days from the date of complaint settlement results at the ward and commune levels and 7 working days for communes and provinces.

The GRM Officer will need to coordinate with the above levels to maintain a database of complaints related to the Project from relevant parties, including information such as: the content of the complaint, the source of the complaint and the date of receipt of the complaint, etc. the full name and address of the complainant, the handling plan and existing status, including complaints received orally and in writing. In case of necessity, the GRM Officer may

contact the complainant directly and instruct them to carry out the project's formal complaint settlement process.

Complaint Resolution Mechanism for Workers:

Project workers (all three types: direct workers, contract workers, and main supply workers) can directly submit their grievances to the GRM for workers. Members of this GRM will be trained to handle worker complaints, including workplace grievances, effectively and reasonably, in compliance with national labor regulations and the World Bank's Environmental and Social Standard 2 (ESS2).

Complainant	GRM Functions	Timeframe
Workers or labor unions will submit their complaints to GRM for Workers through one of the communication channels.	• Refer worker-related complaints to the worker's GRM. • Registration, classification, and analysis of complaints. • Convene the GRM for a workers' meeting to analyze and resolve the complaint. • Provide written feedback to the complainant/contractor. • Provide guidance with recommendations to contractors to improve working conditions/labor management issues.	

World Bank Grievance Redress Mechanism:

Individuals and communities who believe that a subproject supported by the World Bank adversely affects their lives can submit their grievances to the existing subproject-level grievance mechanism or directly to the World Bank's Grievance Redress Service (GRS). This mechanism ensures that submitted grievances are reviewed promptly to address issues related to the subproject. Individuals or organizations affected by a subproject may also submit complaints to the World Bank Inspection Panel to determine whether any harm has occurred or could occur due to non-compliance with World Bank policies and procedures. Complaints can be submitted at any time when the issue is of concern to the World Bank, and the Bank's management is responsible for responding. For more information on how to submit a complaint to the World Bank Grievance Redress Service (GRS), please visit www.worldbank.org/grs. For more information on submitting a complaint to the World Bank Inspection Panel, please visit www.inspectionpanel.org.

CHAPTER 6. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

6.1. Summary of the public consultation process

The World Bank's policies on Environmental and Social Standard No. 5 (ESS5) and

Environmental and Social Standard No. 10 (ESS10) require consultation and notification to affected people and local authorities on environmental and social issues during the preparation of the Project. Public consultation on the ESIA report must also comply with the requirements of Point a, Clause 3, Article 26 of Decree 08/2022/ND-CP of the Government detailing a number of articles of the Law on Environmental Protection.

The public consultation was conducted with the purpose of: (i) sharing information on the proposed project items and activities with the project area community and stakeholders; and (ii) Collecting comments and concerns on local specificities and sensitive environmental and social issues in the project area (including 7 communes and wards in the project area) from local authorities and communities. On that basis, the community concerns will be included in the Environmental and Social Impact Assessment report and project solutions.

Consult with People's Committees of communes/wards and residential communities in the project area

Direct consultation with the People's Committee of the commune/ward is carried out from date to date, including the following main contents:

- Overview of the project, project investment items, identification of villages/areas within the project area.
- Introduces the core requirements of the World Bank's Environmental and Social Framework.
- Current status of environmental and social issues related to investment projects in commune/wards and remaining issues.
- Potential environmental and social impacts of the project on the local community.
- Community-led solutions to limit and minimize environmental and social impacts during project implementation.
- Comments on the construction of the project.

Participants in the community consultation meetings include:

- Project Management Board Representative;
- ESIA consulting representative;
- Representative of the People's Committee of the commune/ward;
- Representatives of local departments and organizations
- Village Chief/Deputy
- Representatives of affected households

6.2. Results of public consultation

During the preparation of the ESIA report, the project owner, with the support of the consulting unit, organized 1 consultation meeting with the communities in the area where the 9 subprojects will be implemented. The consultation meetings will be held in November 2024, with a total of 11 meetings and 306 participants (171 male and 135 female). Details are summarized in the following table.

Table 6-1: Results of community consultation in the project area

Subprojects	Location	Time	Total number of people	Male	Female	Summary of consultation results	Project owner feedback
Subproject 1	Hoang Tien Commune (formerly Hoang Truong Commune, Hoang Hoa District)	11/12/2024	28	8	20	1. Mr. Le Pham Thao, Vice Chairman of the Commune People's Committee - Regarding the project investment policy, people have known for a long time, but only now is the project feasible, so people are very excited. Hope the project will be implemented soon. - Synchronous investment in port infrastructure helps facilitate people's trading, anchoring, and transportation of seafood. - Currently, the estuary is heavily silted, partly because opposite the port area is the clam farm of Ngu Loc commune, Hau Loc district. The clam farm area is on sand, so sand is pumped to raise clams, affecting the boundary, overflowing to Hoang Truong commune, causing sand sedimentation and increasing mud and sand, reducing the water level, making it difficult for boats to enter and exit the port, ensuring the turning position of the boat. - Along the port, many drainage culverts leading to the sea are blocked, so they flood when it rains and cannot drain water to the sea. When building a port, it is necessary to study the arrangement of sewers along the port to ensure drainage in the area and within the port. - Construction should be avoided from April to December. When the net is collected, the old side will be temporarily used. However, it is necessary	- We acknowledged comments of the community; - This ESIA report has assessed these impacts and proposed corresponding mitigation measures in Chapter 5 – ESMP; - We would continue to coordinate closely with local authorities throughout the project preparation and implementation process to ensure the quality and progress of the project. - We would like to commit to seriously implementing environmental impact mitigation measures proposed in the project's ESIA, EIA report.

Subprojects	Location	Time	Total number of people	Male	Female	Summary of consultation results	Project owner feedback
						to seriously evaluate the old embankment because it has been exploited for a long time, the embankment base is at risk of damage, the port collapses, causing great losses to the people. - There needs to be a specific dredging plan and information should be made public to the authorities and people, avoiding areas where dredging causes mud to overflow, leading to shallow channels/channels leading to the wharf. If the channels are shallow, slow boat entry can affect the quality of seafood. - During dredging, attention should be paid to waste (plastic bags, foam boxes, nets, etc.), broken...) floating on the water, drifting to shore, exam areawork, may affect machinery, dredging and transportation vehicles; - It is necessary to study and select transportation routes and methods of transporting waste (road, waterway) to the subproject's dumping site, ensuring safety, efficiency, economy and speed. - Son Trang hamlet area has a surface drainage system along the road, this water source flows down from the mountain, so when designing the project, it is necessary to arrange culverts to collect this water source.	
Subproject 2	Hoa Loc commune (formerly Hoa Loc commune,	11/13/2024	35	9	26	1. Mrs. Nguyen Thi Nam, Hoa Phu village - When dredging Lach Truong fishing port, it will be transported by water or road. If transported by road, the transport vehicles must be covered with tarpaulins to minimize dust emissions and	- We acknowledged comments of the community; - This ESIA report has assessed these impacts and

Subprojects	Location	Time	Total number of people	Male	Female	Summary of consultation results	Project owner feedback
	Hau Loc district)					limit mud and soil from falling onto people's roads and fields. 2. Mr. Dong Sy Bao, Party Cell of Hoa Phu village - When investing and upgrading, both local people and fishermen will benefit directly. Anchoring and transporting seafood will be more convenient, ships will not have to go elsewhere to anchor, increasing local revenue. - When implementing construction, it is necessary to ensure the safety of anchored fishing boats and have plans to respond to extreme weather such as storms. - Anchorage and storm shelters must ensure depth for large ships to be able to anchor. 3. Mr. Pham Van Thuong, head of Hoa Phu village - When dredging and transporting waste from construction activities, vehicles carrying construction materials passing through residential roads will more or less cause damage, subsidence and degradation of residential roads, so the contractor is requested to return the road surface to the people when construction is completed. - The village area does not have an aquaculture area, however, dredging will spread turbidity of the water affecting the aquaculture areas of Hoa Loc and Minh Loc, so the project needs to take measures to notify the above localities during the construction process.	proposed corresponding mitigation measures in Chapter 5 – ESMP; - We would continue to coordinate closely with local authorities throughout the project preparation and implementation process to ensure the quality and progress of the project. - We would like to commit to seriously implementing environmental impact mitigation measures proposed in the project's ESIA, EIA report.

Subprojects	Location	Time	Total number of people	Male	Female	Summary of consultation results	Project owner feedback
						4. Mr. Nguyen Van Huan, Vice Chairman of the Commune People's Committee - Currently, the channel to and from the anchorage area is very difficult due to siltation and there is no project to dredge this area. - According to the proposed design of the storm shelter anchorage area, it is only for ships with a capacity of up to 400CV, however, currently in Hoa Loc commune, there are mainly ships over 1000CV. To ensure the effectiveness of the anchorage area, the project needs to calculate, design and dredge to accommodate ships over 1300CV. - For the sludge when sucked up, it must be settled and the settling area must be designed with drains to drain wastewater into the river so as not to affect residential areas.	
Subproject 3	Tan Tien Commune (formerly Nga Tan and Nga Tien communes, Nga Son district)	11/14/2024	12	9	3	1. Mr. Mai Ngoc Kiem, Vice Chairman of the Commune People's Committee - Local authorities and people highly agree with the investment policy of dredging and constructing an operational route on Ong Ty canal. Note that the project should remove the name Bao Trieu canal (Ong Ty canal) to avoid confusion because the investment location is Ong Ty canal, while Bao Trieu canal is a different canal. - Currently, in the commune, up to 70% of aquaculture households follow extensive farming methods, with the farming time from February to September every year and the harvest time from	- We acknowledged comments of the community; - This ESIA report has assessed these impacts and proposed corresponding mitigation measures in Chapter 5 – ESMP; - We would continue to coordinate closely with local authorities throughout the project preparation and implementation process to

Subprojects	Location	Time	Total number of people	Male	Female	Summary of consultation results	Project owner feedback
						September to October, so when constructing, the time should be chosen when people have finished harvesting. - With canal Ong Ty, when the construction is implemented, it will have less impact on the environment than the Long Son route and the Coastal Corridor route being implemented in the commune because this canal is located outside the residential area. - Currently, the commune has a dumping site that has been planned by the District People's Committee to serve the roads under construction such as Long Son road, coastal corridor road. The dumping site location already exists, however, it is necessary to carry out dumping according to regulations and not affect the surrounding aquaculture areas and traffic on the transportation route. - The project management board and construction contractor need to coordinate with local authorities in site clearance work and fully inform the local authorities about the project implementation plan.	ensure the quality and progress of the project. - We would like to commit to seriously implementing environmental impact mitigation measures proposed in the project's ESIA, EIA report.
Subproject 3	Tan Tien Commune (formerly Nga Tan and Nga Tien communes,	11/15/2024	46	30	16	1. Mr. Pham Thanh Chuong, village 5 - Agree and support the project, the project when completed will make the environment clean, drainage is also guaranteed. - The Golden Bridge area (the beginning of the canal) combined with the current market is polluted due to people dumping garbage and waste,	- We acknowledged comments of the community; - This ESIA report has assessed these impacts and proposed corresponding

Subprojects	Location	Time	Total number of people	Male	Female	Summary of consultation results	Project owner feedback
	Nga Son district)					so when implementing construction, it needs to be dredged to minimize environmental pollution for this area. - Construction trucks must be arranged with the correct load capacity to minimize noise and vibration when passing through residential areas. In case of damage to residential roads, the contractor and the Project Management Board must be responsible for compensating for that area and reach a written agreement before construction, with a survey of the current status with local government representatives. 2. Mr. Mai Sy Tuan, Vice Chairman of the Commune People's Committee - Phu Son 2 canal has been proposed for investment and upgrading by the government and people for a long time. - Phu Son 2 culvert is the drainage culvert for Nga Lien, Nga Thanh and Nga Hai communes, so when designing, it is necessary to calculate the appropriate culvert aperture to speed up the drainage process for the upper communes. - On the dredging route, there are some areas of households' ponds protruding, there are trees of Mrs. Tai, Anh Thuy, Anh Thu, Mr. Thao... some households have temporary houses to raise ducks, some areas are exploited by people themselves: there should be a reasonable compensation policy for land area, trees, adopted children, assets on land	mitigation measures in Chapter 5 – ESMP; - We would continue to coordinate closely with local authorities throughout the project preparation and implementation process to ensure the quality and progress of the project. - - We would like to commit to seriously implementing environmental impact mitigation measures proposed in the project's ESIA, EIA report.

Subprojects	Location	Time	Total number of people	Male	Female	Summary of consultation results	Project owner feedback
						and remaining investments in land when reclaimed.	
Subproject 3	Nga Son commune (formerly Nga Thuy commune, Nga Son district)	11/15/2024	20	14	6	1. Mr. Ngo Van Cuong, Vice Chairman of the Commune People's Committee - When implementing the Ong Ty canal project, the locality is the direct beneficiary of the project. The completion of the project will help people's traffic become more convenient and the water source serving aquaculture in the area will be more stable. - The project scope mainly affects two villages: Hung Dao village and Do Luong village. - Filled soil and rock transported from other places can spill over into the surrounding aquaculture area. Measures must be taken to divide and cover the area, and the volume of transportation must be coordinated appropriately. - During the rainy season, construction may affect the aquaculture area due to local flooding in the excavation and transportation areas in the dike. - From February -> August: should be delayed or avoided or have appropriate measures for this time because this is the time when people plant seeds, cannot stop production for the whole year to complete the project, affecting people's production life. - In September and October, it is necessary to monitor storms and rains, so it is necessary to have	- We acknowledged comments of the community; - This ESIA report has assessed these impacts and proposed corresponding mitigation measures in Chapter 5 – ESMP; - We would continue to coordinate closely with local authorities throughout the project preparation and implementation process to ensure the quality and progress of the project. - We would like to commit to seriously implementing environmental impact mitigation measures proposed in the project's ESIA, EIA report.

Subprojects	Location	Time	Total number of people	Male	Female	Summary of consultation results	Project owner feedback
						a plan to respond to and prevent storms and rains because the land is adjacent to the sea dike; - When moving waste rock and soil to the dumping site, it is necessary to pay attention and manage to reduce the impact on the dike route due to subsidence and collapse. When an incident occurs, it is necessary to record it in minutes and evaluate the level of participation of the Project Management Board and local authorities, as a basis for the restoration of the project immediately after the construction process. - Releasing of seedlings: may be affected by the construction process, therefore, attention and attention should be paid. If there is damage, staff should be immediately assigned to coordinate with local authorities and affected households to determine the level of impact due to the construction process, record and confirm between the parties. - It is necessary to shake hands and reach specific written agreements with relevant parties in implementing projects with related items, close or overlapping construction scopes such as coastal roads, Long Son roads, mangrove projects, etc. 2. Mr. Tran Ngoc Luu, Huong Dao village - Ensuring electricity supply for people in the aquaculture area - Apply measures to minimize and avoid affecting the physiology of shrimp - which is already very sensitive to external influences such	

Subprojects	Location	Time	Total number of people	Male	Female	Summary of consultation results	Project owner feedback
						as noise, vibration, light (if there is light at night, shrimp can jump out of the water or die). - During the rainy season, it is necessary to pay attention to drainage for the construction area and in sections, to delimit the area to prevent overflow into the pond, to avoid damage to the people. If there is any impact, the contractor must compensate according to the actual damage recorded and confirmed by the local authorities.	
Subproject 4	Hoang Tien Commune (formerly Hoang Yen Commune, Hoang Hoa District)	11/12/2024	31	20	11	1. Mr. Le Van Binh, Vice Chairman of the Commune People's Committee - Currently, the Coastal Corridor Road project is going through the commune and is under construction. For this project, aquaculture households near the road face many difficulties in aquaculture due to dust and noise from the transportation of project materials. - When transporting raw materials and waste from the construction site, specialized vehicles will affect residential roads and canal systems including irrigation and drainage canals. Contractors and investors are requested to pay attention to the environment as well as restore the road surface if damage occurs. - Currently, local people are very concerned about the environment when implementing construction such as dust and noise, so contractors need to regularly water to reduce dust when passing through residential areas.	- We acknowledged comments of the community; - This ESIA report has assessed these impacts and proposed corresponding mitigation measures in Chapter 5 – ESMP; - We would continue to coordinate closely with local authorities throughout the project preparation and implementation process to ensure the quality and progress of the project. - - We would like to commit to seriously implementing environmental impact mitigation measures

Subprojects	Location	Time	Total number of people	Male	Female	Summary of consultation results	Project owner feedback
						- I hope the government will invest in synchronous infrastructure to avoid the situation where construction is finished and then dug up, causing loss of landscape as well as affecting the quality of the project. - For the invested dike, this is a very meaningful project, the project not only protects people from floods, inundation, and waterlogging but also helps protect people's agricultural areas. 2. Mr. Ho Quang Tai, head of Nghia Thuc village. - People in Hoang Yen commune have long wanted this project. This is a project that will help develop the local aquaculture area because this area is often affected by salinity. - Currently, the canals do not have sluices to regulate water in and out to serve agricultural production as well as local aquaculture, so people face many difficulties in getting water for production and aquaculture. When investing in Son Trang 1 and Son Trang 2 sluices, it will help solve the above problems. - People are willing to support the project so that the project can be implemented as soon as possible. When the project is implemented smoothly, it is necessary to coordinate harmoniously between the locality, the project management board, the contractor and the people. 3. Mr. Do Van Ngoan_Hung Tien village.	proposed in the project's ESIA, EIA report.

Subprojects	Location	Time	Total number of people	Male	Female	Summary of consultation results	Project owner feedback
						- When implementing GPMB, the project needs to establish a GPMB Compensation Council and provide adequate compensation to affected people. - When carrying out compensation work, it is necessary to carefully review the people's land sources to avoid disadvantages when compensating. - Aquaculture households need to treat wastewater before discharging it into the environment.	
Subproject 5	Hoang Chau commune (formerly Hoang Phong commune, Hoang Hoa district)	11/11/2024	26	14	12	1. Mr. Pham Van Phuong, Chairman of People's Council - The local government and people of Hoang Phong commune highly agree with the investment policy to build the project. - The project needs to note that the dredged sludge needs to be transported and dumped in the right place to avoid affecting the environment and society in the waste transportation area. - How does the project clearly state the canal cross-section? Where to dredge, where to build roads, and note that when implementing construction, it is necessary to limit site clearance. 2. Mr. Luong Anh Mat_Bac Hoi Trieu Village. - Currently, Hoang Phong commune has a planned aquaculture area. When dredging helps the canal system operate well, bringing about effective irrigation as well as providing water for the aquaculture area.	- We acknowledged comments of the community; - This ESIA report has assessed these impacts and proposed corresponding mitigation measures in Chapter 5 – ESMP; - We would continue to coordinate closely with local authorities throughout the project preparation and implementation process to ensure the quality and progress of the project. - - We would like to commit to seriously implementing environmental impact mitigation measures

Subprojects	Location	Time	Total number of people	Male	Female	Summary of consultation results	Project owner feedback
						- Phong Chau canal is a very long canal, running through many communes in Hoang Hoa district. Currently, wastewater from households along the canal is often discharged directly into the canal. On the other hand, some locations on the canal have a lot of duckweed, so the canal has been heavily polluted. When dredged, it will create a good environmental landscape for people and increase irrigation efficiency for agricultural production areas. - Currently, the two culverts on Hoi Trieu canal have seriously degraded. We propose a new investment project to build for the people.	proposed in the project's ESIA, EIA report.
Subproject 6	Hoang Chau commune (formerly Hoang Luu commune, Hoang Hoa district)	11/11/2024	37	22	15	1. Mr. Luong Ke Bao, head of Phuong Ngo village - People are very excited when the government pays attention to investing in infrastructure for aquaculture areas in Hoang Luu commune. The project, when completed, will help people increase their income and help develop the local economy in a more sustainable way. - As the consultant has presented about the environmental impacts as well as the impacts on people's lives, impacts on land acquisition... we completely agree. When implementing projects, it is impossible to avoid the above impacts, so we hope the project will be implemented soon so that people can feel secure in production. 2. Mr. Le Van Hung_Head of Phuc Le village	- We acknowledged comments of the community; - This ESIA report has assessed these impacts and proposed corresponding mitigation measures in Chapter 5 – ESMP; - We would continue to coordinate closely with local authorities throughout the project preparation and implementation process to ensure the quality and progress of the project. - - We would like to commit to seriously

Subprojects	Location	Time	Total number of people	Male	Female	Summary of consultation results	Project owner feedback
						- Agree with the investment policy for construction of project items as presented by the consultant. - During construction, attention must be paid to environmental issues such as dust, noise, and spilled mud when transporting waste out of the site. - The project investment area is an area with planned aquaculture and a production area for the people. When constructing, the time should be chosen when the people have finished harvesting crops and aquatic products. Avoid constructing at the time when people get water for production. - Construction machinery and equipment must meet technical requirements on noise, smoke and dust emissions during operation. - During construction, it is necessary to arrange appropriate construction time. Avoid construction during rush hours when students go to school. 3. Mr. Le Ngoc Hanh_Chairman of the Commune People's Committee - The people and government of Hoang Phong commune are very excited when the Party and the State pay attention to upgrading the infrastructure of the aquaculture area. The project helps the locality develop the aquaculture industry more sustainably. - We completely agree with the environmental and social impacts as presented by the consultant at the conference. It is recommended that construction be carried out in a rolling and quick	implementing environmental impact mitigation measures proposed in the project's ESIA, EIA report.

Subprojects	Location	Time	Total number of people	Male	Female	Summary of consultation results	Project owner feedback
						manner so as not to affect traffic and people's water supply.	
Subproject 7	Hoang Chau commune (formerly Hoang Chau commune, Hoang Hoa district)	11/12/2024	24	13	11	1. Mr. Nguyen Duy Linh, Giang Hai village - The family is affected by the project investment and construction, the family wishes to be compensated in the form of land for land if the local land fund is available. The project needs to consult directly affected households during the project implementation process. 2. Mr. Trinh Xuan Tien, Giang Hai village - We fully support the investment in project construction, dredging of canals and construction of operating routes to serve the local aquaculture industry. - When dredging canals, it will affect the water source serving households engaged in aquaculture, so when implementing the project, it is necessary to have barriers or technical measures and solutions to not affect the aquaculture water source of households. - When constructing, it is necessary to deploy quickly, carry out construction in a rolling manner and ensure environmental safety and social order at the construction site. - The project needs to calculate to minimize the impact of land acquisition on people. 3. Mr. Nguyen Dinh Lam, Vice Chairman of the Commune People's Committee	- We acknowledged comments of the community; - This ESIA report has assessed these impacts and proposed corresponding mitigation measures in Chapter 5 – ESMP; - We would continue to coordinate closely with local authorities throughout the project preparation and implementation process to ensure the quality and progress of the project. - We would like to commit to seriously implementing environmental impact mitigation measures proposed in the project's ESIA, EIA report.

Subprojects	Location	Time	Total number of people	Male	Female	Summary of consultation results	Project owner feedback
						- The commune has planned freshwater and brackish water aquaculture areas. Therefore, investing in projects will be very practical for the people here. - When designing, it is necessary to carefully survey and arrange suitable regulating sluice locations so that people can get water for production and aquaculture most conveniently. - The project notes that Phong Chau canal is only designed to provide fresh water for agricultural production for people in Hoang Luu, Hoang Phong and Hoang Chau communes.	
Subproject 8	Van Loc commune (formerly Da Loc commune, Hau Loc district)	11/13/2024	28	17	11	1. Mr. Bui Van Thai, Vice Chairman of the Commune People's Committee - The government and the people strongly support the investment policy of the project. When completed, the project will help improve the environment, increase crop productivity and ensure water resources for aquaculture. - The project design location is close to residential areas and households' ponds. When implementing construction, it will affect the aquaculture process of households. Therefore, when implementing construction, the contractor needs to have construction measures to minimize the amount of soil, rocks, and construction site wastewater entering the aquaculture pond. - Regulating water in and out of aquaculture and agricultural production areas is very important, so it is necessary to pay attention, calculate, and	- We acknowledged comments of the community; - This ESIA report has assessed these impacts and proposed corresponding mitigation measures in Chapter 5 – ESMP; - The ESIA report also includes the roles and responsibilities of environmental and social management of stakeholders throughout the project implementation process to ensure the quality of the project, labor

Subprojects	Location	Time	Total number of people	Male	Female	Summary of consultation results	Project owner feedback
						coordinate with the locality in regulating water for the contractor's construction. - The construction area is located in an aquaculture area, so it is very sensitive to the environment, construction waste, machinery and equipment, spilled oil and grease, etc. The contractor is requested to regularly collect waste and limit oil and grease spills into the pond. - During construction, dust and noise will directly affect households living along the canal, especially the route of transporting dredged materials will cause sludge to spill onto the road. The contractor needs to regularly clean the roads and spray water to suppress dust regularly. 2. Mr. To Xuan Thach_Yen Loc Village - We fully support and highly agree with the investment in the project. The project helps the locality to sustainably develop the aquaculture area as well as increase the value of agricultural production. - The canal area from Quay Co sluice to Ong Hong sluice has 7 planned aquaculture area, currently there are 7 water intake sluices, when the project builds the operation management road passing through, it will affect these 7 sluices, it is recommended that the project design to return them to the people. - Trees planted along the road corridor during construction are affected. The project is requested to compensate and support the people.	safety, environmental sanitation and social order. - We would continue to coordinate closely with local authorities throughout the project preparation and implementation process to ensure the quality and progress of the project. - We would like to commit to seriously implementing environmental impact mitigation measures proposed in the project's ESIA, EIA report.

Subprojects	Location	Time	Total number of people	Male	Female	Summary of consultation results	Project owner feedback
						- Construction should be done from November to February because this is the time when people have not released seeds. - If during the construction process, animals in the pond die due to the contractor's actions, we request support for the people to reduce their losses. - Mr. Vu Xuan Tung, Yen Loc village - Currently, the aquaculture area does not have a road for people to enter their ponds, making travel difficult. People have to build temporary bridges to get there. Therefore, the investment project to build a road for management and operation has made people very excited. - Currently, there are many construction projects in the village, but the construction quality is not good, leading to new constructions being damaged after a short time of use. It is recommended that when investing in construction projects, the construction process should be closely monitored to ensure the most effective quality of the project.	
Subproject 9	Quang Chinh commune (formerly Quang Trung commune, Quang Xuong district)	11/14/2024	19	15	4	1. Mr. Le Dinh Ninh, Vice Chairman of the Commune People's Committee - Currently, there are 2 culverts on the route, Ong Thuoc culvert and Ong Vanh culvert, which were invested in and built with local budget to regulate water for aquaculture areas and agricultural production areas. Currently, these 2 culverts have seriously degraded and need to be replaced with new culverts to ensure irrigation/drainage.	- We acknowledged comments of the community; - This ESIA report has assessed these impacts and proposed corresponding mitigation measures in Chapter 5 – ESMP;

Subprojects	Location	Time	Total number of people	Male	Female	Summary of consultation results	Project owner feedback
						- Currently, the water in the canal is not enough to serve aquaculture because the canal is narrow. - Measuring the canal section from km00 (Ong Thuoc culvert) to km373+00, this section of the canal has a very steep slope. If dredged, it will cause the existing residential road to collapse. It is recommended that the project have a design plan to form a box culvert to ensure safety. - Ong Thuoc and Ong Vanh culverts: newly built, should have an aperture of 1.6 - 1.8m, plastic milling with steel for control, because the current concrete tray in operation does not ensure safety. - 2 drainage culverts through residential areas need to be 100% restored, these culverts were built by veterans and residents themselves. - 8 culverts through the canals of the aquaculture area: need to be renewed and the depth of the culverts lowered, arranged to install an area inside where people can open and close themselves, and an area outside where people can actively close when taking water and draining this area. - Residential roads across the canal: need to be compensated if damaged like the bridge near Mr. Le Hong Quan's house, Vu Van Dau... the bridge needs to be rebuilt near Van Dien - Van Ha dam, inspected to facilitate direction, operation of aquaculture production and people's travel. - Traffic route: build a traffic route from Ong Vanh culvert to Yen river with concrete Bm=5m, especially serving the travel and aquaculture	- We would continue to coordinate closely with local authorities throughout the project preparation and implementation process to ensure the quality and progress of the project. - We would like to commit to seriously implementing environmental impact mitigation measures proposed in the project's ESIA, EIA report.

Subprojects	Location	Time	Total number of people	Male	Female	Summary of consultation results	Project owner feedback
						production of local people. The eastern road is adjacent to the residential area (Ong Thuoc culvert) to Hoang river dike, Bm=3.5m - During the construction process, there are a number of related projects, the Project Management Boards and related units and agencies need to agree and clearly define the boundaries and scope of work to be performed by each party in the adjacent area or with overlapping items. Specifically, in the North, adjacent to Ong Vanh culvert, the project invested by Agri Company with an area of 33 hectares has cleared the land adjacent to Cong Vanh canal (Yen river side) for high-tech white-leg shrimp farming, the expected investment time is 2025, bringing benefits to the locality and solving the labor problem for about 40-50 local workers. In addition, the construction needs to reduce the impact on the aquaculture area (about 120 hectares) in the area inside the route. - Currently, households in the commune have not been granted land use certificates, therefore, if land is recovered, it is necessary to issue land use right certificates before recovery or have appropriate solutions to prevent waste, overlap, and increase the time for processing records. 2. Mr. Le Dinh Hung, Dung village - The project needs to ensure water drainage for the inner area under construction, especially during the rainy and stormy season at Ong Thuoc culvert, because it is adjacent to the Hoang River bridge, the dike and the road for living, agricultural	

Subprojects	Location	Time	Total number of people	Male	Female	Summary of consultation results	Project owner feedback
						production, aquaculture and transporting waste to the collection site... There needs to be specific solutions and plans. - There must be specific, concise, and sectioned construction measures to avoid affecting the surrounding areas due to the daily water intake and discharge of water from the aquaculture areas. 3. Mr. Le Dinh Toan, Tra 2 village - The road from Ong Thuoc culvert to Tra 2 village, Loc Tien village, Dung village is the only road of the 3 villages and was built by the people's contributions. It is necessary to arrange a reasonable construction plan and restore the original condition if there is damage on the route. - Along the route, there is a section passing through a cemetery, so the contractor needs to pay attention and avoid sensitive times or when there are funerals here. - Research and calculate dredging depth to ensure water intake within 5-6 hours into suitable aquaculture areas. - Construction should not be prolonged but should be carried out on schedule. Prolongation will affect the aquaculture area and benefit of the breeder. - Local authorities and people create all conditions for the construction unit to ensure the project is implemented as quickly as possible.	
The Project	Total		306	171	135		

Overall, the opinions are very supportive of the project, with a desire for the project to be implemented effectively, quickly, and with high quality. Some key feedback includes: (i) ensuring the minimization of environmental impacts during the dredging of the channel; (ii) minimizing the impacts on aquaculture activities; (iii) ensuring traffic safety (both waterway and roadway); and (iv) ensuring a reasonable construction schedule and restoring the original condition in case of any damage along the main transport route for materials to the subprojects.

The project owner has acknowledged comments of the community; This ESIA report has assessed these impacts and proposed corresponding mitigation measures in Chapter 5 – ESMP and commit to seriously implementing environmental impact mitigation measures proposed in the project's ESIA, EIA report.

Some Photos of community consultation in project implementation areas are as follows:



Consulting with representatives of the People's Committee of Hoang Phong commune, Hoang Hoa district



Consulting with representatives of the People's Committee of Quang Trung commune, Quang Xuong district



Community consultation meeting of subproject 9 in Quang Trung commune, Quang Xuong district



Community consultation meeting at subproject 5 in Hoang Phong commune, Hoang Hoa district



Community consultation meeting of subproject 2 in Hoa Loc commune, Hau Loc district



Community consultation meeting of subproject 8 in Da Loc commune, Hau Loc district



Female group discussion of subproject 2 in Hoa Loc commune, Hau Loc district



Group discussion of households in the agricultural cooperatives of subproject 3 in Nga Thuy commune, Nga Son district



Interview with households at subproject 2 in Hoa Loc commune, Hau Loc district.



Interview with households at subproject 1 in Hoang Truong commune, Hoang Hoa district.



Interview with households at subproject 3 in Nga Tan commune, Nga Son district.



Interview with households of subproject 8 in Da Loc commune, Hau Loc district.

6.3. Information Disclosure

The first draft of the ESIA, SEP, LMP, and ESCP in Vietnamese was published locally at the communes within the project area and by the Project Management Board in November 2024 for community consultation. Based on the contents of the ESIA consulted during the meetings, the local people were informed about the Project and provided their feedback/comments on related environmental and social issues.

The final draft of the ESIA, along with the final drafts of the RP, SEP, LMP, and ESCP in English, was published on the World Bank's external website in September 2025 for public consultation. The final ESIA in both Vietnamese and English will be published locally at project sites and on the World Bank website, with an expected release in October 2025.

APPENDICES

APPENDIX 1: DREDGED MATERIALS MANAGEMENT PLAN (DMMP)

*This DMMP (Dredged Material Management Plan) is prepared during the feasibility study (FS) phase. The **DMMP will be updated by the Detailed Design Consultant**, then included in the bidding documents and contracts of the construction packages with dredging activities of 9 sub-projects along with IESMC, worker code of conduct and other mitigation requirements in the ESMP. After signing the contract, the Contractor will prepare the Contractor's DMMP (C-DMMP) based on the DMMP in the contract and submit it to the Project owner/construction supervision consultant for approval before construction commencement.*

In addition, this DMMP proposes measures to minimize impacts on water quality/biology through selection of dredging methods and procedures; mitigation measures and environmental quality monitoring programs.

Introduce

Thanh Hoa SFDP Project consists of 9 subprojects, each of which will have dredging activities in the navigation channel/fishing port/storm shelter area and irrigation canals.

In addition, this DMMP recommends measures to reduce water quality/biological impacts through dredging method and procedure selection; mitigation measures and environmental quality monitoring programs.

Overall, the above mentioned infrastructure investment items will bring about positive impacts. However, negative environmental and social impacts will also occur during the construction phase of the works. In particular, for the dredging and embankment of ports/anchorage/irrigation canals, the site clearance and dredging process will generate a large volume of excavated and dredged materials that need to be disposed of (about 462,142 m³). Specifically as follows.

Table Annex 1: Volume of excavated soil, dredged materials generated by the project

No.	Subprojects	Demolition volume (m ³)	Volume of excavated soil (m ³)	Dredging volume (m ³)	Volume of leveling (backfill soil) (m ³)	Volume of excavated soil used for on-site filling (m ³)	Volume of excavated and dredged materials to be dumped (m ³)
		1	2	3	4	5	6=2+3-5
1	Subproject 1	0	14,290	18,800	26,952	14,290	18,800
2	Subproject 2	1511	5,135	365,000	41307	5,135	365,000
3	Subproject 3	0	253	94	20,049	253	94
4	Subproject 4	49	13,683	12,219	38,598	11,611	22,892
5	Subproject 5	135	9,813	10,829	11,737	4,924	15,717
6	Subproject 6	146	8,728	4,142	14,517	2,894	9,976
7	Subproject 7	18	9,392	8,931	17,687	3,645	14,677
8	Subproject 8	297	7,599	8,731	12,604	4,813	11,517
9	Subproject 9	420	17,789	1,240	18,860	15,560	3,469
	Total	2,576	86,682	429,986	202,311	63,125	462,142

The project's volume of excavated soil and excess dredged materials during the construction phase must be transported to landfills to avoid environmental impacts and to be utilized as resources in the future. Most of the dredged volume (mainly sand) can be utilized as sand resources (filling sand - provided it meets the standards for construction materials) on the basis of future resource auctions according to the provisions of the Law on Minerals. However, without appropriate management plan, excavated and dredged materials will affect the surrounding environment as well as the exploitation and aquaculture activities of fishermen and aquaculture workers in the area.

Therefore, this Dredged Materials Management Plan (DMMP) is prepared to comprehensively manage the impacts and risks during dredging and construction of the Project's works.

DMMP covers the main contents as follows:

- i. Dredging scope and method
- ii. Key characteristics of the current status of rivers/seas/canals to noted
- iii. Volume and properties of excavated and dredged materials
- iv. Description of proposed storage areas and transportation options for excavated and dredged materials
- v. Environmental and social impacts and risks of dredging activities on rivers/seas
- vi. Environmental and social impact and risk mitigation plan
- vii. Environmental monitoring and supervision plan
- viii. Reporting requirements.

1. Dredging scope and method

1.1 Dredging scope

Subproject 1 – Hoang Truong port

Dredging of anchorage area and navigation channel with total dredging volume of about 18,800 m³, including:

- Dredging the anchorage area: The dredging area is the water area in front of the wharf with a length of about 800 m, the width of the berthing area ranges from 12-20 m and of the channel is about 40 m; The anchorage area for ships $L=12\text{ m} - 24\text{ m}$; The dredged bottom elevation is from -2.9 m to -4.0 m.
- Dredging the access channel to the anchorage area: crest elevation according to Article 4.4 TCVN 11820-5:2021 is: (i) Main conditions: Wharf surface elevation = $H_{50\%} + 2.0\text{m} = 0.27 + 2 = +2.27\text{ (m)}$; $H_{50\%}$: the water level monitored over many years (not less than 10 years) with 50% probability of occurrence; (ii) Inspection conditions: Wharf Crest Elevation = $H_{1\%} + 1.5\text{m} = 1.53 + 1.5 = +3.03\text{ (m)}$; $H_{1\%}$: the water level monitored over many years (not less than 10 years) with 1% probability of occurrence; In addition, the wharf crest elevation also takes account into the 2020 Climate Change Scenario, the sea level rise in the Hon Dau - Deo Ngang area by 2080 is about 50cm on average (from 34cm to 71cm according to the RCP8.5 scenario - taken as 73cm); and the elevation of detailed construction planning at a scale of 1/500 of the area has been approved in the area, connecting to the regional infrastructure network with a planned elevation of +2.35m. At the same time, taking consideration into current elevation of the fishing ports in operation along with the projected sea level rise due to climate change, the wharf crest elevation as +2.35m (State system) is recommended.

- Turning basin and channel: The project area has 4 turning areas with diameters of 2 turning areas for ships up to 12m, each with a diameter of D40m, 1 turning area for ships up to 17m with a diameter 55m and 1 turning area for ships up to 24m, with a diameter 75m. The dredging elevation of turning basin and channel is -2.9m (State system).

Subproject 2 – Lach Truong:

- The dredging volume of water area, turning area and ship channel is about 48,380 m³ and storm shelter area is about 321,620 m³.
- Dredging the water area in front of the wharf: Width of about B = (40~50) m, length of 330m (The dredging area in front of the wharf does not affect the inland waterway of Lach Truong river). The dredged bottom elevation from -3.6m to -4.1m.
- Dredging the access channel to the anchorage area and storm shelter anchorage area for fishing boats in Lach Truong: Length of approximately L=1,150.0m; bottom width of B=89-96m. Dredged bottom elevation from -3.6m to -4.1m.

Subproject 3 - Nga Son commune, Nga Tien:

- Dredging volume of the subproject 3 is: about 94 m³.
- Dredging Phu Son 2 canal, length of 1,436.34 m. - Dredging main drainage canal of aquaculture area: trapezoidal canal cross-section: (12 × 2.5) m, canal slope m = 2.0.
- Dredging Bao Trieu canal, length of 2,581.70 m. (i) Section 1: 1,356.10 m – cross-section (6 × 2.25) m, canal slope m = 1.5. (ii) Section 2: 1,225.60 m – cross-section (8 × 2.35) m, canal slope m = 1.5.

Subproject 4 – Hoang Tien commune:

- Dredging volume of the subproject 4 is: 12,219 m³.
- Upgrading and reinforcement of Nghia Thuc canal with a length of 827.16m including: Dredging the entire canal with a length of 827.16 m and a width of 2 m.

Subproject 5 – Hoang Chau commune:

- Dredging volume of the subproject 5 is: 10,829 m³.
- Dong Coi canal is 1,310.20 m long and 3 m wide; Hoi Trieu canal is 1,714.57 m long and 5 m wide; Tay canal is 1,339.0 m long and 5 m wide.

Subproject 6 – Hoang Chau commune:

- Dredging volume of the subproject 6 is: 4,142 m³.
- Upgrading of the canal route 1 with a length of 819.29 m, canal route 2 with 213.38 m long Of which: Dredge entire canal, install settlement joints and reinforce concrete tie beam along the canal route. The canal banks will be integrated with an operation management road, the roadbase is 4.0m wide, road surface is structured of concrete with 3.0 m wide.

Subproject 7 – Hoang Chau commune:

- Dredging volume of the subproject 7 is: 8,931 m³.
- (i) Upgrading the Khe River canal with a length of L=1,200 m, including: Dredge entire canal with a length of 1,200 m and a width of 4.5 m. (ii) Upgrade and dredge canal branch 1 with a length of 487.00 m and a width of 3 m.

Subproject 8 – Van Loc commune:

- Dredging volume of subproject 8 is: 8,731 m³.
- Dredging and completing the main drainage canal with 1,256.13m long and 9m wide.

Subproject 9 – Quang Chinh commune:

- Dredging volume of the subproject 9 is: 1,240 m³.
- Dredging the supply canal from Ong Thuoc sluice to Ong Vanh sluice, building an operation management road with 90m long and 3m wide.

1.2. Dredging method

General method

- Before dredging, it is necessary to conduct surveys, clearance of unexploded ordnance (UXO) and removal of obstacles according to the regulations applicable to each subproject scope.
- Surveying works:
 - + Re-survey the site, verify existing benchmarks, and establish additional benchmarks (if necessary);
 - + Develop a construction control grid as the basis for all surveying work as the basis for all geodetic activities; use this network to perform elevation profiling and control vertical deviations and elevation levels of structural components.
 - + Accurately position the project according to the design, check the deviation in elevation of the project components;
 - + Positioning for construction of all project items;
 - + Subsidence monitoring, deformation observation;
 - + Perform as-built drawings and measurements upon completion of construction; Comply with specific contents specified in construction standards for surveying work.
- For subproject 1,2: Before carrying out the above steps, and before commencing dredging activities, handing over the site and control benchmarks for the construction process, execute procedures to apply for construction permits, and approve marine safety plans;
- Depending on the geology of the dredging area, an appropriate construction method is selected: hydraulic suction dredger or a grab bucket system will be used combined with barge to transport the dredging materials to the disposal site which must be accurately identified in line with the requirements for dredging collection, especially those rated to environmental protection.
- Supervision of construction and transportation of dredged materials must be in compliance with legal regulations; ensuring the disposal of dredged materials takes place at the designated locations.

Specific dredging methods

**** For dredging of wharf and storm shelter anchorages – Subproject 1,2***

- **Subproject 1:** Construction method: use a grab bucket system combined with barge to transport the dredged materials to the disposal site, the disposal distance is L=3km; the dredged materials will be pumped from the barge onto the disposal site at the low-efficiency salt field in Van Loc commune.
- **Subproject 2:** For dredging the storm shelter area, hydraulic suction dredgers are used to pump the dredged materials to the disposal site through a pipeline system with pipeline distance of

L=0.5 km. The dredged material consists mainly of clayey silt containing organic humus, which is pumped directly into the disposal site located in the low-efficiency salt field area of Van Loc Commune, adjacent to the storm shelter anchorage area. Enclosed by a containment embankment system to prevent sediment leakage and is equipped with wastewater filtration outlets, allowing water to drain into the existing canal system before flowing into the river.

- Construction method in dredged material disposal site: this disposal site will be enclosed by sandbags (s and may be sourced from dredged material if it meets quality requirements), with the crest elevation built according to the approved planning elevation, averaging approximately 4 m); During the disposal process, a primary settling pit and a water collection pit will be constructed. Leachate from the dredged materials will flow through a temporary drainage ditch to the water collection pit, then flow to the receiving source.

**** For dredging irrigation canals – Subproject 3 → Subproject 9***

Step 1:

Due to the extended alignment of the project's longitudinal components, construction will be carried out using a segmented approach. Branch roads are utilized for transporting soil, materials, and equipment to the site. The existing canal bed will be utilized for flow diversion during construction. The existing canal bed will be utilized for flow diversion during construction. For sections located on the existing canal bed, anti-softening mats will be used to support excavators during operation. Average mud dredging depth is 0.50m, based on geotechnical data from the approved design phase. Equipment and machinery will be mobilized at both ends of the canal, with construction proceeding from both ends toward the center:

- For Phu Son 2 canal, section from K - K0+809.89 m: Use Lassen III sheet piles to enclose the construction area of the right bank embankment, and divert the flow to allow construction of the remaining section of the drainage canal.
- For For Bao Trieu Canal (Ong Ty Canal): During construction, a pontoon is used to support the excavator for dredging the canal according to the design cross-section, allowing flow diversion through the existing drainage canal.
- For Subprojects 4, 5, 6, 7 in Hoang Yen, Hoang Luu, Hoang Phong, and Hoang Chau communes: During construction, a pontoon is used to support the excavator for dredging the canal bed according to the design cross-section, so flow diversion is not required.
- Main drainage canal, segment from Ong Ninh sluice to Quay Co sluice, section from K0+429.14 – K0+488.90 m (right bank embankment, downstream of Ong Hong sluice): Use bamboo piles and woven bamboo screens to form twin-pile cofferdams for constructing the right bank embankment and divert the flow for the remaining section of the drainage canal.
- Dredging in-field canal branch: During dredging, a pontoon is used to support the excavator for dredging the canal according to the design cross-section, allowing flow diversion through the existing drainage canal.
- Canal from Ong Thuoc sluice to Ong Vanh sluice: Flow diversion follows the existing canal.

Step 2:

- Drive bamboo piles to reinforce the foundation within the construction area of the toe beam for the riverbank revetment.
- Construct the toe beam, complete the cross-section of the revetment and canal bank foundation, and simultaneously build the operation and maintenance road according to the design cross-section.

Step 3:

- Dredging the main canal bank according to design: Excavators are positioned on both sides of the canal, shape the canal slopes as designed. Excavated material is loaded onto trucks and transported to designated disposal site.

Step 4:

- Complete embankment foundation according to design cross-section. Finish the reinforcement of crushed stone layers and concrete on the canal bank.
- The machinery and equipment expected to be used by for subprojects with dredging activities will be as shown in the following table:

Table Annex 2: Machinery and equipment for dredging construction

No.	Machinery/equipment	Quantity (pieces)
I	Subproject 1,2	
1	10T crane	1
2	16T crane	1
3	25T crane	1
4	5T crane	2
5	50T crane	1
6	30T floating crane	1
7	60T steel buoy	1
8	200T barge	1
9	400T barge	1
10	150CV tugboat	2
11	23CV canoe	2
12	126CV diesel-powered sand pump	2
13	250T barge	1
14	360CV tugboat	1
15	Vessel (5T boat) with pump	2
16	Diving station	1
II	Subproject 3	
1	10T crane	1
2	16T Pneumatic-Tire crane	1
3	40T Pneumatic-Tire crane	1
4	16T crawler crane	1
5	Pontoon	1
6	Construction barge - capacity: 200 T	1
7	Construction barge - capacity: 400 T	1
8	Tugboat and Marine Construction Support Vessel (anchoring, oil supply, etc.) - capacity: 150 CV	1
9	Diesel-powered water pump - capacity: 10.0 CV	1
10	1.25 m ³ excavator with hydraulic breaker/clamp jaws	1
11	Bulldozer - capacity: 110 CV	1
III	Subproject 4-> Subproject 7	
1	110 CV bulldozer	2
2	1.25 m ³ excavator	2
3	Water pump	2
4	Drilling machines of all kinds	4
5	Pontoon	1
6	Excavator - bucket capacity 0.80 m ³	2
IV	Subproject 8,9	

No.	Machinery/equipment	Quantity (pieces)
1	110 CV bulldozer	2
2	1.25 m ³ excavator	2
3	Water pump	2
4	Drilling machines of all kinds	4

(Source: Project Basic Design Estimate, 2025)

2. Main characteristics of current status of rivers/seas/canals and related activities

Before developing the construction method, the Contractor must thoroughly review the technical documents of each subproject related to dredging activities in rivers, seas, and irrigation canals, including the creation of navigation channels, turning basins, and irrigation canal, as well as the Environmental and Social Impact Assessment (ESIA). The following characteristics should be carefully considered when preparing the C-DMMP:

Subproject 1 – Hoang Truong:

The planning study area of Subproject 1 is a section of nearshore water surface, including part of the land area currently undergoing leveling. The terrain elevation varies from the shoreline to the boundary of the study area, ranging from 3.6 m to –7.25 m. The slope direction of the shoreline area gently descends from the Southwest to the Northeast. The water surface occupies the majority of the area, while the shoreline is divided into two zones: (i) Eastern zone: Existing stone revetment system and mooring pillars for port vessels. (ii) Western zone: Spontaneously leveling area including a water basin and open land used by private individuals for boat repair, interspersed with temporary tin-covered structures of simple construction. Total area of the subproject 1 is 125,091 m², including: Water surface: approx 121,879.2 m², Creek bank: approx 2,870.6 m², Existing stone revetment land: approx 341.2 m².

Current status of port infrastructure includes:

- The embankment of the wharf is about 400 m long, is located within the boundary of the planning study area. The embankment structure consists of tightly stacked rubble stones. Many sections of the embankment have been degraded, with sediment accumulation along the embankment accompanied by unauthorized land reclamation by surrounding residents for informal business activities over the years, reducing its operational effectiveness.
- The private boat repair area is scattered along the Linh Truong foothill, located outside the boundary of the planning study area, and is arranged alongside spontaneously reclaimed land plots and ship-repair rail tracks that fall within the planning study boundary. This spontaneous development reflects shortcomings in management due to the port area not yet being fully invested and properly planned.
- The navigation channel is shallow due to lack of dredging, making it very difficult for high-capacity vessels to enter and unload cargo.
- Port infrastructure system has not been invested in (wharf, access roads, lighting system, roof, etc.).
- Currently, it is estimated that this location serves as the unloading point for more than 300 fishing vessels from Hoang Truong Commune and neighboring areas, with an annual throughput of approximately 2,000–3,000 tons.

Subproject 2 – Lach Truong:

- Current status of Hoa Loc Fishing Port: It is a Class II fishing port with an area of about 3.5ha; the storm shelter basin has a total area of 19.5 ha, capable of accommodating vessels with capacities up to 400 CV. Hoa Loc Fishing Port is located in Hau Loc District (currently Hoa Loc Commune), Thanh Hoa Province, and is one of the province's major fishing centers. The port

was invested in and put into operation in 2007 as a Class II structure, designed to serve 200 to 300 vessels with capacities ranging from 135 to 450 CV. The current length of the port is about 270.0m, of which 120m are designated for fishing vessels over 400 CV, and 150m are designated for vessels from 90 to 400CV.

- Lach Truong storm shelter anchorage area was invested in and put into operation in 2012, with a designed capacity of 264 vessels. (i) Zone 1 for vessels with capacities from 250 to 400 CV: this zone starts from the entrance of De Canal, runs along the canal, and ends at a point 425 meters from the canal entrance. (ii) Zone 2 for vessels with capacities from 90 to 250 CV: this zone begins at the end of Zone 1 and extends to La La Temple, with a length of 725 meters. Vessels are arranged to anchor on both sides. (iii) Zone 3 for vessels with capacities up to 90 CV: this zone begins at La La Temple Wharf, runs along the De Canal dike to the north, passing through Vich ferry terminal, with a total length of 680m. Zones 1 and 2, with a combined length of about 1.15 km, were invested in and put into operation in 2014, including the components of: channel expansion and dredging, dike construction, and installation of mooring systems for fishing vessels. After nearly 10 years of effective use and operation, the anchorage area has now been heavily affected by flooding and the lack of regular dredging to clear the channel. This has led to significant sediment accumulation within the basin. As a result, when the tide is low, mooring buoys rest on the mud surface. The anchorage area has been reduced in size, while the number of vessels arriving and docking continues to increase, making entry and exit for storm sheltering increasingly difficult and hazardous.
- According to the current survey, the two anchorage areas have experienced significant sediment accumulation. At the entrance to the basin, when the tide is low, the water level is approximately elevation -1, allowing only small vessels under 50 CV to enter. The two anchorage zones have been severely silted, with specific details as follows:
 - Zone 1: Length of 425m, accommodates vessels up to 400 CV. Currently, at low tide, the water depth in the mooring channel is only about 0.5m; during high tide, the depth reaches approximately 1.8m. The area near the ferry terminal from Hoa Loc to Hai Loc and Hoang Hoa has been severely silted.
 - Zone 2: Length of 725m, accommodates vessels up to 250 CV. Currently, at low tide, the water depth in the mooring channel is only about 0.2 meters; during high tide, the depth reaches approximately 1.5m.
- According to Decision No. 5109/QĐ-UBND dated December 30, 2016 approved by Thanh Hoa Provincial People's Committee. The land area assigned to Hoa Loc Fishing Port Management Board for management and use is: 220,791.1 m². It is used for the purpose of building the Fishing Port Headquarters and storm shelter anchorage area, specifically: The area for building the Hoa Loc Fishing Port Management Board Headquarters is 2,237.6 m²; Hoa Loc Fishing Port land is 30,007.3 m²; Land for Lach Truong storm shelter anchorage (land in the storm shelter basin area) is 188,516.2 m².

Subproject 3 – Nga Tien commune:

- Current land use status: It is the land designated for construction works running along the drainage canal bank, integrated with the operation and maintenance road, internal access roads, and the protection corridor of the structure in accordance with current legal regulations.
- Dredging of main and branch drainage canals, upgrading and expanding canal banks combined with construction of operation and maintenance roads are all aligned with the existing infrastructure routes. Therefore, the land area and residential houses along the route are not affected. The affected land mainly consists of aquaculture ponds along the canal route, as well as irrigation surfaces and buffer zones located adjacent to the dike foot.

Subproject4 – Hoang Tien commune:

- Current land use status: The land for construction works along the banks of the drainage canal combined with the operation and management road, internal traffic road and the construction protection corridor according to the provisions of current law.
- The Hung Tien canal currently has a narrow channel bed and is heavily silted, with many sections of the canal banks eroded. As a result, drainage is slow, causing waterlogging and insufficient water supply for aquaculture. The existing culvert under the dike remains in good condition and still ensures adequate drainage capacity, so its current state will be maintained.
- Dredging of the main and branch drainage canals, upgrading and expanding of canal banks combined with the construction of operation and maintenance roads are all aligned with the existing infrastructure routes. Therefore, the land area and residential houses along the route are not affected. The affected land mainly consists of aquaculture ponds along the canal route, as well as irrigation surfaces and buffer zones located adjacent to the dike foot.

Subproject 5 – Hoang Chau commune:

- Current land use status: The land for construction works along the banks of the drainage canal combined with management and operation roads, internal traffic roads and construction protection corridors according to current regulatory laws.
- Dredging Dong Coi canal, Cau Dua canal, Hoi Trieu canal and Tay canal, which are the main drainage canals, branches, upgrading and expanding the canal banks combined with building management and operation roads are all along the existing construction route. Therefore, the land area and residential houses along the route are not affected. The majority of the land area consists of aquaculture ponds located along the canal route, as well as irrigation surfaces and buffer zones situated adjacent to the dike foot.

Subproject 6 – Hoang Chau commune:

- Current land use status: The land for construction works running along the canal bank from the Tay dike of the Cung River to the Con Voi sluice and the village access road—Ngo Hao, Phuong Ngo 2 Village. This land serves the function of water supply and drainage, integrated with the operation and maintenance road, internal access roads, and the protection corridor of the structure in accordance with current legal regulations.
- Dredging of the main and branch drainage canals, upgrading and widening of canal banks combined with the construction of operation and maintenance roads are all aligned with the existing infrastructure routes. Therefore, the land area and residential houses along the route are not affected. The affected land mainly consists of aquaculture ponds located along the canal route, as well as irrigation surfaces and buffer zones situated adjacent to the dike foot.
- Serves drainage for over 200ha aquaculture. The project area includes 170 ha of aquaculture land. Currently, the main supply and drainage canal lacks inlet and outlet culverts at the canal head, resulting in sediment accumulation and canal bank erosion. In addition to supplying and draining water for aquaculture, the main canal also serves as a drainage channel for the local sedge cultivation area. However, the canal system still lacks culverts for water regulation.

Subproject 7 – Hoang Chau commune:

- Khe River Canal provides drainage for more than 400 hectares of aquaculture. The project area has an aquaculture area of 60 hectares. The current status of the farming area is there is no any drainage culvert at the beginning of the canal, so the canal is silted up and the canal banks are eroded. In addition to supplying water to the farming area, the main canal also drains water for the local sedge growing area, but the system lacks sluices to regulate water.

- The Song Khe canal provides water supply and drainage for over 400 hectares of aquaculture. The project area includes 60 hectares of aquaculture land. Currently, the main supply and drainage canal lacks inlet and outlet culverts at the canal head, resulting in sediment accumulation and canal bank erosion. In addition to supplying and draining water for aquaculture, the main canal also serves as a drainage channel for the local sedge cultivation area. However, the canal system still lacks culverts for water regulation.
- Current land use status: is the land designated for construction works running along the drainage canal bank, integrated with the operation and maintenance road, internal access roads, and the protection corridor of the structure in line with current legal regulations.
- Dredging of main drainage canal—1 main canal and 3 branch canals—along with upgrading and widening of canal banks combined with the construction of operation and maintenance roads, all follow the alignment of existing infrastructure. Therefore, the land area and residential houses along the route are not affected. The impacted land mainly consists of aquaculture ponds located along the canal route, as well as irrigation surfaces and buffer zones situated adjacent to the dike foot. The total length is about 3.05 km, including 1.5 km of main canal and 1.55 km of branch canals.

Subproject 8 – Van Loc commune:

- The Da Loc commune project area is 64 ha, which has been planned as a concentrated aquaculture area under the sustainable aquaculture project since 2003. Currently, the main supply and drainage canal, which sources water from the Quay Co sluice under the right dike of Len River, has been silted and lacks inlet and outlet sluice at the canal head. The Ong Ninh sluice, located at the end of the main supply canal, was constructed in 2006. It is a circular culvert with a small diameter that no longer meets the water supply and drainage requirements. The operating gate has rusted, and the sluice is now severely degraded.
- Current land use status: This is the land for construction works running along the drainage canal bank, integrated with the operation and maintenance road, internal access roads, and the protection corridor of the structure in accordance with current legal regulations.
- Dredging of the main and branch drainage canals, upgrading and widening of canal banks combined with the construction of operation and maintenance roads are all aligned with the existing infrastructure routes. Therefore, the land area and residential houses along the route are not affected. The affected land mainly consists of aquaculture ponds located along the canal route, as well as irrigation surfaces and buffer zones situated adjacent to the dike foot.

Subproject 9 – Quang Chinh commune:

- The project area in Quang Trung Commune covers 172 ha and has been zoned as a centralized aquaculture area under the sustainable fishery development project since 1990. Currently, the main supply and drainage canal, which sources water from the Ong Thuoc sluice under the right dike of the Hoang River, has been silted. The inlet and outlet sluices at the canal head have severely deteriorated and no longer have sufficient operational capacity. The saltwater control sluice gate, Ong Vanh, located at the end of the main canal, has also degraded.
- Current land use status: This is the land for construction works running along the drainage canal bank, integrated with the operation and maintenance road, internal access roads, and the protection corridor of the structure in accordance with current legal regulation
- Dredging of the main and branch drainage canals, upgrading and widening of canal banks combined with the construction of operation and maintenance roads are all aligned with the existing infrastructure routes. Therefore, the land area and residential houses along the route are not affected. The affected land mainly consists of aquaculture ponds located along the canal route, as well as irrigation surfaces and buffer zones situated adjacent to the dike foot.

3. Characteristics and composition of dredged materials

Dredged soil and sediment samples were collected by KGZ Investment Joint Stock Company (with VIMCERTS 320 certificate) at each subproject area. Environmental sampling was carried out on 23, 24 and 30/10/2024. There were 11 excavated soil samples and 11 sediment samples (1 sample for each subproject, 3 samples for subproject 3). The quality analysis results are shown below.

No.	Sample	Parameters	Results
1	Sediment Sample	Arsenic (As), Cadmium (Cd), Lead (Pb), Mercury (Hg), Copper (Cu), Zinc (Zn), Total N, Total Phosphorus, pH (H ₂ O), pH (KCL).	The analysis results show that the content of heavy metals in sediments in the project area is much lower than the permissible limits specified in the National Technical Regulation on Sediment Quality (QCVN 43:2017/BTNMT). Therefore, the volume of sediment dredged from the subproject is not hazardous and has not been contaminated with heavy metals. Thus, the dredged material can be used for planting perennial trees or planting trees for urban landscaping purposes, leveling the ground, etc. The volume of excavated and dredged materials from the subprojects will be collected and transported to the excavated and dredged material storage areas at locations approved by local authorities.
2	Excavated material – soil sample	Arsenic (As), Cadmium (Cd), Lead (Pb), Mercury (Hg), Copper (Cu), Zinc (Zn), Total N, Total Phosphorus, pH (H ₂ O), pH (KCL).	The results of soil quality analysis show that all heavy metal parameters are within allowable limit compared to QCVN 03:2023/BTNMT (Type 2). During the project construction process, the topsoil will be removed, depending on the nature of the soil, the reuse or disposal plan will be decided. Therefore, the amount of soil from the excavation of the construction areas of the project items can be reused for different purposes such as leveling the ground.. or can be disposed of as normal waste. According to the approved documents, the volume of excavated soil materials will be collected and transported to the excavated and dredged material storage areas according to the locations approved by the local competent authority.

4. Planned landfills and main transportation routes

The project's volume of excess dredged material during the construction phase will have to be transported to landfills to avoid environmental impacts and to be utilized as resources in the future. Based on the factors such as volume generated, nature/composition, transportation distance and current status of the project area, landfills for excess materials of each subproject have been selected as follows:

Table PL3. Summary of excavated and dredged material volume dumped at excess material dumps of each subproject

No.	Subprojects	Volume of excavated soil/materials to be disposed of (m ³)	Area of disposal sites (ha)	Capacity (m ³)	Transportation distance (Km)
1	Subproject 1	18,800	8.15	383,800	2.5
2	Subproject 2	365,000			0.5
3	Subproject 3	94	15	225.00	0.5
			45	650,000	1.0

No.	Subprojects	Volume of excavated soil/materials to be disposed of (m ³)	Area of disposal sites (ha)	Capacity (m ³)	Transportation distance (Km)
4	Subproject 4	22,892	2.0	40,000	3
5	Subproject 5	15,717	0.33	4,519	1.5
			0.6	12,000	1.5
6	Subproject 6	9,976	1.2	17,500	0.75
7	Subproject 7	14,677	1.5	18,000	1.0
8	Subproject 8	11,517	1.04	22,500	1.5
9	Subproject 9	3,469	0.5	10,000	2.1

(Source: Project Basic Design Estimate, 2025)

Specific description of each subproject's disposal site is presented below:

Table PL4. Description of surplus material disposal site of each subproject

Sub-project	Name of disposal site/area/capacity	Location	Current status
Subproject 1, Subproject 2 (Site No. 2)	Area: 8.15ha; Capacity: 383,800m ³	- Location: Van Loc commune, Hau Loc district (Hau Loc commune, old Hau Loc district). - Boundary: adjacent to the pond area; border the traffic road to the West and East; vacant land to the South. Access route, transportation distance: Subproject area --> Lach Truong river, disposal site, 0.5km away.	- According to the field survey, the disposal site is located in a low-efficiency salt field area in Hai Loc commune, Hau Loc district. The surrounding sides have been embanked higher than the elevation of the land surface.  Location of the disposal site  Photo of the disposal site
Subproject 3	Area: 15ha; Capacity: 225,000 m ³	- Location: Tan Tien ccommune (formerly	- Surrounding the disposal site is the vacant land of Mr. Mai Sy Tuan's house. There are no residents or civil works in this land.

Sub-project	Name of disposal site/area/capacity	Location	Current status
(Site No. for the dredging materials of Phu Son 2 canal		Nga Tan commune, Nga Son district). - Access route, transportation distance: Subproject area --> Disposal site, 0.5km away.	
Subproject 3 (Site No. 2- for the dredging materials of Bao Trieu canal)	Area: 45ha; Capacity: 650,000 m ³	- Location: Tan Tien commune (formerly Nga Tan commune, Nga Son district). - Access route, transportation distance: Subproject area → concrete roads in the area → Disposal site, 1km away.	 Location of the disposal site  Current photo of disposal site No. 1  Current photo of disposal site No. 2
Subproject 4	Area: 2ha; Capacity: 40,000 m ³	- Location: Son Trang village, Hoang Tien commune (formerly Hoang Yen commune). - Access route, transportation distance: subproject area --> Disposal site, 3km away.	The disposal site is surrounded by vacant land, without residents, civil works

Sub-project	Name of disposal site/area/capacity	Location	Current status
			
Subproject 5	- Area 1: Area: 0.33ha; Capacity: 4,519 m³ - Area 2: Area: 0.6ha; reserve 12,000m³	- Location: Bac Hoi Trau village, Hoang Chau commune (formerly Hoang Phong commune, Hoang Hoa district). - Access route, transportation distance: Subproject area --> disposal site, 2km away.	- Currently, the pond land is managed by the Communal People's Committee and leased to local people for production, but the land lease contract expired. + To the south of the site is an inter-commune road, convenient for transportation.   Current photo of disposal site
Subproject 6	- Area: 1.2 ha; - Capacity: 17,500 m³	- Location: In Phuong Ngo 1 village, Hoang Chau commune (formerly Hoang Luu commune). - Access route, transportation distance: subproject area → Disposal site, 0.75km away.	- Currently pond land which is managed by the Communal People's Committee. - To the south of the dump is an inter-commune road, convenient for transportation.  Location of the disposal site

Sub-project	Name of disposal site/area/capacity	Location	Current status
			 Current photo of the disposal site
Subproject 7	Area: 1.5ha; Capacity: 18,000 m ³	- Location: Chau Trieu village, Hoang Chau commune. - Boundary: border agricultural land to the east; drainage ditch to the west; agricultural land to the south; traffic road to the north. - Access route, transportation distance: subproject area → disposal, 1km away.	- Currently, it is land used for cultivating seasonal crops, allocated to households for management and use. - The north of this site is an inter-communal road, convenient for transportation.   Current photo of the disposal
Subproject 8	Area: 1.04ha; Capacity: 22,500 m ³	- Location: Hung Thanh village, Van Loc commune (formerly Da Loc commune, Hau Loc district). - Adjacent location: borders the existing inter-communal road to the North, the crop production area to West, South and North, residential houses to the East. - Access route, transportation distance:	-The land is now managed by the Communal People's Committee, near inter-communal road, convenient for transportation

Sub-project	Name of disposal site/area/capacity	Location	Current status
		subproject area → Disposal site, 1.5km away.	 Current photo of the disposal site
Subproject 9	Area: 0.5ha; Capacity: 10,000 m ³	- Location: Dung village, Quang Chinh commune (formerly Quang Trung commune, Quang Xuong district). - Adjacent location: borders the existing concrete road and Hoang River to the east and crop land to the North, West and South. - Access route, transportation distance: subproject area → disposal site, 2.1km away.	- Currently, it is used for temporarily gathering excess materials and managed by the Communal People's Committee. - To the east of the site is an existing concrete road, convenient for transportation.  Current photo of the disposal site

5. Summary of potential social and environmental impacts and risks

5.1 Overview

Chapter 4 of the Social Environmental Impact Assessment analyzed and assessed detailed social environmental impacts of the dredging activities of each subproject, specifically:

Dredging and material transportation activities:

- Generate noise from dredging equipment
- Generate dust, exhaust gases, wastewater and about 462,142 m³ of dredged material.
- Cause disturbance to the water area, increase turbidity, affect aquatic life and water-dependent activities such as agriculture and aquaculture, and lead to disruption or reduced productivity in aquaculture and fishing operations.
- Disrupt waterway traffic and increase risks to waterway traffic safety
- Cause damage or disruption to existing structures
- Restrict people's access from the shore to the river and vice versa (during port embankments)
- Pose risks to workers' and community's health and safety
- Pose risks of accident, incident.

Dumping activities:

- Risks of material spillage into surrounding areas
- Risk of flooding of surrounding areas due to water discharge from the disposal site
- Risks to the community safety

In addition, there are other site-specific impacts and risks depending on the construction location. Below is the summary of typical impacts and risks associated with dredging activities, transportation, and material disposal at the disposal site.

5.2. Impacts and risks along the transportation route

- Dust from the process of collection and transportation of excavated/dredged materials along the transportation route at the disposal site;
- Increased noise from the process of transporting excavated/dredged soil and people around the disposal site;
- Generation of construction wastewater from leakage during the transportation process by barges equipped with bottom discharge gates to the disposal site. – subproject 1,2;
- Wastewater leakage from dredged materials during transportation from subproject 3 to subproject 9: The dredged material contains organic components and soil-sand sediments. If leakage occurs along the transportation route, it can negatively impact the air environment (due to road transportation by trucks) and affect the water environment when runoff enters the canal system along the transportation corridor to the disposal sites. It also cause loss of beautiful landscape along the transportation route;
- Increased risk of collisions, congestion, and even traffic accidents along the transportation routes to the receiving sites for surplus and dredged materials, including Hai Loc Commune (now Van Loc) – subproject 1,2; Nga Tien commune for subproject 3 (Mr. Mai Sy Tuan's site and Long Son site); Son Trang village, Hoang Yen commune (subproject 4); Hoang Phong commune – now Hoang Chau (subproject 5); Hoang Luu commune – now Hoang Chau (subproject 6); Hoang Chau commune (subproject 7); Da Loc commune – now Hoa Loc – now Van Loc (subproject 8); and Quang Trung commune – now Quang Chinh (subproject 9).

5.3 Impacts and risks at disposal site

In general, the volume of excavated and dredged materials that need to be disposal of from the project is relatively large (462,142 m³), requiring a large area of land for storage and treatment. The project has identified 09 disposal site (including 1 site for excavated and dredged materials of subproject 1,2 and 2

sites designated for subproject 3) to store and manage these materials. At each site, the following key environmental and social risks and impacts may potentially arise:

Risk of overflow and erosion. When the disposal site is significantly elevated compared to the surrounding ground level, dredged material may overflow into adjacent areas, covering vacant land or productive land, vegetation, or infrastructure—thereby affecting local livelihoods and agricultural or aquaculture activities. If the surface of the disposal site is not reinforced or covered after dredged material is deposited, exposure to air and wind may further increase the risk of erosion.

Risk of localized flooding. Processed material at the disposal site may disrupt the existing drainage system. Rainwater can accumulate on the material and then flow into the surrounding environment, potentially causing localized flooding. Additionally, after wet material is pumped into the disposal site, leakage water will be discharged. This water may have high turbidity, thereby reducing the quality of receiving water bodies and affecting the development of aquatic species;

Wastewater leakage and its impacts. After being pumped from the barge to the disposal site, the wet dredged material will gradually settle and release water. The leakage water will flow out of the disposal site by gravity. Experience from other river, bay, and coastal dredging projects shows that: (i) the sediment-to-water ratio in dredged material is 8:2, meaning water accounts for 20% of the total dredged volume; (ii) in bays and coastal areas, the sediment-to-water ratio can be around 6:4, meaning water accounts for 40% of the total dredged volume. This indicates that the volume of leakage water from dredged material is quite large. If not properly controlled, this leakage water can cause localized flooding around the disposal sites. It may also have relatively high turbidity (due to fine particles from excavated and dredged material), leading to sedimentation in water bodies near wharves, canals, irrigation ditches, and receiving waters.

Spill/discharge of dredged material into the surrounding environment. Each disposal site will have a specific design height for the storage area. When waste material is deposited at the edge or top of the site, it may overflow beyond the designated boundaries. Additionally, the slopes formed at the disposal site may collapse under load, causing the material to spill outside the intended area, covering vegetation or filling existing infrastructure—and in some cases, potentially causing accidents involving people.

Safety risks to local communities. Since barges will anchor at a distance from the final disposal site, pipelines will be installed to send the material to the site. The pipeline themselves, wet material leaking from pipeline pose safety risks to the local community—for example, residents may accidentally collide with the pipes for various reasons, or pipeline failures may cause accidents for people nearby. After disposal, the dredged material and ground at the site will only become stable once most of the moisture/water has been drained from the dredged material. If someone enters unstable disposal areas, accidents such as slipping or even drowning may occur.

6. Impacts and risk mitigation plan

During the construction process, the Contractor shall comply with the requirements and take measures to minimize environmental and social impacts as stated in the Environmental and Social Code of Practice (ESCOP), the Code of Conduct for workers, requirements on minimizing environmental and social impacts of dredging and construction of quaysides. The Contractor shall also comply with the measures and requirements set forth in this DMMP, including.

6.1 Personnel arrangement

In the bidding documents, the contractor must propose at least one staff member with appropriate qualifications, certifications, and experience to be responsible for safety, environment, and health for the package implemented by the contractor. These personnel must be mobilized and work throughout the contract implementation period to carry out supervision and reporting tasks within their assigned field. The contractor shall facilitate the participation of these personnel in training courses relevant to their responsibilities, organized by the Project.

6.2 Design of the disposal site for dredged materials

- The disposal site must be determined in advance, in accordance with approved construction specifications. Drainage ditches will be constructed around the site to prevent wastewater from flowing directly into the surrounding environment.
- Store excavated/dredged soil in the designated disposal site approved by the competent authority as mentioned above with the required height, area and reserve.
- Appropriately calculate and design embankments and surrounding drainage ditches. Regularly inspect and reinforce embankments and drainage systems to maintain stability.
- Regularly monitor the waste disposal site by the construction contractor, construction supervisor and Project Owner.
- Manage according to a separate plan, ensuring no release into the environment.
- Set out plan for covering the surface during the period when the disposal site area is not yet in use, in accordance with local regulations/planning. After the disposal site is filled, it is necessary to consider covering it with a layer of soil (if needed) to plant greenery in order to stabilize the surface, prevent erosion, and reduce dust.
- Have a design and planning option for the excavated/dredged material disposal site that are filled and stabilized. These sites may be rehabilitated into construction land or green space, depending on the approved planning.

6.3 Mitigation measures to be taken by contractors during dredging

To manage the potential environmental and social impacts and health and safety risks of the dredging process, including material handling and transportation, the Contractor must perform and/or comply with the following requirements:

- Mitigation measures are outlined in the detailed design and specifications of the tender documents, including dredging methods, transportation procedures and final proposals. The Contractor shall not propose alternative dredging methods, in particular the use of suction pumps to deliver liquid sludge from the riverbed directly onto the disposal site, which may lead to many risks and adverse environmental and social impacts;
- All ESHS (environmental, social, health and safety) terms and conditions in the tender/contract documents including ESCOP, Employee Code of Conduct;
- Designate staff to be responsible for ESHS, including GRM.
- Develop a dredging schedule that avoids the flood season, especially from September to November when floods from rivers and the sea may coincide with high tides caused by storms on certain days.
- In coordination with the PMU and CSC, conduct consultation with the community and local authorities who are likely to be affected by dredging activities such as aquaculture, fishing or using water transport when preparing the contractor's detailed construction schedule. Discuss and agree with local people on the time of water and seed intake into the pond. The contractor may agree to avoid or stop dredging at certain times of the day so that people can take water from the river if they wish.
- Coordinate with the PMU to notify the community and local authorities along each specific river section about the dredging plan at least two weeks before construction.
- Prepare Contractor's DMMP and submit to Construction Supervisor for review and approval. Update C-DMMP every six months or when issues arise that need to be resolved.
- Prepare emergency response plans for contractors in case of incidents or waterway traffic

accidents;

- Register transportation routes, equipment, and construction deadlines with relevant authorities to serve as a basis for inspection and supervision of dredging, transportation, and disposal activities.
- Operators of pontoon bridges, excavators, barges, and suction vessels must undergo extensive training and possess relevant certifications to be approved by the CSC.
- Provide adequate relevant PPE for workers to use and enforce their use, especially wearing life jackets when working underwater. Assign someone to monitor each shift to respond promptly in case of emergency;
- Provide training for workers on ESHS regulations before commencing actual contract work. Weekly ESHS briefings are required;
- All measures specified in the Water Traffic Control prepared as part of the approved Detailed Design shall be implemented prior to the commencement of dredging. Warning signs must be installed and maintained during construction, including buoys on the water surface and signs on the river bank according to the approved plan.
- Re-establish and demarcate the dredging corridor using buoys when the pontoon bridge and barges move to the next river segment for dredging, in order to minimize risks to waterway traffic safety—particularly collisions between dredging equipment and local fishing gear.
- Signal lights are provided on the pontoon bridge, barges, and suction vessels.
- Conduct monitoring of disturbed water areas. Conduct daily water turbidity monitoring in the dredged area. Agree with CSC on water turbidity thresholds. Suspend dredging when turbidity is observed to reach thresholds or may be harmful to aquatic life until water turbidity is restored to acceptable levels. Limit dredging during high tides to reduce sediment and pollutant dispersal in the water.
- Oil and lubricants stored on barges and pontoons shall be kept to a minimum and contained in sealed, waterproof containers placed in covered areas. It is mandatory to ensure no oil leakage into the river. Materials contaminated with oil and lubricants shall be stored in secure containers for collection by licensed hazardous waste treatment facilities.
- Check and maintain equipment and machinery to ensure they are in good condition and renew their registration before they expire.
- No maintenance or overhaul of excavators is allowed on the construction site but must be carried out in a dedicated maintenance workshop.
- It is not permitted to overload dredged material onto barges, holds or any means of transport.
- Move pontoons, excavators, and barges to safe shelters before the flood season arrives. Cover and protect this construction equipment to avoid fuel leaks or being blown away due to storm winds.
- Safely remove all equipment and materials introduced into the river and river prior to completion of dredging work
- The Contractor shall provide riverside accommodation with adequate water supply, electricity, sanitation and basic facilities for the health and safety of the workers. Register the workers with the local authorities.
- Facilitate inspection by IESMC and relevant authorities.
- Prepare contractor logbook with records of ESHS implementation, and monthly ESHS implementation reports.

In addition, the contractor needs to:

- Develop specific construction methods for each river segment, tailored to the actual conditions of the river in terms of flow dynamics, sediment levels, tidal influences, and flood currents.
- Establish a construction schedule for each location considering: (i) water levels, flows, weather conditions; (ii) recommendations from local residents and authorities on water and surface water needs for aquaculture and fishing activities; and (iii) construction schedules for other packages sharing the same construction site, including transportation routes and storage areas. Minimize safety risks for workers and construction equipment: avoid adverse natural conditions such as storms, floods, and natural disasters.
- Work with the Project Owner and supervision consultant to communicate regularly with local authorities and communities during construction planning and throughout the implementation phase.
- The Contractor shall be responsible for repairing and compensating for damages caused by construction activities at the Contractor's expense.
- Minimize disturbance to the ground and riverbed;
- When a storm is forecast, dredging and embankment construction activities will be restricted, and site protection measures will be implemented; all construction activities will be suspended during stormy weather;
- Operate dredging at low speed during periods that allow for sedimentation;
- Provide warning signs in hazardous areas, such as underwater currents, high erosion potential, or deep excavations;
- The Contractor shall excavate and retain existing vegetation to cover the surface of the dredged material upon completion at the impoundment.

Measures to mitigate specific impacts caused by dredging

Subprojects involving dredging activities will result in adverse impacts on aquatic life and water quality degradation. To manage potential environmental and social impacts and health and safety risks during dredging, including material handling, the contractor must comply with the following requirements:

Planning and approval

- The Contractor shall develop a Contractor's Detailed Dredged Material Management Plan (CDMMP), based on the detailed design and DMMP of the project (Appendix 2). The C-DMMP includes the volume of dredged material, physical, biological and chemical characteristics of the dredged material; dredging methods and plans; transportation, disposal and pollution control procedures; and risk mitigation measures at the disposal site. This plan shall be approved by the Owner, updated as necessary, and monitored regularly by CSC during implementation.
- Establish construction schedule for each location, considering water level, flow, weather, people's recommendations and progress of related bid packages.
- Avoid construction during flood season, high tides or adverse weather, especially at times when vessels anchor to avoid storms.
- Consider the cumulative risk from concurrent dredging activities at neighboring subprojects (if any) to adjust construction progress and methods.

Community consultation and notification

- Consultation with communities and local authorities affected by dredging activities.
- Announce dredging plans at least two weeks before commencement.
- Discuss with people about the time to get water and seeds into the pond, can adjust the dredging

time accordingly.

- Work with the Project Owner and supervising consultant to communicate regularly with the community throughout the implementation process.
- Establish a local environmental and social grievance redress mechanism with a clear point of contact and defined resolution timeline.

Equipment and human resources

- Equipment operators must be properly trained and certified.
- Fully equipped with PPE, especially life jackets for workers working underwater.
- Assign a supervisor to each shift to respond when needed.

Traffic and waterway safety

- Comply with waterway traffic control measures according to approved detailed designs.
- Install warning signs, buoys and signal lights on construction equipment to ensure safety, especially at night.
- Clearly demarcate the dredging corridor when equipment moves to a different river segment.

Waste and incident management

- Limit dredging during high tide to reduce the dispersion of sludge and pollutants.
- Do not use the pump suction method to blow/stir the bottom layer, due to potential environmental and social risks.
- Do not overload the barge or transport vehicles with dredged materials.
- Oils and lubricants must be stored safely, in closed, covered containers, to prevent leakage into the aquatic environment.
- Prepare full equipment to respond to incidents, especially to prevent the spread of grease.
- Move equipment to a safe shelter before heavy rain, flood or storm. After completion, remove all equipment and materials from the job site.

Dredged material storage management

- The disposal site must be pre-identified and comply with approved construction specifications. It should avoid areas near sensitive receiving water bodies or any zones close to water sources. Drainage ditches will be constructed around the storage area to block wastewater from flowing out.
- Retaining walls are established around the disposal site if necessary;
- The retaining wall must be completed before the start of disposal and checked periodically during construction. The retaining wall must have a minimum height equal to the disposal elevation to ensure overflow prevention, erosion prevention and stability of dredged material.
- Conduct regular monitoring of the disposal site to ensure that materials are not washed away.
- Fully set up mitigation measures such as embankments, sluice gates, drainage ditches, warning signs, and cofferdams before transporting sludge to the landfill.
- The storage site must have a system to collect leachate and treat it before discharging it into the environment.

- Comply with the procedures for monitoring, transporting, storing and handling dredged materials according to C-DMMP and construction methods.
- If pipelines are used to transport slurry, warning signs must be placed along the pipeline route, along with traffic direction indicators for pedestrians and road users.
- Immediately address any leakage or overflow incidents before continuing storage operations, and coordinate with local authorities and communities when necessary.
- Update the disposal site operation log, recording the volume, time, and condition of the material.

Control of incidents in the disposal site

- Consider potential incidents such as erosion, flooding, subsidence, and natural disaster in the design of the disposal site.
- Establish a general incident control plan for the project, including incidents related to dredging, transportation and disposal.
- Establish an incident response team of at least 3 people.
- Set up a hotline or accessible communication channel to enable the community to easily report incidents promptly.

(viii) *Measures to minimize disruption to existing fishing port operations – Subproject 1,2*

However, stakeholder consultations indicate that the local area has experience in coordinating port upgrading and dredging activities while maintaining safe vessel operations and port functionality. Key mitigation measures include:

Avoidance

- Pre-construction inter-agency consultation: Coordinate with the waterway police, port management board, fisheries department and local community to understand port operations and coordinate construction accordingly.
- Information disclosure and risk communication: Post construction information, schedule, complaint mechanism; broadcast weather information via loudspeakers.
- Maintenance existing port operations: No construction or gathering of machinery or materials in the operating area.
- Construction outside peak hours: Avoid high traffic hours (1–4am and 6–9am).

Minimization

- The storage area must be pre-determined in accordance with approved construction specifications. Areas near sensitive receiving waters, or areas near water sources, should be avoided. Trenches must be constructed around the disposal to contain wastewater.
- Retaining walls are installed around the disposal area if necessary.
- Retaining walls must be completed before commencing disposal activities and inspected regularly throughout the construction process. The walls must have a minimum height equal to the disposal elevation to prevent overflow, erosion, and ensure stability of the dredged material.
- Conduct regular monitoring of the disposal area to ensure that materials are not washed away.
- Strictly adhere to the approved Dredged Materials Management Plan (DMMP), which includes provisions for material transportation, storage, pollution control and safety at the material yard.
- Port access and security management: Control access to the construction area, especially zones adjacent to fishing vessel docking and cargo loading/unloading activities. Vessels or

organizations that do not comply with port regulations are not permitted to enter the construction zone.

- Construction in sections, spatial separation: Construction in sections, with clear fences separating the construction area and the port's operating area.
- Waterway traffic coordination: Coordinate with maritime agencies to inform about the situation of waterways, buoys, and wharves so as to ensure fishing vessels enter and exit the port safely during the construction period.
- Signs and identification signals. Install signs, flags, and lighting in moving and anchoring areas to help fishermen, traders, and residents identify the construction area, especially at night.
- Environmental incident monitoring and handling: Organize on-duty shifts, hang warning signals when there are storms or tropical depressions; handle on-site accidents and environmental pollution incidents if they occur in the port area.

Restoration

- Post-construction restoration: Clean up, restore the site and completed locations before moving on to the next phase.

(ix) Measures to minimize impacts on waterway traffic – Subproject area 1,2

Avoidance

- Conduct consultations and develop a safety and emergency response plan prior to construction:
 - + Develop a plan to ensure maritime and inland waterway safety and submit it to the competent authority for approval.
 - + Work in advance with local medical facilities to be ready to respond in case of an incident.
 - + Establish an early warning system: Contact meteorological stations and local authorities to update weather, proactively adjust construction when there are storms, thunderstorms, and rough seas.
 - + Equip all construction vessels with complete rescue gear: lifeboats, life buoys, signal lights, communication devices, and first aid kits.
 - + Clearly assign responsibilities and conduct regular training sessions for workers on waterway traffic incident response procedures.
- Publicize construction information and safety warnings through mass media.
- Avoid construction during time frames with high vessel traffic density (1-4am and 6-9am).
- Do not carry out construction during adverse weather conditions: suspend operations during thunderstorms, whirlwinds, fog, or rough seas to ensure safety.

Minimization

- Fully comply with regulations on construction vehicles and waterway traffic.
 - + Vehicles and boat must be registered, have license plates, and obtain operation licenses in accordance with regulations.
 - + Operators must hold a valid boat driving license in accordance with regulations.
- Install warning system and limit construction area:
 - + Provide life buoys, signal lights, and warning signs at the construction site, dredging area, and navigation channel.

- + Construction vessels shall operate only within the boundaries marked by buoys. Absolutely no movement outside the designated water area is allowed to prevent collisions and obstruction of waterway traffic.
- + Do not place equipment or materials outside the project area or in areas that potential a risk of obstructing waterway traffic.
- + Successive construction method: Minimize the occupied area of the river/sea surface at any given time.
- Safety and communication equipment:
 - + Equip signal complete signal lights, lifeboats, lifebuoys, and fire-fighting equipment.
 - + Use and regularly inspect VHF communication equipment operating 24/7 on channel 9.
- Compliance with construction and safety plans:
 - + Regularly check communication equipment to ensure smooth operation.
 - + Assign traffic guards throughout the entire construction process.
 - + Move construction vehicles and machinery to safe locations in storm shelters during bad weather conditions, thunderstorms.

Restoration

- Cleaning up and site reinstatement: After each construction phase, immediately remove equipment and clear the navigation channel.
- Update signaling system: Reinstall buoys and signs to ensure waterway traffic safety after construction.

(x) Measures to minimize impacts on aquaculture activities for the subproject 3->9

Temporary mitigation measures for aquaculture households are as follows:

Avoidance

- **Early notification and community consultation:** The project owner coordinates with local authorities to inform the construction plan at least 2 weeks in advance and discuss with people about the water intake and seed stocking times, avoiding overlapping with peak construction time.
- **Restrict water intake from the construction area:** Aquaculture households should draw water from external river sources or other alternatives located far from the construction area.

Minimization

- **Successive construction** in small sections (100–200m): Minimize the extent of impact and allow the aquatic environment to recover between phases.
- **Use appropriate construction equipment:** In terms of capacity and volume to limit stirring up the river bottom but still ensures construction progress.
- **Install buoys to mark the construction area:** Mark the construction area to warn of pollution risks and ensure waterway safety.
- **Use silt curtains in dredging areas near water intake points:** Enclose the construction area with silt curtains to limit the spread of turbidity and pollutants, helping to protect aquatic ecosystems and maintain water quality for aquaculture.

- **Construct protective barriers around aquaculture water intake areas:** Install temporary silt curtains around the farming zone to prevent sediment and pollutants from entering the intake point, thereby minimizing impacts on incoming water quality.
- **Adjust farming season:** Agree with local people on the time of water intake and seed stocking to avoid peak construction time.
- **Water quality monitoring:** Monitor turbidity, TSS and water environmental parameters at water intake areas serving aquaculture, apply appropriate measurement methods when necessary.
- Utilize existing water intake treatment processes of aquaculture households: Farming ponds apply filtration, sedimentation, disinfection, and water quality testing systems before introducing water into the ponds, helping to minimize risks from the water source.

Restoration

- Restoring water channel after construction: Clean up, remove equipment, ensure stable flow after each dredging stage.
- Post-construction monitoring: Monitor water quality at the water intake points to ensure there are no lasting effects.

Compensation

- Compensation and support payments if damage occurs: In case the impact cannot be avoided, the project will compensate households for loss of income due to disruption of farming activities.
- Participate in the livelihood restoration program: Severely affected households will be supported through the income restoration program according to the project's Resettlement Plan (if any).

(xi) Mitigation measures to reduce environmental and marine ecosystem impacts from dredging activities

To prevent impacts of the dredging activities on the environment and marine ecosystem, apart from complying with the measures described in Chapter 5, the Project is required to follow the with the following specific measures to prevent collisions between vessels within the port as well as clashes between vessels and construction equipment, increasing the risk of vessel sink, oil and grease leakage and other impacts affecting the environment and marine ecosystem:

Avoidance

- Dredging activities must be carried out successively within the port. A soft barrier using buoys and warning signs must be established around the dredging area.
- Suspend dredging operations at night, during rough seas, high tides, or adverse weather conditions to allow vessels to seek safe shelter and to limit the spread of pollutants from the port to the surrounding marine protected area. During suspension periods, dredging equipment such as grab dredgers and barges must be relocated to a designated area along the port shoreline to avoid obstructing vessel movement. This area must also be equipped with warning signs and nighttime lighting.
- Conduct monitoring and surveillance of seawater quality, dredged materials, and biological characteristics in both the port area and surrounding environment to track the growth and development of aquatic species, thereby enabling appropriate preventive measures.
- Arrange the transportation route and disposal site reasonably.

Minimization

- Use appropriate dredging equipment to minimize breaking up weathered rock and stirring up the bottom mud layer excessively.

- Dredged materials are transferred to barges immediately after being brought to the surface, without prolonged accumulation in the dock area.
- Do not overload the barge or transportation vehicle with materials, ensure safety and avoid spillage into the environment.
- Do not store oil and lubricants on barges or dredging machinery; oil-contaminated materials must be collected and treated by a licensed entity.
- Dredging equipment operators must be appropriately trained and certified, supervised and certified by a supervising consultant (CSC).
- Provide adequate PPE for workers, especially life jackets when working on water; assign people to monitor each shift for timely rescue.

Emergency Preparedness

- Establish a response plan for waterway traffic incidents, including collisions, engine failures, capsizing, or oil spills. All response plans must be approved by the competent authorities.
- Suspend construction and relocate equipment to a safe shoreline area during adverse weather conditions; this area must be equipped with warning signs and nighttime lighting.
- Regularly train crew on rescue, evacuation and underwater incident handling procedures.
- Notify and coordinate with border guards, fisheries surveillance, coast guard, waterway traffic and port authorities to provide timely support when incidents occur.
- Establish an emergency contact point between the transportation vessel, project owner, contractor and authorities. Ability to quickly handle unusual situations.

Restoration

- Clean up and collect spilled materials and waste after each construction phase, ensuring no residuals or spills remain that could affect water quality.
- Restore water quality and benthic environment by monitoring and adjusting construction progress if prolonged signs of degradation are detected.
- Report periodic environmental monitoring results to the authorities and the Marine Protected Area Management Board.

6.4 Preparation of C-DMMP by Contractor

After signing the contract, must prepare and submit the C-DMMP along with the construction plan and methods. These documents must include measures and actions to mitigate Environmental and Social impacts, considering the following issues:

- Construction methods differ between dredging riverbeds and riverside excavations as well as irrigation canal areas, describing the equipment and labor used.
- The dredging process, transportation and transportation route to the disposal sites of excavated/dredged materials are disposed of with specific and detailed plans.
- Allocate excavated/dredged materials to each disposal site based on additional information about sediment quality from rivers/canals to the disposal areas, which will be available during the detailed design phase.

6.5 Requirements for disposal activities and disposal site management

Waste Treatment and Management Process

- The Contractor shall cancel all provisions in their C-DMMP regarding the connection of barges that may need to anchor at a certain distance from the disposal sites (typically several hundred meters, although it is technically feasible to transfer materials from barges to disposal sites over distances of up to two kilometers; *(the actual distance from where barges can be moored to each disposal site will be determined during the detailed design process)*).
- If pipelines are installed to connect barges to disposal sites (through which slurry will be pumped), the C-DMMP must include mitigation measures such as warning signs along the pipeline route.
- All approved mitigation measures, including embankments, discharge outlets, drainage ditches, warning signs, and fences if necessary for disposal sites must be established prior to the commencement of material handling.
- The pumping of materials into designated cells and the drainage process shall follow the procedures and sequences specified in the C-DMMP and/or the construction plan.
- Conduct regular monitoring at disposal sites. Any leakage or overflow incidents must be promptly addressed before resuming material handling operations.

Incident control

- The design of disposal site must take account into incidents such as erosion, flooding, subsidence, natural disasters, storms and floods.
- Establish a general incident control plan for subprojects, including incidents related to dredging, transportation and disposal at selected sites.
- Establish a Safety Committee or incident response team of at least 3 people to be ready to respond when an incident occurs.
- Establish an accessible hotline or communication channel between stakeholders and the community to enable prompt incident reporting.

7. Environmental and safety monitoring and supervision plan

7.1 Environmental Monitoring Plan

Based on Articles 111 and 112 of the Environmental Protection Law No. 72/2020/QH14, the project is not required to implement a periodic environmental monitoring program during the project construction and operation phase.

However, due to the specific nature of the dredging activities with a large dredging volume, the project will carry out monitoring of the quality of dredged materials (sediment quality). The construction contractor will be required to conduct sampling and quality monitoring of the proposed dredged materials as follows:

- + Location: collect 02 samples at each subproject area with dredging activities (subproject 1- Hoang Truong fishing port and subproject 2 - Lach Truong fishing port) and 01 sample at each remaining subproject (subproject 3-> subproject 9).
- + Monitoring parameters: Salinity (except subproject 3-> subproject 9), As, Hg, Cd, Cu, Pb, Zn.
- + Monitoring frequency: 06 months/time (2 times during the construction period for subproject 1,2 and 1 time during the construction period for subproject 3 -> subproject 9).
- + Comparison standard: QCVN 43: 2017/BTNMT.

7.2 Compliance Monitoring Plan and Reporting Requirements

The Contractor shall be responsible for complying with the requirements and taking the mitigation measures stated in the ESIA, ESMP and DMMP and shall prepare monthly ESHS report on the

implementation situation. The Environmental, Social, Health and Safety (ESHS) compliance report, following the Project's standard template, will be developed during implementation in alignment with the requirements stated in the bidding documents, and submitted to the Project Owner/Supervision Consultant for review and approval. The key aspects to be reported by the Contractor include the following:

- Scope of work under the contract package
- Status of C-ESMP and C-DMMP and related environmental documents submitted to the Project owner
- Monthly construction progress, construction location and volume of work completed
- Mitigation measures implemented during the month
- Emerging issues and outstanding problems
- Environmental, social, safety and health training activities attended
- Inspection and monitoring activities of stakeholders
- The Construction Supervision Consultant shall be responsible for daily monitoring of the Contractor's compliance and preparing monthly supervision reports. The Independent Supervision Consultant shall conduct quarterly monitoring during the construction phase.

APPENDIX 2: ENVIRONMENTAL MONITORING RESULTS

Subproject 1: Environmental Monitoring Results

TEST RESULTS SHEET

Number:

24.1155/KGZ/2024/Q4/433

Customer name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location	:	Thanh Hoa Province Sustainable Fisheries Development Project - Sub-project 1: Upgrading and expanding Hoang Truong fishing port_Hoang Truong Commune, Hoang Hoa District, Thanh Hoa Province	
Sample type	:	Wastewater	Number of samples: 01
Sample code	:	MNT/2410.23/02	
Monitoring date	:	October 23, 2024	
Results date	:	November 9, 2024	

Water sample analysis results					
No	Parameter	Unit	Result	Testing method	Standard
			NT		
1.	pH	-	7.07	TCVN 6492:2011	5.5-9
2.	TDS	mg/L	373	KGZ.SOP.QT.N.07	-
3.	Total suspended solids (TSS)	mg/L	29	TCVN 6625:2000	100
4.	COD	mg/L	24	SMEWW 5220C:2017	150
5.	BOD5	mg/L	8	TCVN 6001-1:2008	50
6.	Nitrite (NO ₂ - as N)	mg/L	0.08	TCVN 6178:1996	-
7.	Phosphate (PO ₄ 3- as P)	mg/L	0.02	TCVN 6202:2008	-
8.	Chloride (Cl-)	mg/L	923	TCVN 6194:1996	1,000
9.	Ammonium (NH ₄ + as N)	mg/L	0.40	TCVN 6179-1:1996	10
10.	Nitrate (NO ₃ -(calculated in N)*)	mg/L	<0.01	SMEWW 4500.NO3.E:2017	-
11.	Iron (Fe)*	mg/L	0.076	TCVN 6177:1996	5
12.	Total mineral oils and fats*	mg/L	0.9	SMEWW 5520.B&F:2017	10
13.	Coliform*	MPN/100mL	13	SMEWW 9221B:2017	5,000

Note/Remark:

- Sampling location:

+ NT:Wastewater samples at the project construction areaCoordinates: X=2199357; Y=599878

- Comparison standards:

+ QCVN 40:2011/BTNMT: National technical regulation on industrial wastewater (Column B).

+ (-): Not specified.

Number:

24.1155/KGZ/2024/Q4/434

TEST RESULTS SHEET

Customer name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location	:	Thanh Hoa Province Sustainable Fisheries Development Project - Sub-project 1: Upgrading and expanding Hoang Truong fishing port_Hoang Truong Commune, Hoang Hoa District, Thanh Hoa Province	
Sample type	:	Groundwater	Number of samples:01
Sample code	:	MNN/2410.23/01	
Monitoring date	:	October 23, 2024	
Results date	:	November 9, 2024	

Water sample analysis results					
No	Parameter	Unit	Result	Test method	Standards
			NN		
1.	pH	-	6.55	TCVN 6492:2011	5.5-8.5
2.	Total Dissolved Solids (TDS)	mg/L	78	KGZ.SOP.QT.N.07	1,500
3.	Hardness	mg/L	155	TCVN 6224:1996	500
4.	Sulfate (SO ₄ ²⁻)	mg/L	82	SMEWW 4500-SO ₄ ²⁻ .E:2017	400
5.	Chloride (Cl ⁻)	mg/L	152	TCVN 6194:1996	250
6.	Nitrite (NO ₂ ⁻ as N)	mg/L	<0.003	TCVN 6178:1996	1
7.	Nitrate (NO ₃ ⁻ as N)	mg/L	4.99	SMEWW 4500.NO ₃ .B:2017	15
8.	Ammonium (NH ₄ ⁺ as N)	mg/L	0.13	TCVN 6179-1:1996	1
9.	Iron (Fe)	mg/L	<0.02	TCVN 6177:1996	5
10.	Arsenic (As)*	mg/L	0.0011	SMEWW 3113B:2017	0.05

Note/Remark:

- Sampling location:

+ NN: Well water sample in the project implementation area. Coordinates: X=2199366; Y=599962

- Comparison standards:

+ QCVN 09:2023/BTNMT: National technical regulation on groundwater quality

+ (-): Not specified.

+ KPH: Not detected. Sample analysis results are lower than the MDL detection limit of the method;

Number:

24.1155/KGZ/2024/Q4/435

TEST RESULTS SHEET

Customer name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location	:	Thanh Hoa Province Sustainable Fisheries Development Project - Sub-project 1: Upgrading and expanding Hoang Truong fishing port_Hoang Truong Commune, Hoang Hoa District, Thanh Hoa Province	
Sample type	:	Surface water	Number of samples: 02
Sample code	:	MNM/2410.23/01-02	
Monitoring date	:	October 23, 2024	
Results date	:	November 9, 2024	

Water sample analysis results						
No	Parameter	Unit	Result		Test method	Standards
			NM1	NM2		
1.	pH	-	6.83	6.83	TCVN 6492:2011	6 ÷ 8.5 ⁽²⁾
2.	Turbidity	NTU	46	29	SMEWW 2130B:2017	-
3.	Salinity	%	0.02	0.08	SMEWW 2520B:2017	-
4.	Total Dissolved Solids (TDS)	mg/L	266	268	KGZ.SOP.QT.N.07	-
5.	Total suspended solids (TSS)	mg/L	32	34	TCVN 6625:2000	≤ 100 ⁽²⁾
6.	COD	mg/L	22	14	SMEWW 5220C:2017	≤ 15 ⁽²⁾
7.	BOD5	mg/L	8	6	TCVN 6001-1:2008	≤ 6 ⁽²⁾
8.	Chloride (Cl-)	mg/L	149	174	TCVN 6194:1996	250(1)
9.	Ammonium (NH4+ as N)	mg/L	0.52	0.46	TCVN 6179-1:1996	0.3(1)
10.	Nitrite (NO2- as N)	mg/L	0.04	0.03	TCVN 6178:1996	0.05(1)
11.	Nitrate (NO3- as N)	mg/L	0.45	0.36	TCVN 6180:1996	-
12.	Phosphate (PO43- as P)	mg/L	0.03	<0.02	TCVN 6202:2008	-
13.	Total N	mg/L	KPH	KPH	TCVN 6638:2000	≤ 1.5 ⁽²⁾

Water sample analysis results						
No	Parameter	Unit	Result		Test method	Standards
			NM1	NM2		
14.	Iron (Fe) *	mg/L	<0.02	0.063	TCVN 6177:1996	0.5(1)
15.	Total oil and grease*	mg/L	1.2	0.7	SMEWW 5520.B:2017	5.0(1)
16.	Coliform*	MPN/ 100mL	130	110	SMEWW 9221B:2017	≤ 5,000 ⁽²⁾

Note/Remark:

- Sampling location:

+ NM1: NEstimated surface area at high tideCoordinates: X=2199408; Y=600015

+ NM2: NEstimated surface area at low tideCoordinates: X=2199410; Y=599996

- Comparison standards:

+ QCVN 08:2023/BTNMT: National technical regulation on surface water quality;

+ Level B – Table 2: Limit values of parameters in surface water for classifying the water quality of rivers, streams, canals, ditches, streams, and protecting aquatic habitats

+ KPH: Not detected. Sample analysis results are lower than the MDL detection limit of the method;

+ (-): Not specified.

Number:
24.1155/KGZ/2024/Q4/436

TEST RESULTS SHEET

Customer name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location	:	Thanh Hoa Province Sustainable Fisheries Development Project - Sub-project 1: Upgrading and expanding Hoang Truong fishing port_Hoang Truong Commune, Hoang Hoa District, Thanh Hoa Province	
Sample type	:	Air	Number of samples: 01
Sample code	:	October 23, 2024	
Monitoring date	:	November 9, 2024	
Results date	:		

Air sample analysis results					
No	Parameter	Unit	Result	Test method	Standard
			K1		
1	Temperature *	°C	31.2	QCVN 46:2012/BTNMT	-
2	Humidity*	%	65.5	QCVN 46:2012/BTNMT	-
3	Wind speed*	m/s	0.9	QCVN 46:2012/BTNMT	-
4	Noise LAeq*	dBA	54.8	TCVN 7878-2:2018	70(1)
5	Total suspended particulate matter (TSP) *	µg/m3	208	TCVN 5067:1995	300
6	SO2*	µg/m3	77.9	TCVN 5971:1995	350
7	NO2*	µg/m3	81	TCVN 6137:2009	200
8	CO*	µg/m3	7,260	SOP.PT.KXQ.03	30,000
9	H2S*	µg/m3	<3	MASA 701	42

Note:

- Sampling location:

+ K1: Air in the construction area. Coordinates: X=2199494; Y=599844.- Comparison standards:+ QCVN 05:2023/BTNMT: National technical regulations on air quality (1-hour average);+ (1): QCVN 26:2010/BTNMT: National technical regulations on noise;+ (-): Not specified.

Number:
24.1155/KGZ/2024/Q4/437

TEST RESULTS SHEET

Customer name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location	:	Thanh Hoa Province Sustainable Fisheries Development Project - Sub-project 1: Upgrading and expanding Hoang Truong fishing port_Hoang Truong Commune, Hoang Hoa District, Thanh Hoa Province	
Sample type	:	Soil samples	Number of samples:01
Sample code	:	October 23, 2024	
Monitoring date	:	November 9, 2024	
Results date	:		

Soil sample analysis results					
No	Parameter	Unit	Result	Test method	Standard
			MD		
1	Total phosphorus *	mg/kg	392	TCVN 6499:1999	-
2	Total nitrogen*	mg/kg	650	TCVN 6498: 2009	-
3	Total Chromium (Cr) *	mg/kg	<0.02	US EPA Method 3050B + US EPA Method 7010	200
4	Cadmium (Cd) *	mg/kg	<0.02	US EPA Method 3050B + US EPA Method 7010	10
5	Copper (Cu) *	mg/kg	<1	US EPA Method 3050B + US EPA Method 7000B	500
6	Lead (Pb) *	mg/kg	<0.02	US EPA Method 3050B + US EPA Method 7010	400
7	Zinc (Zn) *	mg/kg	<2	US EPA Method 3050B + US EPA Method 7000B	600
8	Arsenic (As) *	mg/kg	<0.8	US EPA Method 3050B + US EPA Method 7010	50

Note:

- **Sampling** **location:**
+ MD: Soil sample in the Project implementation area. Coordinates: X=2199481; Y=599840.- Comparison standards:+
QCVN 03:2023/BTNMT: National technical regulations on soil quality (Type 2);
+ (-): Not specified.

Number:
24.1155/KGZ/2024/Q4/438

TEST RESULTS SHEET

Customer name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location	:	Thanh Hoa Province Sustainable Fisheries Development Project - Sub-project 1: Upgrading and expanding Hoang Truong fishing port_Hoang Truong Commune, Hoang Hoa District, Thanh Hoa Province	
Sample type	:	Sediment samples	Number of samples:01
Sample code	:	October 30, 2024	
Monitoring date	:	November 9, 2024	
Results date	:		

Sediment sample analysis results						
No	Parameter	Unit	Result	Test method	Standards	
			TT		(1)	(2)
1	Arsenic (As) *	mg/kg	<0.13	US EPA Method 3050B+ US EPA Method 7062	17	41.6
2	Cadmium (Cd) *	mg/kg	0.41	US EPA Method 3050B+ US EPA Method 7010	3.5	4.2
3	Lead (Pb) *	mg/kg	5.13	US EPA Method 3050B+ US EPA Method 7010	91.3	112
4	Zinc (Zn) *	mg/kg	22.5	US EPA Method 3050B+ US EPA Method 7000B	315	271
5	Mercury (Hg) *	mg/kg	<0.015	TCVN 6649:2000 + TCVN 8882:2011	0.5	0.7
6	Copper (Cu) *	mg/kg	6.42	US EPA Method 3050B+ US EPA Method 7000B	197	108
7	Total N*	mg/kg	99.6	TCVN 6498:1999	-	-
8	Total phosphorus (P) *	mg/kg	241.2	TCVN 8940:2011	-	-
9	pH (H2O) *	-	5.6	TCVN 4402:1987	-	-
10	pH (KCl) *	-	6.3	TCVN 4401:1987	-	-

Note:

- *Sampling location:*

+ TT: Sediment samples at the project construction area, coordinates: VD=19.88468; KD=105.93972

- *Comparison standards:*

+ QCVN 43:2017/BTNMT: National Technical Regulation on Sediment Quality

+ (1): Freshwater sediments

+ (2): Saltwater and brackish water sediments+ (-): Not specified.

Subproject 2: Environmental Monitoring Results**TEST RESULTS SHEET****Number:****24.1165/KGZ/2024/Q4/488**

Customer name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location	:	Thanh Hoa Province Sustainable Fisheries Development Project - Sub-project 2: Upgrading and expanding fishing port combined with storm shelter for fishing boats Lach Truong_Hoa Loc Commune, Hau Loc District, Thanh Hoa Province	
Sample type	:	Wastewater	Number of samples: 01
Sample code	:	MNT/2410.24/10	
Monitoring date	:	October 24, 2024	
Results date	:	November 9, 2024	

Water sample analysis results					
<i>No</i>	Parameter	Unit	Result	Test method	Standards
			NT		
1.	pH	-	7.09	<i>TCVN 6492:2011</i>	5.5-9
2.	TDS	<i>mg/L</i>	360	<i>KGZ.SOP.QT.N.07</i>	-
3.	Total suspended solids (TSS)*	<i>mg/L</i>	63	<i>TCVN 6625:2000</i>	100
4.	BOD5*	<i>mg/L</i>	22	<i>TCVN 6001-1:2008</i>	50
5.	COD*	<i>mg/L</i>	40	<i>SMEWW 5220C:2017</i>	150
6.	Ammonium (NH ₄ ⁺ as N)*	<i>mg/L</i>	2.37	<i>TCVN 6179-1:1996</i>	10
7.	Chloride (Cl ⁻)*	<i>mg/L</i>	655.76	<i>TCVN 6194:1996</i>	1,000
8.	Nitrite (NO ₂ ⁻ as N)*	<i>mg/L</i>	0.16	<i>TCVN 6178:1996</i>	-
9.	Nitrate (NO ₃ -(calculated in N))*	<i>mg/L</i>	0.068	<i>SMEWW 4500.NO3.E:2017</i>	-
10.	Phosphate (PO ₄ ³⁻ as P)*	<i>mg/L</i>	0.03	<i>TCVN 6202:2008</i>	-
11.	Iron (Fe)*	<i>mg/L</i>	0.03	<i>TCVN 6177:1996</i>	5
12.	Total mineral oils and fats*	<i>mg/L</i>	<0.3	<i>SMEWW 5520.B&F:2017</i>	10
13.	Coliform*	<i>MPN /100mL</i>	260	<i>SMEWW 9221B:2017</i>	5,000

Note/Remark:

- *Sampling location:*

+ NT: Wastewater samples at the project construction area Coordinates: X=2199562; Y=598324

- *Comparison standards:*

+ QCVN 40:2011/BTNMT: National technical regulation on industrial wastewater (Column B).

+ (-): Not specified.

Number:
24.1165/KGZ/2024/Q4/489

TEST RESULTS SHEET

Customer name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location	:	Thanh Hoa Province Sustainable Fisheries Development Project - Sub-project 2: Upgrading and expanding fishing port combined with storm shelter for fishing boats Lach Truong_Hoa Loc Commune, Hau Loc District, Thanh Hoa Province	
Sample type	:	Groundwater	Number of samples: 01
Sample code	:	MNN/2410.24/04	
Monitoring date	:	October 24, 2024	
Results date	:	November 9, 2024	

Water sample analysis results					
No	Parameter	Unit	Result	Test method	Standards
			NN		
1.	pH	-	6.56	TCVN 6492:2011	5.5-8.5
2.	Total Dissolved Solids (TDS)	mg/L	78	KGZ.SOP.QT.N.07	1,500
3.	Hardness*	mg/L	38	TCVN 6224:1996	500
4.	Ammonium (NH ₄ ⁺ as N) *	mg/L	0.016	TCVN 6179-1:1996	1
5.	Chloride (Cl ⁻)*	mg/L	35.5	TCVN 6194:1996	250
6.	Sulfate (SO ₄ ²⁻)*	mg/L	8.2	SMEWW 4500-SO42-.E:2017	400
7.	Nitrite (NO ₂ ⁻ as N) *	mg/L	<0.003	TCVN 6178:1996	1
8.	Nitrate (NO ₃ ⁻ as N) *	mg/L	0.039	SMEWW 4500.NO3.B:2017	15
9.	Iron (Fe) *	mg/L	<0.02	TCVN 6177:1996	5
10.	Arsenic (As)*	mg/L	<0.0005	SMEWW 3113B:2017	0.05

Note/Remark:

- Sampling location:

+ NN: Well water sample in the project implementation area. Coordinates: X=2199568; Y=598310

- Comparison standards:

+ QCVN 09:2023/BTNMT: National technical regulation on groundwater quality

+ (-): Not specified.

+ KPH: Not detected. Sample analysis results are lower than the MDL detection limit of the method;

Number:
24.1165/KGZ/2024/Q4/490

TEST RESULTS SHEET

Customer name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location	:	Thanh Hoa Province Sustainable Fisheries Development Project - Sub-project 2: Upgrading and expanding fishing port combined with storm shelter for fishing boats Lach Truong_Hoa Loc Commune, Hau Loc District, Thanh Hoa Province	
Sample type	:	Surface water	Number of samples: 02
Sample code	:	MNM/2410.24/07-08	
Monitoring date	:	October 24, 2024	
Results date	:	November 9, 2024	

Water sample analysis results						
<i>No</i>	Parameter	Unit	Result		Test method	Standards
			NM1	NM2		
1.	pH	-	6.84	6.86	<i>TCVN 6492:2011</i>	6 ÷ 8.5⁽²⁾
2.	Turbidity	<i>NTU</i>	31	17	<i>SMEWW 2130B:2017</i>	-
3.	Salinity	%	0.04	0.1	<i>SMEWW 2520B:2017</i>	-
4.	Total Dissolved Solids (TDS)	<i>mg/L</i>	286	282	<i>KGZ.SOP.QT.N.07</i>	-
5.	Total suspended solids (TSS)*	<i>mg/L</i>	44	22	<i>TCVN 6625:2000</i>	≤ 100⁽²⁾
6.	BOD5*	<i>mg/L</i>	4	2	<i>TCVN 6001-1:2008</i>	≤ 6⁽²⁾
7.	COD*	<i>mg/L</i>	12	8	<i>SMEWW 5220C:2017</i>	≤ 15⁽²⁾
8.	Ammonium (NH4+ as N) *	<i>mg/L</i>	<0.01	<0.01	<i>TCVN 6179-1:1996</i>	0.3(1)
9.	Chloride (Cl-)*	<i>mg/L</i>	1,249.6	1,171.5	<i>TCVN 6194:1996</i>	250(1)
10.	Nitrite (NO2- as N) *	<i>mg/L</i>	<0.003	<0.003	<i>TCVN 6178:1996</i>	0.05(1)
11.	Nitrate (NO3- as N) *	<i>mg/L</i>	0.379	0.306	<i>TCVN 6180:1996</i>	-
12.	Phosphate (PO43- as P) *	<i>mg/L</i>	0.04	0.04	<i>TCVN 6202:2008</i>	-
13.	Total N*	<i>mg/L</i>	<2	<2	<i>TCVN 6638:2000</i>	≤ 1.5⁽²⁾
14.	Iron (Fe) *	<i>mg/L</i>	<0.02	0.02	<i>TCVN 6177:1996</i>	0.5(1)

Water sample analysis results						
No	Parameter	Unit	Result		Test method	Standards
			NM1	NM2		
15.	Total oil and grease*	mg/L	<0.3	<0.3	SMEWW 5520.B:2017	5.0(1)
16.	Coliform*	MPN/ 100mL	270	330	SMEWW 9221B:2017	≤ 5,000 ⁽²⁾

Note/Remark:

- Sampling location:

+ NM1: NEstimated surface area at high tideCoordinates: X=2199541; Y=598291

+ NM2: NEstimated surface area at low tideCoordinates: X=2199542; Y=598299

- Comparison standards:

+ QCVN 08:2023/BTNMT: National technical regulation on surface water quality;

+ Level B – Table 2: Limit values of parameters in surface water for classifying the water quality of rivers, streams, canals, ditches, streams, and protecting aquatic habitats

+ KPH: Not detected. Sample analysis results are lower than the MDL detection limit of the method;

+ (-): Not specified.

Number:
24.1165/KGZ/2024/Q4/491

TEST RESULTS SHEET

Customer name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location	:	Thanh Hoa Province Sustainable Fisheries Development Project - Sub-project 2: Upgrading and expanding fishing port combined with storm shelter for fishing boats Lach Truong_Hoa Loc Commune, Hau Loc District, Thanh Hoa Province	
Sample type	:	Air	Number of samples:01
Sample code	:	October 24, 2024	
Monitoring date	:	November 9, 2024	
Results date	:		

Air sample analysis results					
<i>No</i>	Parameter	<i>Unit</i>	Result	Test method	Standards
			K1		
1	Temperature *	°C	28.2	<i>QCVN 46:2012/BTNMT</i>	-
2	Humidity*	%	68	<i>QCVN 46:2012/BTNMT</i>	-
3	Wind speed*	<i>m/s</i>	1.4	<i>QCVN 46:2012/BTNMT</i>	-
4	Noise LAeq*	<i>dBA</i>	59.6	<i>TCVN 7878-2:2018</i>	70(1)
5	Total suspended particulate matter (TSP) *	$\mu\text{g}/\text{m}^3$	205	<i>TCVN 5067:1995</i>	300
6	SO2*	$\mu\text{g}/\text{m}^3$	66.7	<i>TCVN 5971:1995</i>	350
7	NO2*	$\mu\text{g}/\text{m}^3$	85	<i>TCVN 6137:2009</i>	200
8	CO*	$\mu\text{g}/\text{m}^3$	8,350	<i>SOP.PT.KXQ.03</i>	30,000
9	H2S*	$\mu\text{g}/\text{m}^3$	<3	<i>MASA 701</i>	42

Note:

- Sampling location:

+ K1: Air in the construction area. Coordinates: X=2199662; Y=598095.- Comparison standards:+ QCVN 05:2023/BTNMT: National technical regulations on air quality (1-hour average);+ (1): QCVN 26:2010/BTNMT: National technical regulations on noise;+ (-): Not specified.

Number:
24.1165/KGZ/2024/Q4/492

TEST RESULTS SHEET

Customer name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location	:	Thanh Hoa Province Sustainable Fisheries Development Project - Sub-project 2: Upgrading and expanding fishing port combined with storm shelter for fishing boats Lach Truong_Hoa Loc Commune, Hau Loc District, Thanh Hoa Province	
Sample type	:	Soil samples	Number of samples: 01
Sample code	:	October 24, 2024	
Monitoring date	:	November 9, 2024	
Results date	:		

Soil sample analysis results					
No	Parameter	Unit	Result	Test method	Standard
			MD		
1	Total phosphorus *	mg/kg	490	TCVN 6499:1999	-
2	Total nitrogen*	mg/kg	710	TCVN 6498: 2009	-
3	Total Chromium (Cr) *	mg/kg	0.02	US EPA Method 3050B + US EPA Method 7010	200
4	Cadmium (Cd) *	mg/kg	<0.02	US EPA Method 3050B + US EPA Method 7010	10
5	Copper (Cu) *	mg/kg	<1	US EPA Method 3050B + US EPA Method 7000B	500
6	Lead (Pb) *	mg/kg	<0.02	US EPA Method 3050B + US EPA Method 7010	400
7	Zinc (Zn) *	mg/kg	<2	US EPA Method 3050B + US EPA Method 7000B	600
8	Arsenic (As) *	mg/kg	<0.8	US EPA Method 3050B + US EPA Method 7010	50

Note:

- Sampling location:

+ MD: Soil sample in the project implementation area. Coordinates: X=2199673; Y=598125.- Comparison standards:+ QCVN 03:2023/BTNMT: National technical regulations on soil quality (Type 2);

+ (-): Not specified.

Number:
24.1165/KGZ/2024/Q4/493

TEST RESULTS SHEET

Customer name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location	:	Thanh Hoa Province Sustainable Fisheries Development Project - Sub-project 2: Upgrading and expanding fishing port combined with storm shelter for fishing boats Lach Truong_Hoa Loc Commune, Hau Loc District, Thanh Hoa Province	
Sample type	:	Sediment samples	Number of samples:01
Sample code	:	October 30, 2024	
Monitoring date	:	November 9, 2024	
Results date	:		

Sediment sample analysis results						
No	Parameter	Unit	Result	Test method	Standards	
			TT		(1)	(2)
1	Arsenic (As) *	mg/kg	<0.13	US EPA Method 3050B+ US EPA Method 7062	17	41.6
2	Cadmium (Cd) *	mg/kg	0.39	US EPA Method 3050B+ US EPA Method 7010	3.5	4.2
3	Lead (Pb) *	mg/kg	5.24	US EPA Method 3050B+ US EPA Method 7010	91.3	112
4	Zinc (Zn) *	mg/kg	23.9	US EPA Method 3050B+ US EPA Method 7000B	315	271
5	Mercury (Hg) *	mg/kg	<0.015	TCVN 6649:2000 + TCVN 8882:2011	0.5	0.7
6	Copper (Cu) *	mg/kg	7.15	US EPA Method 3050B+ US EPA Method 7000B	197	108
7	Total N *	mg/kg	113.5	TCVN 6498:1999	-	-
8	Total phosphorus (P) *	mg/kg	246.7	TCVN 8940:2011	-	-
9	pH (H2O) *	-	5.3	TCVN 4402:1987	-	-
10	pH (KCl) *	-	5.9	TCVN 4401:1987	-	-

Note:

- *Sampling location:*

+ TT: Sediment samples at the project construction area, coordinates: VD=19.88974; KD=105.93919

- *Comparison standards:*

+ QCVN 43:2017/BTNMT: National Technical Regulation on Sediment Quality

+ (1): Freshwater sediments

+ (2): Saltwater and brackish water sediments

+ (-): Not specified.

Subproject 3: Environmental Monitoring Results**TEST RESULTS SHEET****Number:****24.1166/KGZ/2024/Q4/445**

Customer name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location	:	Thanh Hoa Province Sustainable Aquaculture Development Project - Sub-project 3: Construction of infrastructure for aquaculture area in Nga Tan commune - Nga Tan commune, Nga Son district, Thanh Hoa province	
Sample type	:	Wastewater	Number of samples:01
Sample code	:	MNT/2410.25/01	
Monitoring date	:	October 25, 2024	
Results date	:	November 9, 2024	

Water sample analysis results					
<i>No</i>	Parameter	Unit	Result	Test method	Standards
			NT		
1.	pH	-	7.03	<i>TCVN 6492:2011</i>	5.5-9
2.	TDS	<i>mg/L</i>	367	<i>KGZ.SOP.QT.N.07</i>	-
3.	Total suspended solids (TSS) *	<i>mg/L</i>	72	<i>TCVN 6625:2000</i>	100
4.	COD*	<i>mg/L</i>	30	<i>SMEWW 5220C:2017</i>	150
5.	BOD5*	<i>mg/L</i>	14	<i>TCVN 6001-1:2008</i>	50
6.	Nitrite (NO ₂ - as N) *	<i>mg/L</i>	<0.003	<i>TCVN 6178:1996</i>	-
7.	Phosphate (PO ₄ ³⁻ as P) *	<i>mg/L</i>	0.04	<i>TCVN 6202:2008</i>	-
8.	Chloride (Cl-)*	<i>mg/L</i>	41.18	<i>TCVN 6194:1996</i>	1,000
9.	Ammonium (NH ₄ ⁺ as N) *	<i>mg/L</i>	<0.01	<i>TCVN 6179-1:1996</i>	10
10.	Nitrate (NO ₃ -(calculated in N))*	<i>mg/L</i>	0.075	<i>SMEWW 4500.NO3.E:2017</i>	-
11.	Iron (Fe)*	<i>mg/L</i>	1.04	<i>TCVN 6177:1996</i>	5
12.	Total grease *	<i>mg/L</i>	<0.3	<i>SMEWW 5520B:2017</i>	-
13.	Coliform*	<i>MPN /100mL</i>	400	<i>SMEWW 9221B:2017</i>	5,000

Note/Remark:

- Sampling location:

+ NT:Wastewater samples at the project construction areaCoordinates: X=2209192; Y=605805

- Comparison standards:

+ QCVN 40:2011/BTNMT: National technical regulation on industrial wastewater (Column B).

+ (-): Not specified.

Number:
24.1166/KGZ/2024/Q4/446

TEST RESULTS SHEET

Customer name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location	:	Thanh Hoa Province Sustainable Aquaculture Development Project - Sub-project 3: Construction of infrastructure for aquaculture area in Nga Tan commune - Nga Tan commune, Nga Son district, Thanh Hoa province	
Sample type	:	Groundwater	Number of samples: 01
Sample code	:	MNN/2410.25/01	
Monitoring date	:	October 25, 2024	
Results date	:	November 9, 2024	

Water sample analysis results					
No	Parameter	Unit	Result	Test method	Standards
			NN		
1.	pH	-	6.56	TCVN 6492:2011	5.5-8.5
2.	Total Dissolved Solids (TDS)	mg/L	81	KGZ.SOP.QT.N.07	1,500
3.	Hardness*	mg/L	392	TCVN 6224:1996	500
4.	Sulfate (SO42-)*	mg/L	76.4	SMEWW 4500-SO42-.E:2017	400
5.	Chloride (Cl-)*	mg/L	39.76	TCVN 6194:1996	250
6.	Nitrite (NO2- as N) *	mg/L	<0.003	TCVN 6178:1996	1
7.	Nitrate (NO3- as N) *	mg/L	0.047	SMEWW 4500.NO3.B:2017	15
8.	Ammonium (NH4+ as N) *	mg/L	<0.01	TCVN 6179-1:1996	1
9.	Iron (Fe) *	mg/L	0.05	TCVN 6177:1996	5
10.	Arsenic (As)*	mg/L	<0.0005	SMEWW 3113B:2017	0.05

Note/Remark:

- *Sampling location:*

+ NN: Well water sample in the project implementation area. Coordinates: X=2209133; Y=605877

- *Comparison standards:*

+ QCVN 09:2023/BTNMT: National technical regulation on groundwater quality; + (-): Not specified.

+ KPH: Not detected. Sample analysis results are lower than the MDL detection limit of the method;

Number:

24.1166/KGZ/2024/Q4/447

TEST RESULTS SHEET

Customer name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location	:	Thanh Hoa Province Sustainable Aquaculture Development Project - Sub-project 3: Construction of infrastructure for aquaculture area in Nga Tan commune - Nga Tan commune, Nga Son district, Thanh Hoa province	
Sample type	:	Surface water	Number of samples: 02
Sample code	:	MNM/2410.25/01-02	
Monitoring date	:	October 25, 2024	
Results date	:	November 9, 2024	

Water sample analysis results						
No	Parameter	Unit	Result		Test method	Standards
			NM1	NM2		
1.	pH	-	6.86	6.85	TCVN 6492:2011	6 ÷ 8.5 ⁽²⁾
2.	Turbidity	NTU	40	21	SMEWW 2130B:2017	-
3.	Salinity	%	0.01	0.06	SMEWW 2520B:2017	-
4.	Total Dissolved Solids (TDS)	mg/L	279	273	KGZ.SOP.QT.N.07	-
5.	Total suspended solids (TSS)*	mg/L	65	62	TCVN 6625:2000	≤ 100 ⁽²⁾
6.	COD*	mg/L	14	12	SMEWW 5220C:2017	≤ 15 ⁽²⁾
7.	BOD5*	mg/L	6	4	TCVN 6001-1:2008	≤ 6 ⁽²⁾
8.	Chloride (Cl-)*	mg/L	38.34	39.76	TCVN 6194:1996	250(1)
9.	Ammonium (NH4+ as N) *	mg/L	<0.01	<0.01	TCVN 6179-1:1996	0.3(1)
10.	Nitrite (NO2- as N) *	mg/L	<0.003	<0.003	TCVN 6178:1996	0.05(1)
11.	Nitrate (NO3- as N) *	mg/L	<0.02	<0.02	TCVN 6180:1996	-
12.	Phosphate (PO43- as P) *	mg/L	0.08	0.06	TCVN 6202:2008	-

Water sample analysis results						
No	Parameter	Unit	Result		Test method	Standards
			NM1	NM2		
13.	Total N*	mg/L	<2	<2	TCVN 6638:2000	≤ 1.5 ⁽²⁾
14.	Iron (Fe) *	mg/L	0.93	0.3	TCVN 6177:1996	0.5(1)
15.	Total oil and grease*	mg/L	<0.3	<0.3	SMEWW 5520.B:2017	5.0(1)
16.	Coliform*	MPN/ 100mL	170	130	SMEWW 9221B:2017	≤ 5,000 ⁽²⁾

Note/Remark:

- Sampling location:

+ NM1: NEstimated surface area at high tide Coordinates: X=2209140; Y=605852

+ NM2: NEstimated surface area at low tide Coordinates: X=2209155; Y=605829

- Comparison standards:

+ QCVN 08:2023/BTNMT: National technical regulation on surface water quality;

+ Level B – Table 2: Limit values of parameters in surface water for classifying the water quality of rivers, streams, canals, ditches, streams, and protecting aquatic habitats

+ KPH: Not detected. Sample analysis results are lower than the MDL detection limit of the method;

+ (-): Not specified.

Number:
24.1166/KGZ/2024/Q4/448

TEST RESULTS SHEET

Customer name/ <i>Custom name</i>	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location/ <i>Monitoring location</i>	:	Thanh Hoa Province Sustainable Aquaculture Development Project - Sub-project 3: Construction of infrastructure for aquaculture area in Nga Tan commune - Nga Tan commune, Nga Son district, Thanh Hoa province	
Sample type/ <i>Type</i>	:	Air	Number of samples:01
Observation date/ <i>Monitoring date</i>	:	October 25, 2024	
Date of result return/ <i>Results date</i>	:	November 9, 2024	

Air sample analysis results					
No	Parameter	Unit	Result	Test method	Standards
			K1		
1	Temperature *	°C	29	QCVN 46:2012/BTNMT	-
2	Humidity*	%	67.3	QCVN 46:2012/BTNMT	-
3	Wind speed*	m/s	1.4	QCVN 46:2012/BTNMT	-
4	Noise LAeq*	dBA	62.2	TCVN 7878-2:2018	70(1)
5	Total suspended particulate matter (TSP) *	µg/m3	212	TCVN 5067:1995	300
6	SO2*	µg/m3	81.9	TCVN 5971:1995	350
7	NO2*	µg/m3	93	TCVN 6137:2009	200
8	CO*	µg/m3	6,320	SOP.PT.KXQ.03	30,000
9	H2S*	µg/m3	<3	MASA 701	42

Note:

- Sampling location:

+ K1: Air in the construction area. Coordinates: X=2168582; Y=580829.- Comparison standards:+ QCVN 05:2023/BTNMT: National technical regulations on air quality (1-hour average);+ (1): QCVN 26:2010/BTNMT: National technical regulations on noise;+ (-): Not specified.

Number:
24.1166/KGZ/2024/Q4/450

TEST RESULTS SHEET

Customer name/Custom name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location/Monitoring location	:	Thanh Hoa Province Sustainable Aquaculture Development Project - Sub-project 3: Construction of infrastructure for aquaculture area in Nga Tan commune - Nga Tan commune, Nga Son district, Thanh Hoa province	
Sample type/Type	:	Soil samples	Number of samples:01
Observation date/Monitoring date	:	October 25, 2024	
Date of result return/Results date	:	November 9, 2024	

Soil sample analysis results					
No	Parameter	Unit	Result	Test method	Standards
			D		
1	Total phosphorus*	mg/kg	460	TCVN 6499:1999	-
2	Total nitrogen*	mg/kg	720	TCVN 6498: 2009	-
3	Total Chromium (Cr) *	mg/kg	0.052	US EPA Method 3050B + US EPA Method 7010	200
4	Cadmium (Cd) *	mg/kg	<0.02	US EPA Method 3050B + US EPA Method 7010	10
5	Copper (Cu) *	mg/kg	<1	US EPA Method 3050B + US EPA Method 7000B	500
6	Lead (Pb) *	mg/kg	0.086	US EPA Method 3050B + US EPA Method 7010	400
7	Zinc (Zn) *	mg/kg	<2	US EPA Method 3050B + US EPA Method 7000B	600
8	Arsenic (As) *	mg/kg	<0.8	US EPA Method 3050B + US EPA Method 7010	50

Note:

- Sampling location:

+ MD: Soil sample in the project implementation area. Coordinates: X=2168589; Y=580846.

- Comparison standards:

+ QCVN 03:2023/BTNMT: National technical regulation on soil quality (type 2);+ (-): Not specified.

Number:

24.1166/KGZ/2024/Q4/449

TEST RESULTS SHEET

Customer name/Custom name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location/Monitoring location	:	Thanh Hoa Province Sustainable Aquaculture Development Project - Sub-project 3: Construction of infrastructure for aquaculture area in Nga Tan commune - Nga Tan commune, Nga Son district, Thanh Hoa province	
Sample type/Type	:	Sediment samples	Number of samples:01
Observation date/Monitoring date	:	October 30, 2024	
Date of result return/Results date	:	November 9, 2024	

Sediment sample analysis results						
<i>No</i>	Parameter	<i>Unit</i>	Result	Test method	Standards	
			TT		(1)	(2)
1	Arsenic (As)*	mg/kg	<0.13	US EPA Method 3050B+ US EPA Method 7062	17	41.6
2	Cadmium (Cd)(*	mg/kg	0.42	US EPA Method 3050B+ US EPA Method 7010	3.5	4.2
3	Lead (Pb) *	mg/kg	6.01	US EPA Method 3050B+ US EPA Method 7010	91.3	112
4	Zinc (Zn) *	mg/kg	25.1	US EPA Method 3050B+ US EPA Method 7000B	315	271
5	Mercury (Hg) *	mg/kg	<0.015	TCVN 6649:2000 + TCVN 8882:2011	0.5	0.7
6	Copper (Cu) *	mg/kg	8.12	US EPA Method 3050B+ US EPA Method 7000B	197	108
7	Total N*	mg/kg	132.7	TCVN 6498:1999	-	-
8	Total phosphorus (P) *	mg/kg	240.2	TCVN 8940:2011	-	-
9	pH (H2O) *	-	5.4	TCVN 4402:1987	-	-

Sediment sample analysis results						
No	Parameter	Unit	Result	Test method	Standards	
			TT		(1)	(2)
10	pH (KCl) *	-	6.1	TCVN 4401:1987	-	-

Note:

- Sampling location:

+ TT: Sediment samples at the project construction area, coordinates: X=19.97615; Y=106.01164

- Comparison standards:

+ QCVN 43:2017/BTNMT: National Technical Regulation on Sediment Quality+ (1): Freshwater Sediments

+ (2): Saltwater and brackish water sediments

+ (-): Not specified.

TEST RESULTS SHEET

Number:
24.1167/KGZ/2024/Q4/503

Customer name/Custom name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location/Monitoring location	:	Thanh Hoa Province Sustainable Aquaculture Development Project - Sub-project 3: Building infrastructure for aquaculture area in Nga Tien Commune_Nga Tien Commune, Nga Son District, Thanh Hoa Province	
Sample type/Type	:	Wastewater	Number of samples:01
Sample code/Sample encryption	:	MNT/2410.25/02	
Observation date/Monitoring date	:	October 25, 2024	
Date of result return/Results date	:	November 9, 2024	

Water sample analysis results					
No	Parameter	Unit	Result	Test method	Standards
			NT		
1.	pH	-	7.04	TCVN 6492:2011	5.5-9
2.	TDS	mg/L	364	KGZ.SOP.QT.N.07	-
3.	Total suspended solids (TSS)*	mg/L	98	TCVN 6625:2000	100
4.	BOD5*	mg/L	14	TCVN 6001-1:2008	50
5.	COD*	mg/L	34	SMEWW 5220C:2017	150
6.	Ammonium (NH4+ as N)*	mg/L	2.04	TCVN 6179-1:1996	10
7.	Chloride (Cl-)*	mg/L	39.76	TCVN 6194:1996	1,000
8.	Nitrite (NO2- as N)*	mg/L	0.048	TCVN 6178:1996	-
9.	Nitrate (NO3-(calculated in N))*	mg/L	<0.01	SMEWW 4500.NO3.E:2017	-
10.	Phosphate (PO43- as P)*	mg/L	0.11	TCVN 6202:2008	-
11.	Iron (Fe)*	mg/L	1.65	TCVN 6177:1996	5
12.	Total mineral oils and fats*	mg/L	<0.3	SMEWW 5520.B&F:2017	10
13.	Coliform*	MPN	390	SMEWW 9221B:2017	5,000

Water sample analysis results					
No	Parameter	Unit	Result	Test method	Standards
			NT		
		/100mL			

Note/Remark:

- Sampling location:

+ NT: Wastewater samples at the project construction area Coordinates: X=2211747; Y=607102

- Comparison standards:

+ QCVN 40:2011/BTNMT: National technical regulation on industrial wastewater (Column B).

+ (-): Not specified.

Number:
24.1167/KGZ/2024/Q4/504

TEST RESULTS SHEET

Customer name/Custom name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location/Monitoring location	:	Thanh Hoa Province Sustainable Aquaculture Development Project - Sub-project 3: Building infrastructure for aquaculture area in Nga Tien Commune_Nga Tien Commune, Nga Son District, Thanh Hoa Province	
Sample type/Type	:	Groundwater	Number of samples:01
Sample code/Sample encryption	:	MNN/2410.25/02	
Observation date/Monitoring date	:	October 25, 2024	
Date of result return/Results date	:	November 9, 2024	

Water sample analysis results					
No	Parameter	Unit	Result	Test method	Standards
			NN		
1.	pH	-	6.54	TCVN 6492:2011	5.5-8.5
2.	Total Dissolved Solids (TDS)	mg/L	76	KGZ.SOP.QT.N.07	1,500
3.	Hardness*	mg/L	34	TCVN 6224:1996	500
4.	Ammonium (NH ₄ ⁺ as N) *	mg/L	<0.01	TCVN 6179-1:1996	1
5.	Chloride (Cl ⁻)*	mg/L	7.1	TCVN 6194:1996	250
6.	Sulfate (SO ₄ ²⁻)*	mg/L	<2	SMEWW 4500-SO ₄ ²⁻ .E:2017	400
7.	Nitrite (NO ₂ ⁻ as N) *	mg/L	<0.003	TCVN 6178:1996	1
8.	Nitrate (NO ₃ ⁻ as N) *	mg/L	0.041	SMEWW 4500.NO ₃ .B:2017	15
9.	Iron (Fe) *	mg/L	0.02	TCVN 6177:1996	5
10.	Arsenic (As)*	mg/L	<0.0005	SMEWW 3113B:2017	0.05

Note/Remark:

- Sampling location:

+ NN: Well water sample in the project implementation area. Coordinates: X=2211878; Y=607049

- Comparison standards:

+ QCVN 09:2023/BTNMT: National technical regulation on groundwater quality

+ (-): Not specified.

+ KPH: Not detected. Sample analysis results are lower than the MDL detection limit of the method;

Number:
24.1167/KGZ/2024/Q4/505

TEST RESULTS SHEET

Customer name/Custom name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location/Monitoring location	:	Thanh Hoa Province Sustainable Aquaculture Development Project - Sub-project 3: Building infrastructure for aquaculture area in Nga Tien Commune_Nga Tien Commune, Nga Son District, Thanh Hoa Province	
Sample type/Type	:	Surface water	Number of samples:02
Sample code/Sample encryption	:	MNM/2410.25/03-04	
Observation date/Monitoring date	:	October 25, 2024	
Date of result return/Results date	:	November 9, 2024	

Water sample analysis results						
No	Parameter	Unit	Result		Test method	Standards
			NM1	NM2		
1.	pH	-	6.85	6.86	TCVN 6492:2011	6 ÷ 8.5 ⁽²⁾
2.	Turbidity	NTU	40	28	SMEWW 2130B:2017	-
3.	Salinity	%	0.02	0.08	SMEWW 2520B:2017	-
4.	Total Dissolved Solids (TDS)	mg/L	265	269	KGZ.SOP.QT.N.07	-
5.	Total suspended solids (TSS)*	mg/L	69	75	TCVN 6625:2000	≤ 100 ⁽²⁾
6.	BOD5*	mg/L	4	6	TCVN 6001-1:2008	≤ 6 ⁽²⁾
7.	COD*	mg/L	12	14	SMEWW 5220C:2017	≤ 15 ⁽²⁾
8.	Ammonium (NH4+ as N) *	mg/L	<0.01	12	TCVN 6179-1:1996	0.3(1)
9.	Chloride (Cl-)*	mg/L	38.34	36.92	TCVN 6194:1996	250(1)
10.	Nitrite (NO2- as N) *	mg/L	<0.003	<0.003	TCVN 6178:1996	0.05(1)
11.	Nitrate (NO3- as N) *	mg/L	<0.02	<0.02	TCVN 6180:1996	-
12.	Phosphate (PO43- as P) *	mg/L	0.13	0.21	TCVN 6202:2008	-
13.	Total N*	mg/L	<2	<2	TCVN 6638:2000	≤ 1.5 ⁽²⁾
14.	Iron (Fe) *	mg/L	1.35	0.18	TCVN 6177:1996	0.5(1)

Water sample analysis results						
No	Parameter	Unit	Result		Test method	Standards
			NM1	NM2		
15.	Total oil and grease*	mg/L	<0.3	<0.3	SMEWW 5520.B:2017	5.0(1)
16.	Coliform*	MPN/ 100mL	470	490	SMEWW 9221B:2017	≤ 5,000 ⁽²⁾

Note/Remark:

- Sampling location:

+ NM1: NEstimated surface area at high tideCoordinates: X=2211755; Y=607093

+ NM2: NEstimated surface area at low tideCoordinates: X=2211730; Y=607083

- Comparison standards:

+ QCVN 08:2023/BTNMT: National technical regulation on surface water quality;

+ Level B – Table 2: Limit values of parameters in surface water for classifying the water quality of rivers, streams, canals, ditches, streams, and protecting aquatic habitats

+ KPH: Not detected. Sample analysis results are lower than the MDL detection limit of the method;

+ (-): Not specified.

Number:
24.1167/KGZ/2024/Q4/506

TEST RESULTS SHEET

Customer name/Custom name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location/Monitoring location	:	Thanh Hoa Province Sustainable Aquaculture Development Project - Sub-project 3: Building infrastructure for aquaculture area in Nga Tien Commune_Nga Tien Commune, Nga Son District, Thanh Hoa Province	
Sample type/Type	:	Air	Number of samples:01
Observation date/Monitoring date	:	October 25, 2024	
Date of result return/Results date	:	November 9, 2024	

Air sample analysis results					
No	Parameter	Unit	Result	Test method	Standards
			K1		
1	Temperature *	°C	31	QCVN 46:2012/BTNMT	-
2	Humidity*	%	65.7	QCVN 46:2012/BTNMT	-
3	Wind speed*	m/s	0.9	QCVN 46:2012/BTNMT	-
4	Noise LAeq*	dBA	59.7	TCVN 7878-2:2018	70(1)
5	Total suspended particulate matter (TSP) *	µg/m3	215	TCVN 5067:1995	300
6	SO2*	µg/m3	59.7	TCVN 5971:1995	350
7	NO2*	µg/m3	88	TCVN 6137:2009	200
8	CO*	µg/m3	5,230	SOP.PT.KXQ.03	30,000
9	H2S*	µg/m3	<3	MASA 701	42

Note:

- Sampling location:

+ K1: Air in the construction area. Coordinates: X=2211843; Y=606915.- Comparison standards:+ QCVN 05:2023/BTNMT: National technical regulations on air quality (1-hour average);+ (1): QCVN 26:2010/BTNMT: National technical regulations on noise;+ (-): Not specified.

Number:
24.1167/KGZ/2024/Q4/507

TEST RESULTS SHEET

Customer name/Custom name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location/Monitoring location	:	Thanh Hoa Province Sustainable Aquaculture Development Project - Sub-project 3: Building infrastructure for aquaculture area in Nga Tien Commune_Nga Tien Commune, Nga Son District, Thanh Hoa Province	
Sample type/Type	:	Soil samples	Number of samples:01
Observation date/Monitoring date	:	October 25, 2024	
Date of result return/Results date	:	November 9, 2024	

Soil sample analysis results					
No	Parameter	Unit	Result	Test method	Standards
			MD		
1	Total phosphorus *	mg/kg	477	TCVN 6499:1999	-
2	Total nitrogen*	mg/kg	790	TCVN 6498: 2009	-
3	Total Chromium (Cr) *	mg/kg	0.099	US EPA Method 3050B + US EPA Method 7010	200
4	Cadmium (Cd) *	mg/kg	<0.02	US EPA Method 3050B + US EPA Method 7010	10
5	Copper (Cu) *	mg/kg	<1	US EPA Method 3050B + US EPA Method 7000B	500
6	Lead (Pb) *	mg/kg	0.135	US EPA Method 3050B + US EPA Method 7010	400
7	Zinc (Zn) *	mg/kg	<2	US EPA Method 3050B + US EPA Method 7000B	600
8	Arsenic (As) *	mg/kg	<0.8	US EPA Method 3050B + US EPA Method 7010	50

Note:

- Sampling location:

+ MD: Soil sample in the project implementation area. Coordinates: X=2211868; Y=606908.- Comparison standards:+ QCVN 03:2023/BTNMT: National technical regulations on soil quality (Type 2);
+ (-): Not specified.

Number:
24.1167/KGZ/2024/Q4/508

TEST RESULTS SHEET

Customer name/Custom name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location/Monitoring location	:	Thanh Hoa Province Sustainable Aquaculture Development Project - Sub-project 3: Building infrastructure for aquaculture area in Nga Tien Commune_Nga Tien Commune, Nga Son District, Thanh Hoa Province	
Sample type/Type	:	Sediment samples	Number of samples: 01
Observation date/Monitoring date	:	October 30, 2024	
Date of result return/Results date	:	November 9, 2024	

Sediment sample analysis results						
No	Parameter	Unit	Result	Test method	Standards	
			TT		(1)	(2)
1	Arsenic (As) *	mg/kg	<0.13	US EPA Method 3050B+ US EPA Method 7062	17	41.6
2	Cadmium (Cd) *	mg/kg	0.38	US EPA Method 3050B+ US EPA Method 7010	3.5	4.2
3	Lead (Pb) *	mg/kg	4.86	US EPA Method 3050B+ US EPA Method 7010	91.3	112
4	Zinc (Zn) *	mg/kg	21.5	US EPA Method 3050B+ US EPA Method 7000B	315	271
5	Mercury (Hg) *	mg/kg	<0.015	TCVN 6649:2000 + TCVN 8882:2011	0.5	0.7
6	Copper (Cu) *	mg/kg	6.93	US EPA Method 3050B+ US EPA Method 7000B	197	108
7	Total N *	mg/kg	98.3	TCVN 6498:1999	-	-
8	Total phosphorus (P) *	mg/kg	242.5	TCVN 8940:2011	-	-
9	pH (H2O) *	-	5.2	TCVN 4402:1987	-	-
10	pH (KCl) *	-	5.6	TCVN 4401:1987	-	-

Note:

- Sampling location:

+ TT: Sediment samples at the project construction area, coordinates: VD=19.99959; KD=106.02390

- Comparison standards:

+ QCVN 43:2017/BTNMT: National Technical Regulation on Sediment Quality

+ (1): Freshwater sediments

+ (2): Saltwater and brackish water sediments

+ (-): Not specified.

TEST RESULTS SHEET

Number:

24.1168/KGZ/2024/Q4/513

Customer name/Custom name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location/Monitoring location	:	Thanh Hoa Province Sustainable Aquaculture Development Project - Sub-project 3: Building infrastructure for aquaculture area in Nga Thuy Commune_Nga Thuy Commune, Nga Son District, Thanh Hoa Province	
Sample type/Type	:	Wastewater	Number of samples:01
Sample code/Sample encryption	:	MNT/2410.25/03	
Observation date/Monitoring date	:	October 25, 2024	
Date of result return/Results date	:	November 9, 2024	

Water sample analysis results					
No	Parameter	Unit	Result	Test method	Standards
			NT		
1.	pH	-	7.07	TCVN 6492:2011	5.5-9
2.	TDS	mg/L	368	KGZ.SOP.QT.N.07	-
3.	Total suspended solids (TSS)*	mg/L	72	TCVN 6625:2000	100
4.	BOD5*	mg/L	12	TCVN 6001-1:2008	50
5.	COD*	mg/L	28	SMEWW 5220C:2017	150
6.	Ammonium (NH4+ as N)*	mg/L	0.063	TCVN 6179-1:1996	10
7.	Chloride (Cl-)*	mg/L	386.95	TCVN 6194:1996	1,000
8.	Nitrite (NO2- as N)*	mg/L	0.028	TCVN 6178:1996	-
9.	Nitrate (NO3-(calculated in N))*	mg/L	0.478	SMEWW 4500.NO3.E:2017	-
10.	Phosphate (PO43- as P)*	mg/L	<0.02	TCVN 6202:2008	-
11.	Iron (Fe)*	mg/L	<0.02	TCVN 6177:1996	5
12.	Total mineral oils and fats*	mg/L	0.4	SMEWW 5520.B&F:2017	10
13.	Coliform*	MPN	330	SMEWW 9221B:2017	5,000

Water sample analysis results					
No	Parameter	Unit	Result	Test method	Standards
			NT		
		/100mL			

Note/Remark:

- Sampling location:

+ NT: Wastewater samples at the project construction area Coordinates: X=2208708; Y=604053

- Comparison standards:

+ QCVN 40:2011/BTNMT: National technical regulation on industrial wastewater (Column B).

+ (-): Not specified.

Number:
24.1168/KGZ/2024/Q4/514

TEST RESULTS SHEET

Customer name/Custom name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location/Monitoring location	:	Thanh Hoa Province Sustainable Aquaculture Development Project - Sub-project 3: Building infrastructure for aquaculture area in Nga Thuy Commune_Nga Thuy Commune, Nga Son District, Thanh Hoa Province	
Sample type/Type	:	Groundwater	Number of samples:01
Sample code/Sample encryption	:	MNN/2410.25/03	
Observation date/Monitoring date	:	October 25, 2024	
Date of result return/Results date	:	November 9, 2024	

Water sample analysis results					
No	Parameter	Unit	Result	Test method	Standards
			NN		
1.	pH	-	6.53	TCVN 6492:2011	5.5-8.5
2.	Total Dissolved Solids (TDS)	mg/L	79	KGZ.SOP.QT.N.07	1,500
3.	Hardness*	mg/L	56	TCVN 6224:1996	500
4.	Ammonium (NH ₄ ⁺ as N) *	mg/L	0.079	TCVN 6179-1:1996	1
5.	Chloride (Cl ⁻)*	mg/L	35.5	TCVN 6194:1996	250
6.	Sulfate (SO ₄ ²⁻)*	mg/L	67.6	SMEWW 4500-SO ₄ ²⁻ .E:2017	400
7.	Nitrite (NO ₂ ⁻ as N) *	mg/L	<0.003	TCVN 6178:1996	1
8.	Nitrate (NO ₃ ⁻ as N) *	mg/L	0.114	SMEWW 4500.NO ₃ .B:2017	15
9.	Iron (Fe) *	mg/L	0.02	TCVN 6177:1996	5
10.	Arsenic (As)*	mg/L	0.0005	SMEWW 3113B:2017	0.05

Note/Remark:

- Sampling location:

+ NN: Well water sample in the project implementation area. Coordinates: X=2208731; Y=604079

- Comparison standards:

+ QCVN 09:2023/BTNMT: National technical regulation on groundwater quality

+ (-): Not specified.

+ KPH: Not detected. Sample analysis results are lower than the MDL detection limit of the method;

Number:
24.1168/KGZ/2024/Q4/515

TEST RESULTS SHEET

Customer name/Custom name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location/Monitoring location	:	Thanh Hoa Province Sustainable Aquaculture Development Project - Sub-project 3: Building infrastructure for aquaculture area in Nga Thuy Commune_Nga Thuy Commune, Nga Son District, Thanh Hoa Province	
Sample type/Type	:	Surface water	Number of samples:02
Sample code/Sample encryption	:	MNM/2410.25/05-06	
Observation date/Monitoring date	:	October 25, 2024	
Date of result return/Results date	:	November 9, 2024	

Water sample analysis results						
No	Parameter	Unit	Result		Test method	Standards
			NM1	NM2		
1.	pH	-	6.85	6.86	TCVN 6492:2011	6 ÷ 8.5 ⁽²⁾
2.	Turbidity	NTU	42	22	SMEWW 2130B:2017	-
3.	Salinity	%	0.01	0.07	SMEWW 2520B:2017	-
4.	Total Dissolved Solids (TDS)	mg/L	262	265	KGZ.SOP.QT.N.07	-
5.	Total suspended solids (TSS)*	mg/L	68	65	TCVN 6625:2000	≤ 100 ⁽²⁾
6.	BOD5*	mg/L	4	2	TCVN 6001-1:2008	≤ 6 ⁽²⁾
7.	COD*	mg/L	10	8	SMEWW 5220C:2017	≤ 15 ⁽²⁾
8.	Ammonium (NH4+ as N) *	mg/L	0.048	0.31	TCVN 6179-1:1996	0.3(1)
9.	Chloride (Cl-)*	mg/L	447.3	390.5	TCVN 6194:1996	250(1)
10.	Nitrite (NO2- as N) *	mg/L	<0.003	<0.003	TCVN 6178:1996	0.05(1)
11.	Nitrate (NO3- as N) *	mg/L	<0.02	<0.02	TCVN 6180:1996	-
12.	Phosphate (PO43- as P) *	mg/L	0.02	0.02	TCVN 6202:2008	-
13.	Total N*	mg/L	<2	<2	TCVN 6638:2000	≤ 1.5 ⁽²⁾
14.	Iron (Fe) *	mg/L	<0.02	<0.02	TCVN 6177:1996	0.5(1)

Water sample analysis results						
No	Parameter	Unit	Result		Test method	Standards
			NM1	NM2		
15.	Total oil and grease*	mg/L	<0.3	<0.3	SMEWW 5520.B:2017	5.0(1)
16.	Coliform*	MPN/ 100mL	130	170	SMEWW 9221B:2017	≤ 5,000 ⁽²⁾

Note/Remark:

- Sampling location:

+ NM1: NEstimated surface area at high tideCoordinates: X=2208378; Y=604898

+ NM2: NEstimated surface area at low tideCoordinates: X=2208378; Y=604898

- Comparison standards:

+ QCVN 08:2023/BTNMT: National technical regulation on surface water quality;

+ Level B – Table 2: Limit values of parameters in surface water for classifying the water quality of rivers, streams, canals, ditches, streams, and protecting aquatic habitats

+ KPH: Not detected. Sample analysis results are lower than the MDL detection limit of the method;

+ (-): Not specified.

Number:
24.1168/KGZ/2024/Q4/516

TEST RESULTS SHEET

Customer name/Custom name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location/Monitoring location	:	Thanh Hoa Province Sustainable Aquaculture Development Project - Sub-project 3: Building infrastructure for aquaculture area in Nga Thuy Commune_Nga Thuy Commune, Nga Son District, Thanh Hoa Province	
Sample type/Type	:	Air	Number of samples:01
Observation date/Monitoring date	:	October 25, 2024	
Date of result return/Results date	:	November 9, 2024	

Air sample analysis results					
No	Parameter	Unit	Result	Test method	Standards
			K1		
1	Temperature *	°C	28	QCVN 46:2012/BTNMT	-
2	Humidity*	%	68.9	QCVN 46:2012/BTNMT	-
3	Wind speed*	m/s	1.5	QCVN 46:2012/BTNMT	-
4	Noise LAeq*	dBA	64.1	TCVN 7878-2:2018	70(1)
5	Total suspended particulate matter (TSP) *	µg/m3	235	TCVN 5067:1995	300
6	SO2*	µg/m3	62.5	TCVN 5971:1995	350
7	NO2*	µg/m3	94	TCVN 6137:2009	200
8	CO*	µg/m3	5,780	SOP.PT.KXQ.03	30,000
9	H2S*	µg/m3	<3	MASA 701	42

Note:

- Sampling location:

+ K1: Air in the construction area. Coordinates: X=2208805; Y=603627.- Comparison standards:+ QCVN 05:2023/BTNMT: National technical regulations on air quality (1-hour average);+ (1): QCVN 26:2010/BTNMT: National technical regulations on noise;+ (-): Not specified.

Number:
24.1168/KGZ/2024/Q4/517

TEST RESULTS SHEET

Customer name/Custom name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location/Monitoring location	:	Thanh Hoa Province Sustainable Aquaculture Development Project - Sub-project 3: Building infrastructure for aquaculture area in Nga Thuy Commune_Nga Thuy Commune, Nga Son District, Thanh Hoa Province	
Sample type/Type	:	Soil samples	Number of samples:01
Observation date/Monitoring date	:	October 25, 2024	
Date of result return/Results date	:	November 9, 2024	

Soil sample analysis results					
No	Parameter	Unit	Result	Test method	Standards
			MD		
1	Total phosphorus *	mg/kg	513	TCVN 6499:1999	-
2	Total nitrogen*	mg/kg	610	TCVN 6498: 2009	-
3	Total Chromium (Cr) *	mg/kg	0.0625	US EPA Method 3050B + US EPA Method 7010	200
4	Cadmium (Cd) *	mg/kg	<0.02	US EPA Method 3050B + US EPA Method 7010	10
5	Copper (Cu) *	mg/kg	<1	US EPA Method 3050B + US EPA Method 7000B	500
6	Lead (Pb) *	mg/kg	0.098	US EPA Method 3050B + US EPA Method 7010	400
7	Zinc (Zn) *	mg/kg	<2	US EPA Method 3050B + US EPA Method 7000B	600
8	Arsenic (As) *	mg/kg	<0.8	US EPA Method 3050B + US EPA Method 7010	50

Note:

- Sampling location:

+ MD: Soil sample in the project implementation area. Coordinates: X=2208802; Y=603602.- Comparison standards:+ QCVN 03:2023/BTNMT: National technical regulations on soil quality (Type 2);
+ (-): Not specified.

Number:
24.1168/KGZ/2024/Q4/518

TEST RESULTS SHEET

Customer name/Custom name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location/Monitoring location	:	Thanh Hoa Province Sustainable Aquaculture Development Project - Sub-project 3: Building infrastructure for aquaculture area in Nga Thuy Commune_Nga Thuy Commune, Nga Son District, Thanh Hoa Province	
Sample type/Type	:	Sediment samples	Number of samples:01
Observation date/Monitoring date	:	October 30, 2024	
Date of result return/Results date	:	November 9, 2024	

Sediment sample analysis results						
<i>No</i>	Parameter	<i>Unit</i>	Result	Test method	Standards	
			TT		(1)	(2)
1	Arsenic (As) *	mg/kg	<0.13	US EPA Method 3050B+ US EPA Method 7062	17	41.6
2	Cadmium (Cd) *	mg/kg	0.42	US EPA Method 3050B+ US EPA Method 7010	3.5	4.2
3	Lead (Pb) *	mg/kg	5.63	US EPA Method 3050B+ US EPA Method 7010	91.3	112
4	Zinc (Zn) *	mg/kg	24.3	US EPA Method 3050B+ US EPA Method 7000B	315	271
5	Mercury (Hg) *	mg/kg	<0.015	TCVN 6649:2000 + TCVN 8882:2011	0.5	0.7
6	Copper (Cu) *	mg/kg	7.5	US EPA Method 3050B+ US EPA Method 7000B	197	108
7	Total N *	mg/kg	122.6	TCVN 6498:1999	-	-
8	Total phosphorus (P) *	mg/kg	248.6	TCVN 8940:2011	-	-
9	pH (H2O) *	-	5.3	TCVN 4402:1987	-	-
10	pH (KCl) *	-	5.8	TCVN 4401:1987	-	-

Note:

- Sampling location:

+ TT: Sediment samples at the project construction area, coordinates: VD=19.96947; KD=106.00232

- Comparison standards:

+ QCVN 43:2017/BTNMT: National Technical Regulation on Sediment Quality

+ (1): Freshwater sediments

+ (2): Saltwater and brackish water sediments

+ (-): Not specified.

Subproject 4: Environmental Monitoring Results

TEST RESULTS SHEET

Number:
24.1156/KGZ/2024/Q4/439

Customer name/Custom name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location/Monitoring location	:	Thanh Hoa Province Sustainable Aquaculture Development Project - Sub-project 4: Upgrading Aquaculture Infrastructure_Hoang Yen Commune, Hoang Hoa District, Thanh Hoa Province	
Sample type/Type	:	Wastewater	Number of samples: 01
Sample code/Sample encryption	:	MNT/2410.23/03	
Observation date/Monitoring date	:	October 23, 2024	
Date of result return/Results date	:	November 9, 2024	

Water sample analysis results					
No	Parameter	Unit	Result	Test method	Standards
			NT		
1.	pH	-	7.06	TCVN 6492:2011	5.5-9
2.	TDS	mg/L	372	KGZ.SOP.QT.N.07	-
3.	Total suspended solids (TSS)	mg/L	35	TCVN 6625:2000	100
4.	COD	mg/L	18	SMEWW 5220C:2017	150
5.	BOD5	mg/L	8	TCVN 6001-1:2008	50
6.	Nitrite (NO2- as N)	mg/L	0.07	TCVN 6178:1996	-
7.	Phosphate (PO43- as P)	mg/L	<0.02	TCVN 6202:2008	-
8.	Chloride (Cl-)	mg/L	369	TCVN 6194:1996	1,000
9.	Ammonium (NH4+ as N)	mg/L	0.75	TCVN 6179-1:1996	10
10.	Nitrate (NO3-(calculated in N)*	mg/L	0.044	SMEWW 4500.NO3.E:2017	-
11.	Iron (Fe)*	mg/L	0.034	TCVN 6177:1996	5

Water sample analysis results					
No	Parameter	Unit	Result	Test method	Standards
			NT		
12.	Total mineral oils and fats*	mg/L	1.2	SMEWW 5520.B&F:2017	10
13.	Coliform*	MPN/100mL	470	SMEWW 9221B:2017	5,000

Note/Remark:

- Sampling location:

+ NT: Wastewater samples at the project construction area Coordinates: X=2197476; Y=594180

- Comparison standards:

+ QCVN 40:2011/BTNMT: National technical regulation on industrial wastewater (Column B).

+ (-): Not specified.

Number:
24.1156/KGZ/2024/Q4/440

TEST RESULTS SHEET

Customer name/Custom name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location/Monitoring location	:	Thanh Hoa Province Sustainable Aquaculture Development Project - Sub-project 4: Upgrading Aquaculture Infrastructure_Hoang Yen Commune, Hoang Hoa District, Thanh Hoa Province	
Sample type/Type	:	Groundwater	Number of samples: 01
Sample code/Sample encryption	:	MNN/2410.23/02	
Observation date/Monitoring date	:	October 23, 2024	
Date of result return/Results date	:	November 9, 2024	

Water sample analysis results					
No	Parameter	Unit	Result	Test method	Standards
			NN		
1.	pH	-	6.55	TCVN 6492:2011	5.5-8.5
2.	Total Dissolved Solids (TDS)	mg/L	78	KGZ.SOP.QT.N.07	1,500
3.	Hardness	mg/L	30	TCVN 6224:1996	500
4.	Sulfate (SO42-)	mg/L	143	SMEWW 4500-SO42-.E:2017	400
5.	Chloride (Cl-)	mg/L	124	TCVN 6194:1996	250
6.	Nitrite (NO2- as N)	mg/L	0.33	TCVN 6178:1996	1
7.	Nitrate (NO3- as N)	mg/L	0.83	SMEWW 4500.NO3.B:2017	15
8.	Ammonium (NH4+ as N)	mg/L	2.44	TCVN 6179-1:1996	1
9.	Iron (Fe)	mg/L	0.07	TCVN 6177:1996	5
10.	Arsenic (As)*	mg/L	0.0007	SMEWW 3113B:2017	0.05

Note/Remark:

- Sampling location:

+ NN: Well water sample in the project implementation area. Coordinates: X=2197732; Y=594281

- Comparison standards:

+ QCVN 09:2023/BTNMT: National technical regulation on groundwater quality

+ (-): Not specified.

+ KPH: Not detected. Sample analysis results are lower than the MDL detection limit of the method;

Number:
24.1156/KGZ/2024/Q4/441

TEST RESULTS SHEET

Customer name/Custom name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location/Monitoring location	:	Thanh Hoa Province Sustainable Aquaculture Development Project - Sub-project 4: Upgrading Aquaculture Infrastructure_Hoang Yen Commune, Hoang Hoa District, Thanh Hoa Province	
Sample type/Type	:	Surface water	Number of samples: 02
Sample code/Sample encryption	:	MNM/2410.23/03-04	
Observation date/Monitoring date	:	October 23, 2024	
Date of result return/Results date	:	November 9, 2024	

Water sample analysis results						
No	Parameter	Unit	Result		Test method	Standards
			NM1	NM2		
1.	pH	-	6.83	6.86	TCVN 6492:2011	6 ÷ 8.5 ⁽²⁾
2.	Turbidity	NTU	39	23	SMEWW 2130B:2017	-
3.	Salinity	%	0.03	0.08	SMEWW 2520B:2017	-
4.	Total Dissolved Solids (TDS)	mg/L	257	267	KGZ.SOP.QT.N.07	-
5.	Total suspended solids (TSS)	mg/L	31	28	TCVN 6625:2000	≤ 100 ⁽²⁾
6.	COD	mg/L	14	12	SMEWW 5220C:2017	≤ 15 ⁽²⁾
7.	BOD5	mg/L	6	4	TCVN 6001-1:2008	≤ 6 ⁽²⁾
8.	Chloride (Cl-)	mg/L	128	134	TCVN 6194:1996	250(1)
9.	Ammonium (NH4+ as N)	mg/L	0.66	0.78	TCVN 6179-1:1996	0.3(1)
10.	Nitrite (NO2- as N)	mg/L	0.12	0.11	TCVN 6178:1996	0.05(1)
11.	Nitrate (NO3- as N)	mg/L	0.66	0.58	TCVN 6180:1996	-
12.	Phosphate (PO43- as P)	mg/L	<0.02	<0.02	TCVN 6202:2008	-
13.	Total N	mg/L	KPH	KPH	TCVN 6638:2000	≤ 1.5 ⁽²⁾
14.	Iron (Fe) *	mg/L	0.1	0.089	TCVN 6177:1996	0.5(1)

Water sample analysis results						
No	Parameter	Unit	Result		Test method	Standards
			NM1	NM2		
15.	Total oil and grease*	mg/L	<0.3	<0.3	SMEWW 5520.B:2017	5.0(1)
16.	Coliform*	MPN/ 100mL	270	490	SMEWW 9221B:2017	≤ 5,000 ⁽²⁾

Note/Remark:

- Sampling location:

+ NM1: NEstimated surface area at high tideCoordinates: X=219447; Y=594172

+ NM2: NEstimated surface area at low tideCoordinates: X=2197463; Y=594163

- Comparison standards:

+ QCVN 08:2023/BTNMT: National technical regulation on surface water quality;

+ Level B – Table 2: Limit values of parameters in surface water for classifying the water quality of rivers, streams, canals, ditches, streams, and protecting aquatic habitats

+ KPH: Not detected. Sample analysis results are lower than the MDL detection limit of the method;

+ (-): Not specified.

Number:
24.1156/KGZ/2024/Q4/442

TEST RESULTS SHEET

Customer name/Custom name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location/Monitoring location	:	Thanh Hoa Province Sustainable Aquaculture Development Project - Sub-project 4: Upgrading Aquaculture Infrastructure_Hoang Yen Commune, Hoang Hoa District, Thanh Hoa Province	
Sample type/Type	:	Air	Number of samples:01
Observation date/Monitoring date	:	October 23, 2024	
Date of result return/Results date	:	November 9, 2024	

Air sample analysis results					
No	Parameter	Unit	Result	Test method	Standards
			K1		
1	Temperature *	°C	28.3	QCVN 46:2012/BTNMT	-
2	Humidity*	%	65.5	QCVN 46:2012/BTNMT	-
3	Wind speed*	m/s	1	QCVN 46:2012/BTNMT	-
4	Noise LAeq*	dBA	53.6	TCVN 7878-2:2018	70(1)
5	Total suspended particulate matter (TSP) *	µg/m3	212	TCVN 5067:1995	300
6	SO2*	µg/m3	70.8	TCVN 5971:1995	350
7	NO2*	µg/m3	68	TCVN 6137:2009	200
8	CO*	µg/m3	7,030	SOP.PT.KXQ.03	30,000
9	H2S*	µg/m3	<3	MASA 701	42

Note:

- Sampling location:

+ K1: Air in the construction area. Coordinates: X=2197597; Y=593971.- Comparison standards:+ QCVN 05:2023/BTNMT: National technical regulations on air quality (1-hour average);+ (1): QCVN 26:2010/BTNMT: National technical regulations on noise;+ (-): Not specified.

Number:
24.1156/KGZ/2024/Q4/443

TEST RESULTS SHEET

Customer name/Custom name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location/Monitoring location	:	Thanh Hoa Province Sustainable Aquaculture Development Project - Sub-project 4: Upgrading Aquaculture Infrastructure_Hoang Yen Commune, Hoang Hoa District, Thanh Hoa Province	
Sample type/Type	:	Soil samples	Number of samples: 01
Observation date/Monitoring date	:	October 23, 2024	
Date of result return/Results date	:	November 9, 2024	

Soil sample analysis results					
No	Parameter	Unit	Result	Test method	Standards
			MD		
1	Total phosphorus *	mg/kg	527	TCVN 6499:1999	-
2	Total nitrogen*	mg/kg	820	TCVN 6498: 2009	-
3	Total Chromium (Cr) *	mg/kg	<0.02	US EPA Method 3050B + US EPA Method 7010	200
4	Cadmium (Cd) *	mg/kg	<0.02	US EPA Method 3050B + US EPA Method 7010	10
5	Copper (Cu) *	mg/kg	<1	US EPA Method 3050B + US EPA Method 7000B	500
6	Lead (Pb) *	mg/kg	<0.02	US EPA Method 3050B + US EPA Method 7010	400
7	Zinc (Zn) *	mg/kg	<2	US EPA Method 3050B + US EPA Method 7000B	600
8	Arsenic (As) *	mg/kg	<0.8	US EPA Method 3050B + US EPA Method 7010	50

Note:

- Sampling location:

+ MD: Soil sample in the project implementation area. Coordinates: X=2197619; Y=593987.- Comparison standards:+ QCVN 03:2023/BTNMT: National technical regulations on soil quality (Type 2);
+ (-): Not specified.

Number:
24.1156/KGZ/2024/Q4/444

TEST RESULTS SHEET

Customer name/Custom name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location/Monitoring location	:	Thanh Hoa Province Sustainable Aquaculture Development Project - Sub-project 4: Upgrading Aquaculture Infrastructure_Hoang Yen Commune, Hoang Hoa District, Thanh Hoa Province	
Sample type/Type	:	Sediment samples	Number of samples: 01
Observation date/Monitoring date	:	October 30, 2024	
Date of result return/Results date	:	November 9, 2024	

Sediment sample analysis results						
No	Parameter	Single taste	Result	Test method	Standards	
			TT		(1)	(2)
1	Arsenic (As) *	mg/kg	<0.13	US EPA Method 3050B+ US EPA Method 7062	17	41.6
2	Cadmium (Cd) *	mg/kg	0.48	US EPA Method 3050B+ US EPA Method 7010	3.5	4.2
3	Lead (Pb) *	mg/kg	5.04	US EPA Method 3050B+ US EPA Method 7010	91.3	112
4	Zinc (Zn) *	mg/kg	23.1	US EPA Method 3050B+ US EPA Method 7000B	315	271
5	Mercury (Hg) *	mg/kg	<0.015	TCVN 6649:2000 + TCVN 8882:2011	0.5	0.7
6	Copper (Cu) *	mg/kg	7.03	US EPA Method 3050B+ US EPA Method 7000B	197	108
7	Total N*	mg/kg	126.4	TCVN 6498:1999	-	-
8	Total phosphorus (P) *	mg/kg	241.6	TCVN 8940:2011	-	-
9	pH (H2O) *	-	5.3	TCVN 4402:1987	-	-
10	pH (KCl) *	-	6	TCVN 4401:1987	-	-

Note:

- Sampling location:

+ TT: Sediment samples at the project construction area, coordinates: VD=19.88750; KD=105.94036

- Comparison standards:

+ QCVN 43:2017/BTNMT: National Technical Regulation on Sediment Quality

+ (1): Freshwater sediments

+ (2): Saltwater and brackish water sediments

+ (-): Not specified.

Subproject 5: Environmental Monitoring Results

TEST RESULTS SHEET

Number:
24.1157/KGZ/2024/Q4/451

Customer name/Custom name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location/Monitoring location	:	Thanh Hoa Province Sustainable Aquaculture Development Project - Sub-project 5: Upgrading Aquaculture Infrastructure_Hoang Phong Commune, Hoang Hoa District, Thanh Hoa Province	
Sample type/Type	:	Wastewater	Number of samples:01
Sample code/Sample encryption	:	MNT/2410.23/04	
Observation date/Monitoring date	:	October 23, 2024	
Date of result return/Results date	:	November 9, 2024	

Water sample analysis results					
No	Parameter	Unit	Result	Test method	Standards
			NT		
1.	pH	-	7.05	TCVN 6492:2011	5.5-9
2.	TDS	mg/L	369	KGZ.SOP.QT.N.07	-
3.	Total suspended solids (TSS)	mg/L	21	TCVN 6625:2000	100
4.	COD	mg/L	46	SMEWW 5220C:2017	150
5.	BOD5	mg/L	18	TCVN 6001-1:2008	50
6.	Nitrite (NO2- as N)	mg/L	0.07	TCVN 6178:1996	-
7.	Phosphate (PO43- as P)	mg/L	0.05	TCVN 6202:2008	-
8.	Chloride (Cl-)	mg/L	404	TCVN 6194:1996	1,000
9.	Ammonium (NH4+ as N)	mg/L	1.49	TCVN 6179-1:1996	10
10.	Nitrate (NO3- as N) *	mg/L	0.053	SMEWW 4500.NO3.E:2017	-
11.	Iron (Fe) *	mg/L	0.203	TCVN 6177:1996	5
12.	Total mineral oils and fats*	mg/L	0.4	SMEWW 5520.B&F:2017	10

Water sample analysis results					
No	Parameter	Unit	Result	Test method	Standards
			NT		
13.	Coliform*	MPN/100mL	700	SMEWW 9221B:2017	5,000

Note/Remark:

- Sampling location:

+ NT: Wastewater sample at the project construction area. Coordinates: X=2189555; Y=593817

- Comparison standards:

+ QCVN 40:2011/BTNMT: National technical regulation on industrial wastewater (Column B).

+ (-): Not specified.

Number:
24.1157/KGZ/2024/Q4/452

TEST RESULTS SHEET

Customer name/Custom name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location/Monitoring location	:	Thanh Hoa Province Sustainable Aquaculture Development Project - Sub-project 5: Upgrading Aquaculture Infrastructure_Hoang Phong Commune, Hoang Hoa District, Thanh Hoa Province	
Sample type/Type	:	Groundwater	Number of samples:01
Sample code/Sample encryption	:	MNN/2410.23/03	
Observation date/Monitoring date	:	October 23, 2024	
Date of result return/Results date	:	November 9, 2024	

Water sample analysis results					
No	Parameter	Unit	Result	Test method	Standards
			NN		
1.	pH	-	6.54	TCVN 6492:2011	5.5-8.5
2.	Total Dissolved Solids (TDS)	mg/L	78	KGZ.SOP.QT.N.07	1,500
3.	Hardness	mg/L	330	TCVN 6224:1996	500
4.	Sulfate (SO42-)	mg/L	2	SMEWW 4500-SO42-.E:2017	400
5.	Chloride (Cl-)	mg/L	235	TCVN 6194:1996	250
6.	Nitrite (NO2- as N)	mg/L	<0.003	TCVN 6178:1996	1
7.	Nitrate (NO3- as N)	mg/L	1.82	SMEWW 4500.NO3.B:2017	15
8.	Ammonium (NH4+ as N)	mg/L	0.14	TCVN 6179-1:1996	1
9.	Iron (Fe)	mg/L	<0.02	TCVN 6177:1996	5
10.	Arsenic (As) *	mg/L	0.0008	SMEWW 3113B:2017	0.05

Note/Remark:

- Sampling location:

+ NN: Well water sample in the project implementation area. Coordinates: X=2189553; Y=593819

- Comparison standards:

+ QCVN 09:2023/BTNMT: National technical regulation on groundwater quality

+ (-): Not specified.

+ KPH: Not detected. Sample analysis results are lower than the MDL detection limit of the method;

Number:
24.1157/KGZ/2024/Q4/453

TEST RESULTS SHEET

Customer name/Custom name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location/Monitoring location	:	Thanh Hoa Province Sustainable Aquaculture Development Project - Sub-project 5: Upgrading Aquaculture Infrastructure_Hoang Phong Commune, Hoang Hoa District, Thanh Hoa Province	
Sample type/Type	:	Surface water	Number of samples:02
Sample code/Sample encryption	:	MNM/2410.23/05-06	
Observation date/Monitoring date	:	October 23, 2024	
Date of result return/Results date	:	November 9, 2024	

Water sample analysis results						
No	Parameter	Unit	Result		Test method	Standards
			NM1	NM2		
1.	pH	-	6.83	6.85	TCVN 6492:2011	6 ÷ 8.5(2)
2.	Turbidity	NTU	34	20	SMEWW 2130B:2017	-
3.	Salinity	%	0.05	0.1	SMEWW 2520B:2017	-
4.	Total Dissolved Solids (TDS)	mg/L	273	266	KGZ.SOP.QT.N.07	-
5.	Total suspended solids (TSS)	mg/L	19	23	TCVN 6625:2000	≤ 100(2)
6.	COD	mg/L	6	8	SMEWW 5220C:2017	≤ 15(2)
7.	BOD5	mg/L	2	2	TCVN 6001-1:2008	≤ 6(2)
8.	Chloride (Cl-)	mg/L	186	104	TCVN 6194:1996	250(1)
9.	Ammonium (NH4+ as N)	mg/L	0.65	0.77	TCVN 6179-1:1996	0.3(1)
10.	Nitrite (NO2- as N)	mg/L	0.05	0.04	TCVN 6178:1996	0.05(1)
11.	Nitrate (NO3- as N)	mg/L	0.21	0.16	TCVN 6180:1996	-
12.	Phosphate (PO43- as P)	mg/L	0.04	0.05	TCVN 6202:2008	-
13.	Total N	mg/L	KPH	KPH	TCVN 6638:2000	≤ 1.5(2)
14.	Iron (Fe) *	mg/L	0.234	0.31	TCVN 6177:1996	0.5(1)

Water sample analysis results						
No	Parameter	Unit	Result		Test method	Standards
			NM1	NM2		
15.	Total oil and grease*	mg/L	<0.3	<0.3	SMEWW 5520.B:2017	5.0(1)
16.	Coliform*	MPN/ 100mL	790	700	SMEWW 9221B:2017	≤ 5,000(2)

Note/Remark:

- Sampling location:

+ NM1: Surface water in the project area at high tide. Coordinates: X=2189516 Y=593814

+ NM2: Surface water in the project area at low tide. Coordinates: X=2189531; Y=593795

- Comparison standards:

+ QCVN 08:2023/BTNMT: National technical regulation on surface water quality;

+ Level B – Table 2: Limit values of parameters in surface water for classifying the water quality of rivers, streams, canals, ditches, streams, and protecting aquatic habitats

+ KPH: Not detected. Sample analysis results are lower than the MDL detection limit of the method;

+ (-): Not specified.

Number:
24.1157/KGZ/2024/Q4/454

TEST RESULTS SHEET

Customer name/Custom name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location/Monitoring location	:	Thanh Hoa Province Sustainable Aquaculture Development Project - Sub-project 5: Upgrading Aquaculture Infrastructure_Hoang Phong Commune, Hoang Hoa District, Thanh Hoa Province	
Sample type/Type	:	Air	Number of samples:01
Observation date/Monitoring date	:	October 23, 2024	
Date of result return/Results date	:	November 9, 2024	

Air sample analysis results					
No	Parameter	Unit	Result	Test method	Standards
			K1		
1	Temperature *	°C	26.4	QCVN 46:2012/BTNMT	-
2	Humidity*	%	65.5	QCVN 46:2012/BTNMT	-
3	Wind speed*	m/s	1.1	QCVN 46:2012/BTNMT	-
4	Noise LAeq*	dBA	53.1	TCVN 7878-2:2018	70(1)
5	Total suspended particulate matter (TSP) *	µg/m3	201	TCVN 5067:1995	300
6	SO2*	µg/m3	65.9	TCVN 5971:1995	350
7	NO2*	µg/m3	63	TCVN 6137:2009	200
8	CO*	µg/m3	7,340	SOP.PT.KXQ.03	30,000
9	H2S*	µg/m3	<3	MASA 701	42

Note:

- Sampling location:

+ K1: Air in the construction area. Coordinates: X=2189634; Y=593583.- Comparison standards:+ QCVN 05:2023/BTNMT: National technical regulations on air quality (1-hour average);+ (1): QCVN 26:2010/BTNMT: National technical regulations on noise;+ (-): Not specified.

Number:
24.1157/KGZ/2024/Q4/455

TEST RESULTS SHEET

Customer name/Custom name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location/Monitoring location	:	Thanh Hoa Province Sustainable Aquaculture Development Project - Sub-project 5: Upgrading Aquaculture Infrastructure_Hoang Phong Commune, Hoang Hoa District, Thanh Hoa Province	
Sample type/Type	:	Soil samples	Number of samples:01
Observation date/Monitoring date	:	October 23, 2024	
Date of result return/Results date	:	November 9, 2024	

Soil sample analysis results					
No	Parameter	Unit	Result	Test method	Standards
			MD		
1	Total phosphorus *	mg/kg	560	TCVN 6499:1999	-
2	Total nitrogen*	mg/kg	830	TCVN 6498: 2009	-
3	Total Chromium (Cr) *	mg/kg	<0.02	US EPA Method 3050B + US EPA Method 7010	200
4	Cadmium (Cd) *	mg/kg	<0.02	US EPA Method 3050B + US EPA Method 7010	10
5	Copper (Cu) *	mg/kg	<1	US EPA Method 3050B + US EPA Method 7000B	500
6	Lead (Pb) *	mg/kg	<0.02	US EPA Method 3050B + US EPA Method 7010	400
7	Zinc (Zn) *	mg/kg	<2	US EPA Method 3050B + US EPA Method 7000B	600
8	Arsenic (As) *	mg/kg	<0.8	US EPA Method 3050B + US EPA Method 7010	50

Note:

- Sampling location:

+ MD: Soil sample at the project implementation area. Coordinates: X=2189624; Y=593614.- Comparison standards: + QCVN 03:2023/BTNMT: National technical regulations on soil quality (Type 2);

+ (-): Not specified.

Number:
24.1157/KGZ/2024/Q4/456

TEST RESULTS SHEET

Customer name/Custom name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location/Monitoring location	:	Thanh Hoa Province Sustainable Aquaculture Development Project - Sub-project 5: Upgrading Aquaculture Infrastructure_Hoang Phong Commune, Hoang Hoa District, Thanh Hoa Province	
Sample type/Type	:	Sediment samples	Number of samples: 01
Observation date/Monitoring date	:	October 30, 2024	
Date of result return/Results date	:	November 9, 2024	

Sediment sample analysis results						
No	Parameter	Unit	Result	Test method	Standards	
			TT		(1)	(2)
1	Arsenic (As) *	mg/kg	<0.13	US EPA Method 3050B+ US EPA Method 7062	17	41.6
2	Cadmium (Cd) *	mg/kg	0.56	US EPA Method 3050B+ US EPA Method 7010	3.5	4.2
3	Lead (Pb) *	mg/kg	6.35	US EPA Method 3050B+ US EPA Method 7010	91.3	112
4	Zinc (Zn) *	mg/kg	21.9	US EPA Method 3050B+ US EPA Method 7000B	315	271
5	Mercury (Hg) *	mg/kg	<0.015	TCVN 6649:2000 + TCVN 8882:2011	0.5	0.7
6	Copper (Cu) *	mg/kg	7.04	US EPA Method 3050B+ US EPA Method 7000B	197	108
7	Total N *	mg/kg	111.5	TCVN 6498:1999	-	-
8	Total phosphorus (P) *	mg/kg	240.1	TCVN 8940:2011	-	-
9	pH (H2O) *	-	5.4	TCVN 4402:1987	-	-
10	pH (KCl) *	-	5.9	TCVN 4401:1987	-	-

Note:

- Sampling location:

+ TT: Sediment samples at the project construction area, coordinates: VD=19.80312; KD=105.89021

- Comparison standards:

+ QCVN 43:2017/BTNMT: National Technical Regulation on Sediment Quality

+ (1): Freshwater sediments

+ (2): Saltwater and brackish water sediments

+ (-): Not specified.

Subproject 6: Environmental Monitoring Results

TEST RESULTS SHEET

Number:
24.1162/KGZ/2024/Q4/464

Customer name/Custom name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location/Monitoring location	:	Thanh Hoa Province Sustainable Aquaculture Development Project - Sub-project 6: Upgrading Aquaculture Infrastructure_Hoang Luu Commune, Hoang Hoa District, Thanh Hoa Province	
Sample type/Type	:	Wastewater	Number of samples: 01
Sample code/Sample encryption	:	MNT/2410.24/07	
Observation date/Monitoring date	:	October 24, 2024	
Date of result return/Results date	:	November 9, 2024	

Water sample analysis results					
No	Parameter	Unit	Result	Test method	Standards
			NT		
1.	pH	-	7.09	TCVN 6492:2011	5.5-9
2.	TDS	mg/L	360	KGZ.SOP.QT.N.07	-
3.	Total suspended solids (TSS)*	mg/L	78	TCVN 6625:2000	100
4.	BOD5*	mg/L	8	TCVN 6001-1:2008	50
5.	COD*	mg/L	22	SMEWW 5220C:2017	150
6.	Ammonium (NH4+ as N)*	mg/L	0.95	TCVN 6179-1:1996	10
7.	Chloride (Cl-)*	mg/L	12.8	TCVN 6194:1996	1,000
8.	Nitrite (NO2- as N)*	mg/L	0.019	TCVN 6178:1996	-
9.	Nitrate (NO3-(calculated in N)*	mg/L	0.023	SMEWW 4500.NO3.E:2017	-
10.	Phosphate (PO43- as P)*	mg/L	0.03	TCVN 6202:2008	-
11.	Iron (Fe)*	mg/L	0.05	TCVN 6177:1996	5
12.	Total mineral oils and fats*	mg/L	<0.3	SMEWW 5520.B&F:2017	10

Water sample analysis results					
No	Parameter	Unit	Result	Test method	Standards
			NT		
13.	Coliform*	MPN /100mL	130	SMEWW 9221B:2017	5,000

Note/Remark:

- Sampling location:

+ NT: Wastewater samples at the project construction area Coordinates: X=2191571; Y=592422

- Comparison standards:

+ QCVN 40:2011/BTNMT: National technical regulation on industrial wastewater (Column B).

+ (-): Not specified.

Number:
24.1162/KGZ/2024/Q4/465

TEST RESULTS SHEET

Customer name/Custom name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location/Monitoring location	:	Thanh Hoa Province Sustainable Aquaculture Development Project - Sub-project 6: Upgrading Aquaculture Infrastructure_Hoang Luu Commune, Hoang Hoa District, Thanh Hoa Province	
Sample type/Type	:	Groundwater	Number of samples:01
Sample code/Sample encryption	:	MNN/2410.24/01	
Observation date/Monitoring date	:	October 24, 2024	
Date of result return/Results date	:	November 9, 2024	

Water sample analysis results					
No	Parameter	Unit	Result	Test method	Standards
			NN		
1.	pH	-	6.55	TCVN 6492:2011	5.5-8.5
2.	Total Dissolved Solids (TDS)	mg/L	79	KGZ.SOP.QT.N.07	1,500
3.	Hardness*	mg/L	318	TCVN 6224:1996	500
4.	Ammonium (NH ₄ ⁺ as N) *	mg/L	<0.01	TCVN 6179-1:1996	1
5.	Chloride (Cl ⁻)*	mg/L	132.1	TCVN 6194:1996	250
6.	Sulfate (SO ₄ ²⁻)*	mg/L	<2	SMEWW 4500-SO ₄ ²⁻ .E:2017	400
7.	Nitrite (NO ₂ ⁻ as N) *	mg/L	<0.003	TCVN 6178:1996	1
8.	Nitrate (NO ₃ ⁻ as N) *	mg/L	<0.02	SMEWW 4500.NO ₃ .B:2017	15
9.	Iron (Fe) *	mg/L	<0.02	TCVN 6177:1996	5
10.	Arsenic (As)*	mg/L	<0.0005	SMEWW 3113B:2017	0.05

Note/Remark:

- Sampling location:

+ NN: Well water sample in the project implementation area. Coordinates: X=2191652; Y=592437

- Comparison standards:

+ QCVN 09:2023/BTNMT: National technical regulation on groundwater quality

+ (-): Not specified.

+ KPH: Not detected. Sample analysis results are lower than the MDL detection limit of the method;

Number:
24.1162/KGZ/2024/Q4/466

TEST RESULTS SHEET

Customer name/Custom name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location/Monitoring location	:	Thanh Hoa Province Sustainable Aquaculture Development Project - Sub-project 6: Upgrading Aquaculture Infrastructure_Hoang Luu Commune, Hoang Hoa District, Thanh Hoa Province	
Sample type/Type	:	Surface water	Number of samples:02
Sample code/Sample encryption	:	MNM/2410.24/01-02	
Observation date/Monitoring date	:	October 24, 2024	
Date of result return/Results date	:	November 9, 2024	

Water sample analysis results						
No	Parameter	Unit	Result		Test method	Standards
			NM1	NM2		
1.	pH	-	6.85	6.84	TCVN 6492:2011	6 ÷ 8.5 ⁽²⁾
2.	Turbidity	NTU	32	21	SMEWW 2130B:2017	-
3.	Salinity	%	0.03	0.09	SMEWW 2520B:2017	-
4.	Total Dissolved Solids (TDS)	mg/L	275	277	KGZ.SOP.QT.N.07	-
5.	Total suspended solids (TSS)*	mg/L	45	40	TCVN 6625:2000	≤ 100 ⁽²⁾
6.	BOD5*	mg/L	6	4	TCVN 6001-1:2008	≤ 6 ⁽²⁾
7.	COD*	mg/L	14	12	SMEWW 5220C:2017	≤ 15 ⁽²⁾
8.	Ammonium (NH4+ as N) *	mg/L	<0.01	<0.01	TCVN 6179-1:1996	0.3(1)
9.	Chloride (Cl-)*	mg/L	12.8	11.4	TCVN 6194:1996	250(1)
10.	Nitrite (NO2- as N) *	mg/L	<0.003	0.024	TCVN 6178:1996	0.05(1)
11.	Nitrate (NO3- as N) *	mg/L	0.168	0.127	TCVN 6180:1996	-
12.	Phosphate (PO43- as P) *	mg/L	0.16	0.17	TCVN 6202:2008	-
13.	Total N*	mg/L	<2	<2	TCVN 6638:2000	≤ 1.5 ⁽²⁾
14.	Iron (Fe) *	mg/L	0.03	0.03	TCVN 6177:1996	0.5(1)

Water sample analysis results						
No	Parameter	Unit	Result		Test method	Standards
			NM1	NM2		
15.	Total oil and grease*	mg/L	<0.3	<0.3	SMEWW 5520.B:2017	5.0(1)
16.	Coliform*	MPN/ 100mL	170	240	SMEWW 9221B:2017	≤ 5,000 ⁽²⁾

Note/Remark:

- Sampling location:

+ NM1: NEstimated surface area at high tideCoordinates: X=2191622; Y=592445

+ NM2: NEstimated surface area at low tideCoordinates: X=2191621; Y=592444

- Comparison standards:

+ QCVN 08:2023/BTNMT: National technical regulation on surface water quality;

+ Level B – Table 2: Limit values of parameters in surface water for classifying the water quality of rivers, streams, canals, ditches, streams, and protecting aquatic habitats

+ KPH: Not detected. Sample analysis results are lower than the MDL detection limit of the method;

+ (-): Not specified.

Number:
24.1162/KGZ/2024/Q4/467

TEST RESULTS SHEET

Customer name/Custom name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location/Monitoring location	:	Thanh Hoa Province Sustainable Aquaculture Development Project - Sub-project 6: Upgrading Aquaculture Infrastructure_Hoang Luu Commune, Hoang Hoa District, Thanh Hoa Province	
Sample type/Type	:	Air	Number of samples:01
Observation date/Monitoring date	:	October 24, 2024	
Date of result return/Results date	:	November 9, 2024	

Air sample analysis results					
No	Parameter	Unit	Result	Test method	Standards
			K1		
1	Temperature *	°C	30.8	QCVN 46:2012/BTNMT	-
2	Humidity*	%	62.9	QCVN 46:2012/BTNMT	-
3	Wind speed*	m/s	1	QCVN 46:2012/BTNMT	-
4	Noise LAeq*	dBA	58.5	TCVN 7878-2:2018	70(1)
5	Total suspended particulate matter (TSP) *	µg/m3	216	TCVN 5067:1995	300
6	SO2*	µg/m3	77.5	TCVN 5971:1995	350
7	NO2*	µg/m3	76	TCVN 6137:2009	200
8	CO*	µg/m3	6,480	SOP.PT.KXQ.03	30,000
9	H2S*	µg/m3	<3	MASA 701	42

Note:

- Sampling location:

+ KK1: Air in the construction area. Coordinates: X= 2191784; Y= 592267.- Comparison standards:+ QCVN 05:2023/BTNMT: National technical regulations on air quality (1-hour average);+ (1): QCVN 26:2010/BTNMT: National technical regulations on noise;+ (-): Not specified.

Number:
24.1162/KGZ/2024/Q4/468

TEST RESULTS SHEET

Customer name/Custom name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location/Monitoring location	:	Thanh Hoa Province Sustainable Aquaculture Development Project - Sub-project 6: Upgrading Aquaculture Infrastructure_Hoang Luu Commune, Hoang Hoa District, Thanh Hoa Province	
Sample type/Type	:	Soil samples	Number of samples: 01
Observation date/Monitoring date	:	October 24, 2024	
Date of result return/Results date	:	November 9, 2024	

Soil sample analysis results					
No	Parameter	Unit	Result	Test method	Standards
			MD		
1	Total phosphorus *	mg/kg	487	TCVN 6499:1999	-
2	Total nitrogen*	mg/kg	780	TCVN 6498: 2009	-
3	Total Chromium (Cr) *	mg/kg	<0.02	US EPA Method 3050B + US EPA Method 7010	200
4	Cadmium (Cd) *	mg/kg	<0.02	US EPA Method 3050B + US EPA Method 7010	10
5	Copper (Cu) *	mg/kg	<1	US EPA Method 3050B + US EPA Method 7000B	500
6	Lead (Pb) *	mg/kg	<0.02	US EPA Method 3050B + US EPA Method 7010	400
7	Zinc (Zn) *	mg/kg	<2	US EPA Method 3050B + US EPA Method 7000B	600
8	Arsenic (As) *	mg/kg	<0.8	US EPA Method 3050B + US EPA Method 7010	50

Note:

- Sampling location:

+ MD1: Soil sample in the project implementation area. Coordinates: X= 2191793; Y= 592273.- Comparison standards: + QCVN 03:2023/BTNMT: National technical regulations on soil quality (Type 2);
+ (-): Not specified.

Number:
24.1162/KGZ/2024/Q4/469

TEST RESULTS SHEET

Customer name/Custom name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location/Monitoring location	:	Thanh Hoa Province Sustainable Aquaculture Development Project - Sub-project 6: Upgrading Aquaculture Infrastructure_Hoang Luu Commune, Hoang Hoa District, Thanh Hoa Province	
Sample type/Type	:	Sediment samples	Number of samples: 01
Observation date/Monitoring date	:	October 30, 2024	
Date of result return/Results date	:	November 9, 2024	

Sediment sample analysis results						
<i>No</i>	Parameter	<i>Unit</i>	Result	Test method	Standards	
			TT		(1)	(2)
1	Arsenic (As) *	mg/kg	<0.13	US EPA Method 3050B+ US EPA Method 7062	17	41.6
2	Cadmium (Cd) *	mg/kg	0.47	US EPA Method 3050B+ US EPA Method 7010	3.5	4.2
3	Lead (Pb) *	mg/kg	5.51	US EPA Method 3050B+ US EPA Method 7010	91.3	112
4	Zinc (Zn) *	mg/kg	22.4	US EPA Method 3050B+ US EPA Method 7000B	315	271
5	Mercury (Hg) *	mg/kg	<0.015	TCVN 6649:2000 + TCVN 8882:2011	0.5	0.7
6	Copper (Cu) *	mg/kg	6.82	US EPA Method 3050B+ US EPA Method 7000B	197	108
7	Total N *	mg/kg	152.9	TCVN 6498:1999	-	-
8	Total phosphorus (P) *	mg/kg	235.7	TCVN 8940:2011	-	-
9	pH (H2O) *	-	5.1	TCVN 4402:1987	-	-
10	pH (KCl) *	-	5.8	TCVN 4401:1987	-	-

Note:

- Sampling location:

+ TT: Sediment samples at the project construction area, coordinates: VD=19.81852; KD=105.88270

- Comparison standards:

+ QCVN 43:2017/BTNMT: National Technical Regulation on Sediment Quality

+ (1): Freshwater sediments

+ (2): Saltwater and brackish water sediments

+ (-): Not specified.

Subproject 7: Environmental Monitoring Results

TEST RESULTS SHEET

Number:
24.1163/KGZ/2024/Q4/470

Customer name/Custom name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location/Monitoring location	:	Thanh Hoa Province Sustainable Aquaculture Development Project - Sub-project 7: Upgrading Aquaculture Infrastructure - Hoang Chau Commune, Hoang Hoa District, Thanh Hoa Province	
Sample type/Type	:	Wastewater	Number of samples:01
Sample code/Sample encryption	:	MNT/2410.24/08	
Observation date/Monitoring date	:	October 24, 2024	
Date of result return/Results date	:	November 9, 2024	

Water sample analysis results					
No	Parameter	Unit	Result	Test method	Standards
			NT		
1.	pH	-	7.04	TCVN 6492:2011	5.5-9
2.	TDS	mg/L	380	KGZ.SOP.QT.N.07	-
3.	Total suspended solids (TSS)*	mg/L	85	TCVN 6625:2000	100
4.	BOD5*	mg/L	16	TCVN 6001-1:2008	50
5.	COD*	mg/L	36	SMEWW 5220C:2017	150
6.	Ammonium (NH4+ as N)*	mg/L	<0.01	TCVN 6179-1:1996	10
7.	Chloride (Cl-)*	mg/L	75.3	TCVN 6194:1996	1,000
8.	Nitrite (NO2- as N)*	mg/L	0.033	TCVN 6178:1996	-
9.	Nitrate (NO3-(calculated in N))*	mg/L	0.035	SMEWW 4500.NO3.E:2017	-
10.	Phosphate (PO43- as P)*	mg/L	0.06	TCVN 6202:2008	-
11.	Iron (Fe)*	mg/L	1.18	TCVN 6177:1996	5
12.	Total mineral oils and fats*	mg/L	<0.3	SMEWW 5520.B&F:2017	10

Water sample analysis results					
No	Parameter	Unit	Result	Test method	Standards
			NT		
13.	Coliform*	MPN /100mL	2,400	SMEWW 9221B:2017	5,000

Note/Remark:

- Sampling location:

+ NT: Wastewater samples at the project construction area Coordinates: X=2188305; Y=593192

- Comparison standards:

+ QCVN 40:2011/BTNMT: National technical regulation on industrial wastewater (Column B).

+ (-): Not specified.

Number:
24.1163/KGZ/2024/Q4/471

TEST RESULTS SHEET

Customer name/Custom name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location/Monitoring location	:	Thanh Hoa Province Sustainable Aquaculture Development Project - Sub-project 7: Upgrading Aquaculture Infrastructure - Hoang Chau Commune, Hoang Hoa District, Thanh Hoa Province	
Sample type/Type	:	Groundwater	Number of samples:01
Sample code/Sample encryption	:	MNN/2410.24/02	
Observation date/Monitoring date	:	October 24, 2024	
Date of result return/Results date	:	November 9, 2024	

Water sample analysis results					
No	Parameter	Unit	Result	Test method	Standards
			NN		
1.	pH	-	6.53	TCVN 6492:2011	5.5-8.5
2.	Total Dissolved Solids (TDS)	mg/L	79	KGZ.SOP.QT.N.07	1,500
3.	Hardness*	mg/L	300	TCVN 6224:1996	500
4.	Ammonium (NH ₄ ⁺ as N) *	mg/L	<0.01	TCVN 6179-1:1996	1
5.	Chloride (Cl ⁻)*	mg/L	113.1	TCVN 6194:1996	250
6.	Sulfate (SO ₄ ²⁻)*	mg/L	<2	SMEWW 4500-SO ₄ ²⁻ .E:2017	400
7.	Nitrite (NO ₂ ⁻ as N) *	mg/L	<0.003	TCVN 6178:1996	1
8.	Nitrate (NO ₃ ⁻ as N) *	mg/L	<0.02	SMEWW 4500.NO ₃ .B:2017	15
9.	Iron (Fe) *	mg/L	0.02	TCVN 6177:1996	5
10.	Arsenic (As)*	mg/L	<0.0005	SMEWW 3113B:2017	0.05

Note/Remark:

- Sampling location:

+ NN: Well water sample in the project implementation area. Coordinates: X=2187987; Y=592648

- Comparison standards:

+ QCVN 09:2023/BTNMT: National technical regulation on groundwater quality

+ (-): Not specified.

+ KPH: Not detected. Sample analysis results are lower than the MDL detection limit of the method;

Number:
24.1163/KGZ/2024/Q4/472

TEST RESULTS SHEET

Customer name/Custom name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location/Monitoring location	:	Thanh Hoa Province Sustainable Aquaculture Development Project - Sub-project 7: Upgrading Aquaculture Infrastructure - Hoang Chau Commune, Hoang Hoa District, Thanh Hoa Province	
Sample type/Type	:	Surface water	Number of samples: 02
Sample code/Sample encryption	:	MNM/2410.24/03-04	
Observation date/Monitoring date	:	October 24, 2024	
Date of result return/Results date	:	November 9, 2024	

Water sample analysis results						
No	Parameter	Unit	Result		Test method	Standards
			NM1	NM2		
1.	pH	-	6.83	6.86	TCVN 6492:2011	6 ÷ 8.5 ⁽²⁾
2.	Turbidity	NTU	31	20	SMEWW 2130B:2017	-
3.	Salinity	%	0.01	0.07	SMEWW 2520B:2017	-
4.	Total Dissolved Solids (TDS)	mg/L	260	265	KGZ.SOP.QT.N.07	-
5.	Total suspended solids (TSS)*	mg/L	52	42	TCVN 6625:2000	≤ 100 ⁽²⁾
6.	BOD5*	mg/L	4	6	TCVN 6001-1:2008	≤ 6 ⁽²⁾
7.	COD*	mg/L	10	14	SMEWW 5220C:2017	≤ 15 ⁽²⁾
8.	Ammonium (NH4+ as N) *	mg/L	<0.01	0.015	TCVN 6179-1:1996	0.3(1)
9.	Chloride (Cl-)*	mg/L	44.0	149.1	TCVN 6194:1996	250(1)
10.	Nitrite (NO2- as N) *	mg/L	0.015	0.021	TCVN 6178:1996	0.05(1)
11.	Nitrate (NO3- as N) *	mg/L	0.291	0.216	TCVN 6180:1996	-
12.	Phosphate (PO43- as P) *	mg/L	0.02	0.03	TCVN 6202:2008	-
13.	Total N*	mg/L	<2	<2	TCVN 6638:2000	≤ 1.5 ⁽²⁾
14.	Iron (Fe) *	mg/L	1.05	<0.02	TCVN 6177:1996	0.5(1)

Water sample analysis results						
No	Parameter	Unit	Result		Test method	Standards
			NM1	NM2		
15.	Total oil and grease*	mg/L	<0.3	<0.3	SMEWW 5520.B:2017	5.0(1)
16.	Coliform*	MPN/ 100mL	400	340	SMEWW 9221B:2017	≤ 5,000 ⁽²⁾

Note/Remark:

- Sampling location:

+ NM1: NEstimated surface area at high tideCoordinates: X=2187992; Y=592658

+ NM2: NEstimated surface area at low tideCoordinates: X=2188000; Y=592657

- Comparison standards:

+ QCVN 08:2023/BTNMT: National technical regulation on surface water quality;

+ Level B – Table 2: Limit values of parameters in surface water for classifying the water quality of rivers, streams, canals, ditches, streams, and protecting aquatic habitats

+ KPH: Not detected. Sample analysis results are lower than the MDL detection limit of the method;

+ (-): Not specified.

Number:
24.1163/KGZ/2024/Q4/473

TEST RESULTS SHEET

Customer name/Custom name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location/Monitoring location	:	Thanh Hoa Province Sustainable Aquaculture Development Project - Sub-project 7: Upgrading Aquaculture Infrastructure - Hoang Chau Commune, Hoang Hoa District, Thanh Hoa Province	
Sample type/Type	:	Air	Number of samples:01
Observation date/Monitoring date	:	October 24, 2024	
Date of result return/Results date	:	November 9, 2024	

Air sample analysis results					
No	Parameter	Unit	Result	Test method	Standards
			K1		
1	Temperature *	°C	30.1	QCVN 46:2012/BTNMT	-
2	Humidity*	%	64.4	QCVN 46:2012/BTNMT	-
3	Wind speed*	m/s	1.3	QCVN 46:2012/BTNMT	-
4	Noise LAeq*	dB(A)	60.4	TCVN 7878-2:2018	70(1)
5	Total suspended particulate matter (TSP) *	µg/m3	199	TCVN 5067:1995	300
6	SO2*	µg/m3	67.8	TCVN 5971:1995	350
7	NO2*	µg/m3	98	TCVN 6137:2009	200
8	CO*	µg/m3	6,320	SOP.PT.KXQ.03	30,000
9	H2S*	µg/m3	<3	MASA 701	42

Note:

- Sampling location:

+ KK1: Air in the construction area. Coordinates: X= 2188289; Y= 592434.- Comparison standards:+ QCVN 05:2023/BTNMT: National technical regulations on air quality (1-hour average);+ (1): QCVN 26:2010/BTNMT: National technical regulations on noise;+ (-): Not specified.

Number:
24.1163/KGZ/2024/Q4/474

TEST RESULTS SHEET

Customer name/Custom name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location/Monitoring location	:	Thanh Hoa Province Sustainable Aquaculture Development Project - Sub-project 7: Upgrading Aquaculture Infrastructure - Hoang Chau Commune, Hoang Hoa District, Thanh Hoa Province	
Sample type/Type	:	Soil samples	Number of samples: 01
Observation date/Monitoring date	:	October 24, 2024	
Date of result return/Results date	:	November 9, 2024	

Soil sample analysis results					
No	Parameter	Unit	Result	Test method	Standards
			MD		
1	Total phosphorus *	mg/kg	492	TCVN 6499:1999	-
2	Total nitrogen*	mg/kg	730	TCVN 6498: 2009	-
3	Total Chromium (Cr) *	mg/kg	<0.02	US EPA Method 3050B + US EPA Method 7010	200
4	Cadmium (Cd) *	mg/kg	<0.02	US EPA Method 3050B + US EPA Method 7010	10
5	Copper (Cu) *	mg/kg	<1	US EPA Method 3050B + US EPA Method 7000B	500
6	Lead (Pb) *	mg/kg	<0.02	US EPA Method 3050B + US EPA Method 7010	400
7	Zinc (Zn) *	mg/kg	<2	US EPA Method 3050B + US EPA Method 7000B	600
8	Arsenic (As) *	mg/kg	<0.8	US EPA Method 3050B + US EPA Method 7010	50

Note:

- Sampling location:

+ MD1: Soil sample in the project implementation area. Coordinates: X= 2188099; Y= 592459.- Comparison standards: + QCVN 03:2023/BTNMT: National technical regulations on soil quality (Type 2); + (-): Not specified.

Number:
24.1163/KGZ/2024/Q4/475

TEST RESULTS SHEET

Customer name/Custom name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location/Monitoring location	:	Thanh Hoa Province Sustainable Aquaculture Development Project - Sub-project 7: Upgrading Aquaculture Infrastructure - Hoang Chau Commune, Hoang Hoa District, Thanh Hoa Province	
Sample type/Type	:	Sediment samples	Number of samples: 01
Observation date/Monitoring date	:	October 30, 2024	
Date of result return/Results date	:	November 9, 2024	

Sediment sample analysis results						
No	Parameter	Unit	Result	Test method	Standards	
			TT		(1)	(2)
1	Arsenic (As) *	mg/kg	<0.13	US EPA Method 3050B+ US EPA Method 7062	17	41.6
2	Cadmium (Cd) *	mg/kg	0.65	US EPA Method 3050B+ US EPA Method 7010	3.5	4.2
3	Lead (Pb) *	mg/kg	5.29	US EPA Method 3050B+ US EPA Method 7010	91.3	112
4	Zinc (Zn) *	mg/kg	20.6	US EPA Method 3050B+ US EPA Method 7000B	315	271
5	Mercury (Hg) *	mg/kg	<0.015	TCVN 6649:2000 + TCVN 8882:2011	0.5	0.7
6	Copper (Cu) *	mg/kg	7.12	US EPA Method 3050B+ US EPA Method 7000B	197	108
7	Total N *	mg/kg	133.9	TCVN 6498:1999	-	-
8	Total phosphorus (P) *	mg/kg	238.4	TCVN 8940:2011	-	-
9	pH (H2O) *	-	5.4	TCVN 4402:1987	-	-
10	pH (KCl) *	-	5.8	TCVN 4401:1987	-	-

Note:

- Sampling location:

+ TT: Sediment samples at the project construction area, coordinates: VD=19.78870; KD=105.88956

- Comparison standards:

+ QCVN 43:2017/BTNMT: National Technical Regulation on Sediment Quality

+ (1): Freshwater sediments

+ (2): Saltwater and brackish water sediments

+ (-): Not specified.

Subproject 8: Environmental Monitoring Results

TEST RESULTS SHEET

Number:
24.1164/KGZ/2024/Q4/480

Customer name/Custom name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location/Monitoring location	:	Thanh Hoa Province Sustainable Aquaculture Development Project - Sub-project 8: Upgrading infrastructure of aquaculture areas_ Da Loc Commune, Hau Loc District, Thanh Hoa Province	
Sample type/Type	:	Wastewater	Number of samples: 01
Sample code/Sample encryption	:	MNT/2410.24/09	
Observation date/Monitoring date	:	October 24, 2024	
Date of result return/Results date	:	November 9, 2024	

Water sample analysis results					
No	Parameter	Unit	Result	Test method	Standards
			NT		
1.	pH	-	7.02	TCVN 6492:2011	5.5-9
2.	TDS	mg/L	379	KGZ.SOP.QT.N.07	-
3.	Total suspended solids (TSS)*	mg/L	75	TCVN 6625:2000	100
4.	BOD5*	mg/L	10	TCVN 6001-1:2008	50
5.	COD*	mg/L	24	SMEWW 5220C:2017	150
6.	Ammonium (NH4+ as N)*	mg/L	0.61	TCVN 6179-1:1996	10
7.	Chloride (Cl-)*	mg/L	41.18	TCVN 6194:1996	1,000
8.	Nitrite (NO2- as N)*	mg/L	0.028	TCVN 6178:1996	-
9.	Nitrate (NO3-(calculated in N)*	mg/L	0.098	SMEWW 4500.NO3.E:2017	-
10.	Phosphate (PO43- as P)*	mg/L	0.12	TCVN 6202:2008	-
11.	Iron (Fe)*	mg/L	0.13	TCVN 6177:1996	5
12.	Total mineral oils and fats*	mg/L	<0.3	SMEWW 5520.B&F:2017	10

Water sample analysis results					
No	Parameter	Unit	Result	Test method	Standards
			NT		
13.	Coliform*	MPN /100mL	240	SMEWW 9221B:2017	5,000

Note/Remark:

- Sampling location:

+ NT: Wastewater samples at the project construction area Coordinates: X=2207618; Y=603751

- Comparison standards:

+ QCVN 40:2011/BTNMT: National technical regulation on industrial wastewater (Column B).

+ (-): Not specified.

Number:
24.1164/KGZ/2024/Q4/481

TEST RESULTS SHEET

Customer name/Custom name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location/Monitoring location	:	Thanh Hoa Province Sustainable Aquaculture Development Project - Sub-project 8: Upgrading infrastructure of aquaculture areas_ Da Loc Commune, Hau Loc District, Thanh Hoa Province	
Sample type/Type	:	Groundwater	Number of samples:01
Sample code/Sample encryption	:	MNN/2410.24/03	
Observation date/Monitoring date	:	October 24, 2024	
Date of result return/Results date	:	November 9, 2024	

Water sample analysis results					
No	Parameter	Unit	Result	Test method	Standards
			NN		
1.	pH	-	6.52	TCVN 6492:2011	5.5-8.5
2.	Total Dissolved Solids (TDS)	mg/L	80	KGZ.SOP.QT.N.07	1,500
3.	Hardness*	mg/L	36	TCVN 6224:1996	500
4.	Ammonium (NH ₄ ⁺ as N) *	mg/L	<0.01	TCVN 6179-1:1996	1
5.	Chloride (Cl ⁻)*	mg/L	12.78	TCVN 6194:1996	250
6.	Sulfate (SO ₄ ²⁻)*	mg/L	<2	SMEWW 4500-SO ₄ ²⁻ .E:2017	400
7.	Nitrite (NO ₂ ⁻ as N) *	mg/L	<0.003	TCVN 6178:1996	1
8.	Nitrate (NO ₃ ⁻ as N) *	mg/L	0.046	SMEWW 4500.NO ₃ .B:2017	15
9.	Iron (Fe) *	mg/L	<0.02	TCVN 6177:1996	5
10.	Arsenic (As)*	mg/L	<0.0005	SMEWW 3113B:2017	0.05

Note/Remark:

- Sampling location:

+ NN: Well water sample in the project implementation area. Coordinates: X=2207733; Y=603694

- Comparison standards:

+ QCVN 09:2023/BTNMT: National technical regulation on groundwater quality

+ (-): Not specified.

+ KPH: Not detected. Sample analysis results are lower than the MDL detection limit of the method;

Number:
24.1164/KGZ/2024/Q4/482

TEST RESULTS SHEET

Customer name/Custom name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location/Monitoring location	:	Thanh Hoa Province Sustainable Aquaculture Development Project - Sub-project 8: Upgrading infrastructure of aquaculture areas_ Da Loc Commune, Hau Loc District, Thanh Hoa Province	
Sample type/Type	:	Surface water	Number of samples: 02
Sample code/Sample encryption	:	MNM/2410.24/05-06	
Observation date/Monitoring date	:	October 24, 2024	
Date of result return/Results date	:	November 9, 2024	

Water sample analysis results						
No	Parameter	Unit	Result		Test method	Standards
			NM1	NM2		
1.	pH	-	6.85	6.88	TCVN 6492:2011	6 ÷ 8.5 ⁽²⁾
2.	Turbidity	NTU	31	16	SMEWW 2130B:2017	-
3.	Salinity	%	0.02	0.08	SMEWW 2520B:2017	-
4.	Total Dissolved Solids (TDS)	mg/L	276	270	KGZ.SOP.QT.N.07	-
5.	Total suspended solids (TSS)*	mg/L	58	62	TCVN 6625:2000	≤ 100 ⁽²⁾
6.	BOD5*	mg/L	4	4	TCVN 6001-1:2008	≤ 6 ⁽²⁾
7.	COD*	mg/L	12	10	SMEWW 5220C:2017	≤ 15 ⁽²⁾
8.	Ammonium (NH4+ as N) *	mg/L	<0.01	<0.01	TCVN 6179-1:1996	0.3(1)
9.	Chloride (Cl-)*	mg/L	36.92	39.76	TCVN 6194:1996	250(1)
10.	Nitrite (NO2- as N) *	mg/L	<0.003	<0.003	TCVN 6178:1996	0.05(1)
11.	Nitrate (NO3- as N) *	mg/L	0.425	0.317	TCVN 6180:1996	-
12.	Phosphate (PO43- as P) *	mg/L	0.17	0.15	TCVN 6202:2008	-
13.	Total N*	mg/L	<2	<2	TCVN 6638:2000	≤ 1.5 ⁽²⁾
14.	Iron (Fe) *	mg/L	0.07	0.05	TCVN 6177:1996	0.5(1)

Water sample analysis results						
No	Parameter	Unit	Result		Test method	Standards
			NM1	NM2		
15.	Total oil and grease*	mg/L	<0.3	<0.3	SMEWW 5520.B:2017	5.0(1)
16.	Coliform*	MPN/ 100mL	170	130	SMEWW 9221B:2017	≤ 5,000 ⁽²⁾

Note/Remark:

- Sampling location:

+ NM1: NEstimated surface area at high tideCoordinates: X=2207651 Y=603766

+ NM2: NEstimated surface area at low tideCoordinates: X=2207643; Y=603757

- Comparison standards:

+ QCVN 08:2023/BTNMT: National technical regulation on surface water quality;

+ Level B – Table 2: Limit values of parameters in surface water for classifying the water quality of rivers, streams, canals, ditches, streams, and protecting aquatic habitats

+ KPH: Not detected. Sample analysis results are lower than the MDL detection limit of the method;

+ (-): Not specified.

Number:
24.1164/KGZ/2024/Q4/483

TEST RESULTS SHEET

Customer name/Custom name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location/Monitoring location	:	Thanh Hoa Province Sustainable Aquaculture Development Project - Sub-project 8: Upgrading infrastructure of aquaculture areas_ Da Loc Commune, Hau Loc District, Thanh Hoa Province	
Sample type/Type	:	Air	Number of samples: 01
Observation date/Monitoring date	:	October 24, 2024	
Date of result return/Results date	:	November 9, 2024	

Air sample analysis results					
No	Parameter	Unit	Result	Test method	Standards
			K1		
1	Temperature *	°C	29	QCVN 46:2012/BTNMT	-
2	Humidity*	%	67.5	QCVN 46:2012/BTNMT	-
3	Wind speed*	m/s	0.9	QCVN 46:2012/BTNMT	-
4	Noise LAeq*	dBA	60.7	TCVN 7878-2:2018	70(1)
5	Total suspended particulate matter (TSP) *	µg/m3	215	TCVN 5067:1995	300
6	SO2*	µg/m3	66.7	TCVN 5971:1995	350
7	NO2*	µg/m3	78	TCVN 6137:2009	200
8	CO*	µg/m3	5,540	SOP.PT.KXQ.03	30,000
9	H2S*	µg/m3	<3	MASA 701	42

Note:

- Sampling location:

+ KK1: Air in the construction area. Coordinates: X=2207750; Y= 603568.- Comparison standards:+ QCVN 05:2023/BTNMT: National technical regulations on air quality (1-hour average);+ (1): QCVN 26:2010/BTNMT: National technical regulations on noise;+ (-): Not specified.

Number:
24.1164/KGZ/2024/Q4/484

TEST RESULTS SHEET

Customer name/Custom name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location/Monitoring location	:	Thanh Hoa Province Sustainable Aquaculture Development Project - Sub-project 8: Upgrading infrastructure of aquaculture areas_ Da Loc Commune, Hau Loc District, Thanh Hoa Province	
Sample type/Type	:	Soil samples	Number of samples: 01
Observation date/Monitoring date	:	October 24, 2024	
Date of result return/Results date	:	November 9, 2024	

Soil sample analysis results					
<i>No</i>	Parameter	<i>Unit</i>	Result	Test method	Standards
			MD		
1	Total phosphorus *	mg/kg	581	TCVN 6499:1999	-
2	Total nitrogen*	mg/kg	700	TCVN 6498: 2009	-
3	Total Chromium (Cr) *	mg/kg	0.0275	US EPA Method 3050B + US EPA Method 7010	200
4	Cadmium (Cd) *	mg/kg	0.037	US EPA Method 3050B + US EPA Method 7010	10
5	Copper (Cu) *	mg/kg	<1	US EPA Method 3050B + US EPA Method 7000B	500
6	Lead (Pb) *	mg/kg	0.0365	US EPA Method 3050B + US EPA Method 7010	400
7	Zinc (Zn) *	mg/kg	<2	US EPA Method 3050B + US EPA Method 7000B	600
8	Arsenic (As) *	mg/kg	<0.8	US EPA Method 3050B + US EPA Method 7010	50

Note:

- Sampling location:

+ MD1: Soil sample in the project implementation area. Coordinates: X= 2207730; Y= 603543.- Comparison standards: + QCVN 03:2023/BTNMT: National technical regulations on soil quality (Type 2);
+ (-): Not specified.

Number:
24.1164/KGZ/2024/Q4/485

TEST RESULTS SHEET

Customer name/Custom name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location/Monitoring location	:	Thanh Hoa Province Sustainable Aquaculture Development Project - Sub-project 8: Upgrading infrastructure of aquaculture areas_ Da Loc Commune, Hau Loc District, Thanh Hoa Province	
Sample type/Type	:	Sediment samples	Number of samples: 01
Observation date/Monitoring date	:	October 30, 2024	
Date of result return/Results date	:	November 9, 2024	

Sediment sample analysis results						
No	Parameter	Unit	Result	Test method	Standards	
			TT		(1)	(2)
1	Arsenic (As) *	mg/kg	<0.13	US EPA Method 3050B+ US EPA Method 7062	17	41.6
2	Cadmium (Cd) *	mg/kg	0.47	US EPA Method 3050B+ US EPA Method 7010	3.5	4.2
3	Lead (Pb) *	mg/kg	4.53	US EPA Method 3050B+ US EPA Method 7010	91.3	112
4	Zinc (Zn) *	mg/kg	19.2	US EPA Method 3050B+ US EPA Method 7000B	315	271
5	Mercury (Hg) *	mg/kg	<0.015	TCVN 6649:2000 + TCVN 8882:2011	0.5	0.7
6	Copper (Cu) *	mg/kg	6.03	US EPA Method 3050B+ US EPA Method 7000B	197	108
7	Total N *	mg/kg	103.6	TCVN 6498:1999	-	-
8	Total phosphorus (P) *	mg/kg	247.4	TCVN 8940:2011	-	-
9	pH (H2O) *	-	5.2	TCVN 4402:1987	-	-
10	pH (KCl) *	-	5.8	TCVN 4401:1987	-	-

Note:

- Sampling location:

+ TT: Sediment samples at the project construction area, coordinates: VD=19.88974; KD=105.93919

- Comparison standards:

+ QCVN 43:2017/BTNMT: National Technical Regulation on Sediment Quality

+ (1): Freshwater sediments

+ (2): Saltwater and brackish water sediments

+ (-): Not specified.

Subproject 9: Environmental Monitoring Results

TEST RESULTS SHEET

Number:
24.1169/KGZ/2024/Q4/519

Customer name/Custom name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location/Monitoring location	:	Thanh Hoa Province Sustainable Aquaculture Development Project -Sub-project 9: Upgrading infrastructure of aquaculture area_Quang Trung Commune, Quang Xuong District, Thanh Hoa Province	
Sample type/Type	:	Wastewater	Number of samples: 01
Sample code/Sample encryption	:	MNT/2410.25/04	
Observation date/Monitoring date	:	October 25, 2024	
Date of result return/Results date	:	November 9, 2024	

Water sample analysis results					
No	Parameter	Unit	Result	Test method	Standards
			NT		
1.	pH	-	7.05	TCVN 6492:2011	5.5-9
2.	TDS	mg/L	358	KGZ.SOP.QT.N.07	-
3.	Total suspended solids (TSS)*	mg/L	115	TCVN 6625:2000	100
4.	BOD5*	mg/L	28	TCVN 6001-1:2008	50
5.	COD*	mg/L	76	SMEWW 5220C:2017	150
6.	Ammonium (NH4+ as N)*	mg/L	0.41	TCVN 6179-1:1996	10
7.	Chloride (Cl-)*	mg/L	44.02	TCVN 6194:1996	1,000
8.	Nitrite (NO2- as N)*	mg/L	0.03	TCVN 6178:1996	-
9.	Nitrate (NO3-(calculated in N))*	mg/L	0.395	SMEWW 4500.NO3.E:2017	-
10.	Phosphate (PO43- as P)*	mg/L	0.06	TCVN 6202:2008	-
11.	Iron (Fe)*	mg/L	1.19	TCVN 6177:1996	5
12.	Total mineral oils and fats*	mg/L	0.3	SMEWW 5520.B&F:2017	10

Water sample analysis results					
No	Parameter	Unit	Result	Test method	Standards
			NT		
13.	Coliform*	MPN /100mL	470	SMEWW 9221B:2017	5,000

Note/Remark:

- Sampling location:

+ NT: Wastewater samples at the project construction area Coordinates: X=2168440; Y=581005

- Comparison standards:

+ QCVN 40:2011/BTNMT: National technical regulation on industrial wastewater (Column B).

+ (-): Not specified.

Number:
24.1169/KGZ/2024/Q4/520

TEST RESULTS SHEET

Customer name/Custom name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location/Monitoring location	:	Thanh Hoa Province Sustainable Aquaculture Development Project -Sub-project 9: Upgrading infrastructure of aquaculture area_Quang Trung Commune, Quang Xuong District, Thanh Hoa Province	
Sample type/Type	:	Groundwater	Number of samples:01
Sample code/Sample encryption	:	MNN/2410.25/04	
Observation date/Monitoring date	:	October 25, 2024	
Date of result return/Results date	:	November 9, 2024	

Water sample analysis results					
No	Parameter	Unit	Result	Test method	Standards
			NN		
1.	pH	-	6.57	TCVN 6492:2011	5.5-8.5
2.	Total Dissolved Solids (TDS)	mg/L	76	KGZ.SOP.QT.N.07	1,500
3.	Hardness*	mg/L	34	TCVN 6224:1996	500
4.	Ammonium (NH ₄ ⁺ as N) *	mg/L	0.064	TCVN 6179-1:1996	1
5.	Chloride (Cl ⁻)*	mg/L	11.36	TCVN 6194:1996	250
6.	Sulfate (SO ₄ ²⁻)*	mg/L	<2	SMEWW 4500-SO ₄ ²⁻ .E:2017	400
7.	Nitrite (NO ₂ ⁻ as N) *	mg/L	<0.003	TCVN 6178:1996	1
8.	Nitrate (NO ₃ ⁻ as N) *	mg/L	0.092	SMEWW 4500.NO ₃ .B:2017	15
9.	Iron (Fe) *	mg/L	<0.02	TCVN 6177:1996	5
10.	Arsenic (As)*	mg/L	0.0005	SMEWW 3113B:2017	0.05

Note/Remark:

- Sampling location:

+ NN: Well water sample in the project implementation area. Coordinates: X=2168439; Y=581006

- Comparison standards:

+ QCVN 09:2023/BTNMT: National technical regulation on groundwater quality

+ (-): Not specified.

+ KPH: Not detected. Sample analysis results are lower than the MDL detection limit of the method;

Number:
24.1169/KGZ/2024/Q4/521

TEST RESULTS SHEET

Customer name/Custom name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location/Monitoring location	:	Thanh Hoa Province Sustainable Aquaculture Development Project -Sub-project 9: Upgrading infrastructure of aquaculture area_Quang Trung Commune, Quang Xuong District, Thanh Hoa Province	
Sample type/Type	:	Surface water	Number of samples: 02
Sample code/Sample encryption	:	MNM/2410.25/07-08	
Observation date/Monitoring date	:	October 25, 2024	
Date of result return/Results date	:	November 9, 2024	

Water sample analysis results						
No	Parameter	Unit	Result		Test method	Standards
			NM1	NM2		
1.	pH	-	6.83	6.85	TCVN 6492:2011	6 ÷ 8.5 ⁽²⁾
2.	Turbidity	NTU	37	24	SMEWW 2130B:2017	-
3.	Salinity	%	0.03	0.09	SMEWW 2520B:2017	-
4.	Total Dissolved Solids (TDS)	mg/L	263	271	KGZ.SOP.QT.N.07	-
5.	Total suspended solids (TSS)*	mg/L	60	58	TCVN 6625:2000	≤ 100 ⁽²⁾
6.	BOD5*	mg/L	4	4	TCVN 6001-1:2008	≤ 6 ⁽²⁾
7.	COD*	mg/L	10	12	SMEWW 5220C:2017	≤ 15 ⁽²⁾
8.	Ammonium (NH4+ as N) *	mg/L	0.09	0.041	TCVN 6179-1:1996	0.3(1)
9.	Chloride (Cl-)*	mg/L	213	220.1	TCVN 6194:1996	250(1)
10.	Nitrite (NO2- as N) *	mg/L	<0.003	<0.003	TCVN 6178:1996	0.05(1)
11.	Nitrate (NO3- as N) *	mg/L	0.054	0.11	TCVN 6180:1996	-
12.	Phosphate (PO43- as P) *	mg/L	0.02	<0.02	TCVN 6202:2008	-
13.	Total N*	mg/L	<2	<2	TCVN 6638:2000	≤ 1.5 ⁽²⁾
14.	Iron (Fe) *	mg/L	<0.02	0.21	TCVN 6177:1996	0.5(1)

Water sample analysis results						
No	Parameter	Unit	Result		Test method	Standards
			NM1	NM2		
15.	Total oil and grease*	mg/L	<0.3	<0.3	SMEWW 5520.B:2017	5.0(1)
16.	Coliform*	MPN/ 100mL	210	110	SMEWW 9221B:2017	≤ 5,000 ⁽²⁾

Note/Remark:

- Sampling location:

+ NM1: NEstimated surface area at high tideCoordinates: X=2168384; Y=581007

+ NM2: NEstimated surface area at low tideCoordinates: X=2168492; Y=580960

- Comparison standards:

+ QCVN 08:2023/BTNMT: National technical regulation on surface water quality;

+ Level B – Table 2: Limit values of parameters in surface water for classifying the water quality of rivers, streams, canals, ditches, streams, and protecting aquatic habitats

+ KPH: Not detected. Sample analysis results are lower than the MDL detection limit of the method;

+ (-): Not specified.

Number:
24.1169/KGZ/2024/Q4/522

TEST RESULTS SHEET

Customer name/Custom name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location/Monitoring location	:	Thanh Hoa Province Sustainable Aquaculture Development Project -Sub-project 9: Upgrading infrastructure of aquaculture area_Quang Trung Commune, Quang Xuong District, Thanh Hoa Province	
Sample type/Type	:	Air	Number of samples:01
Observation date/Monitoring date	:	October 25, 2024	
Date of result return/Results date	:	November 9, 2024	

Air sample analysis results					
No	Parameter	Unit	Result	Test method	Standards
			K1		
1	Temperature *	°C	30.6	QCVN 46:2012/BTNMT	-
2	Humidity*	%	66	QCVN 46:2012/BTNMT	-
3	Wind speed*	m/s	1.2	QCVN 46:2012/BTNMT	-
4	Noise LAeq*	dBA	61.7	TCVN 7878-2:2018	70(1)
5	Total suspended particulate matter (TSP) *	µg/m3	211	TCVN 5067:1995	300
6	SO2*	µg/m3	64.1	TCVN 5971:1995	350
7	NO2*	µg/m3	62	TCVN 6137:2009	200
8	CO*	µg/m3	8,350	SOP.PT.KXQ.03	30,000
9	H2S*	µg/m3	<3	MASA 701	42

Note:

- Sampling location:

+ K1: Air in the construction area. Coordinates: X=2168582; Y=580829.- Comparison standards:+ QCVN 05:2023/BTNMT: National technical regulations on air quality (1-hour average);+ (1): QCVN 26:2010/BTNMT: National technical regulations on noise;+ (-): Not specified.

Number:
24.1169/KGZ/2024/Q4/523

TEST RESULTS SHEET

Customer name/ <i>Custom name</i>	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location/ <i>Monitoring location</i>	:	Thanh Hoa Province Sustainable Aquaculture Development Project -Sub-project 9: Upgrading infrastructure of aquaculture area_Quang Trung Commune, Quang Xuong District, Thanh Hoa Province	
Sample type/ <i>Type</i>	:	Soil samples	Number of samples:01
Observation date/ <i>Monitoring date</i>	:	October 25, 2024	
Date of result return/ <i>Results date</i>	:	November 9, 2024	

Soil sample analysis results					
No	Parameter	Unit	Result	Test method	Standards
			MD		
1	Total phosphorus *	mg/kg	438	TCVN 6499:1999	-
2	Total nitrogen*	mg/kg	710	TCVN 6498: 2009	-
3	Total Chromium (Cr) *	mg/kg	0.15	US EPA Method 3050B + US EPA Method 7010	200
4	Cadmium (Cd) *	mg/kg	<0.02	US EPA Method 3050B + US EPA Method 7010	10
5	Copper (Cu) *	mg/kg	<1	US EPA Method 3050B + US EPA Method 7000B	500
6	Lead (Pb) *	mg/kg	<0.02	US EPA Method 3050B + US EPA Method 7010	400
7	Zinc (Zn) *	mg/kg	<2	US EPA Method 3050B + US EPA Method 7000B	600
8	Arsenic (As) *	mg/kg	<0.8	US EPA Method 3050B + US EPA Method 7010	50

Note:

- **Sampling** **location:**
+ MD: Soil sample in the project implementation area. Coordinates: X=2168589; Y=580846.- Comparison standards:+ QCVN 03:2023/BTNMT: National technical regulations on soil quality (Type 2); + (-): Not specified.

Number:
24.1169/KGZ/2024/Q4/524

TEST RESULTS SHEET

Customer name/Custom name	:	Project Management Board of Construction Investment of Agricultural and Rural Development Works in Thanh Hoa	
Monitoring location/Monitoring location	:	Thanh Hoa Province Sustainable Aquaculture Development Project -Sub-project 9: Upgrading infrastructure of aquaculture area_ Quang Trung Commune, Quang Xuong District, Thanh Hoa Province	
Sample type/Type	:	Sediment samples	Number of samples: 01
Observation date/Monitoring date	:	October 30, 2024	
Date of result return/Results date	:	November 9, 2024	

Sediment sample analysis results						
No	Parameter	Unit	Result	Test method	Standards	
			TT		(1)	(2)
1	Arsenic (As) *	mg/kg	<0.13	US EPA Method 3050B+ US EPA Method 7062	17	41.6
2	Cadmium (Cd) *	mg/kg	0.35	US EPA Method 3050B+ US EPA Method 7010	3.5	4.2
3	Lead (Pb) *	mg/kg	5.12	US EPA Method 3050B+ US EPA Method 7010	91.3	112
4	Zinc (Zn) *	mg/kg	23.7	US EPA Method 3050B+ US EPA Method 7000B	315	271
5	Mercury (Hg) *	mg/kg	<0.015	TCVN 6649:2000 + TCVN 8882:2011	0.5	0.7
6	Copper (Cu) *	mg/kg	7.21	US EPA Method 3050B+ US EPA Method 7000B	197	108
7	Total N *	mg/kg	100.8	TCVN 6498:1999	-	-
8	Total phosphorus (P) *	mg/kg	252.4	TCVN 8940:2011	-	-
9	pH (H2O) *	-	5.1	TCVN 4402:1987	-	-
10	pH (KCl) *	-	6.2	TCVN 4401:1987	-	-

Note:

- Sampling location:

+ TT: Sediment samples at the project construction area, coordinates: VD=19.60985; KD=105.77196

- Comparison standards:

+ QCVN 43:2017/BTNMT: National Technical Regulation on Sediment Quality

+ (1): Freshwater sediments

+ (2): Saltwater and brackish water sediments

+ (-): Not specified.

APPENDIX 3: MINUTES OF COMMUNITY CONSULTATION MEETING

CỘNG HÒA XÃ HỘI CHỦ NGHĨA VIỆT NAM
Độc lập - Tự do - Hạnh phúc

BIÊN BẢN

Họp tham vấn lấy ý kiến cộng đồng dân cư, cá nhân chịu tác động trực tiếp về các tác động môi trường và xã hội của dự án

Tên dự án: “Dự án phát triển thủy sản bền vững tỉnh Thanh Hóa, vốn vay WB”.

Thời gian họp: ngày..... tháng..... năm 2024

Địa chỉ nơi họp: Hội trường UBND xã Đa Lộc, huyện Hậu
Lạc, tỉnh Thanh Hóa

1. Thành phần dự họp

1.1. Đại diện Ủy ban nhân dân cấp xã nơi thực hiện dự án.

Ông (bà): Bà: Văn Thái Chức vụ: PCT UBND xã

Ông (bà): Bà: Văn Đức Chức vụ: PCT UBND TG xã

Ông (bà): Trần Thị Tuyên Chức vụ: CC địa phương NVN

1.2. Đại diện chủ dự án.

Ông (bà): Nguyễn Đăng Sơn Chức vụ: Cán bộ kỹ thuật

Ông (bà): Chức vụ:

1.3. Đơn vị tư vấn lập báo cáo đánh giá tác động môi trường xã hội.

Ông (bà): Nguyễn Thị Thuý Chức vụ: Tư vấn trưởng

Ông (bà): Lê Đức Hùng Chức vụ: Chuyên gia xã hội

Ông (bà): Nguyễn Thị Mai Hoa Chức vụ: Chuyên gia môi trường

1.4. Thành phần tham dự họp: Cộng đồng dân cư, cá nhân chịu tác động trực tiếp bởi dự án (danh sách được đính kèm theo biên bản này).

2. Nội dung tham vấn và tóm tắt kết quả tham vấn cộng đồng

2.1. Nội dung:

(i) Giới thiệu và phổ biến thông tin về dự án và trình bày tóm tắt các tác động môi trường và xã hội đến các hộ dân bị ảnh hưởng bởi “Dự án phát triển thủy sản bền vững tỉnh Thanh Hóa, vốn vay WB”.

(ii) Tham vấn ý kiến, nguyện vọng của các hộ dân liên quan đến bồi thường, hỗ trợ, tái định cư, vấn đề về giới và nhóm dễ bị tổn thương khác và tham vấn các biện pháp hỗ trợ phục hồi thu nhập cho người bị ảnh hưởng...

(iii) Tham vấn ý kiến, nguyện vọng của các hộ dân liên quan đến các tác động môi trường của dự án, các tác động tích cực và tiêu cực của dự án đến môi trường và sức khỏe cộng đồng, các biện pháp giảm thiểu tác động môi trường...



(iv) Thảo luận, trao đổi giữa cộng đồng dân cư chịu tác động trực tiếp bởi dự án, UBND cấp xã về các tác động môi trường và xã hội của "Dự án phát triển thủy sản bền vững tỉnh Thanh Hóa, vốn vay WB".

2.2 Tóm tắt kết quả tham vấn và ý kiến của những người tham dự

* Ông Bùi Văn Thái, Phó CT UBND xã

- Chính quyền và người dân đồng tình ủng hộ các chủ trương đầu tư xây dựng dự án Công trình khi hoàn thành giúp các thôn môi trường, tăng năng suất cây trồng và đàn bò nguồn nước phục vụ NTTS.

- Vì tư thiết kế dự án sát khu dân cư và khu vực ao đầm của hệ dân, khi triển khai thi công sẽ ảnh hưởng đến quá trình NTTS của các hộ dân do vậy khi triển khai thi công nhà thầu cần có các biện pháp thi công ban chốt tối đa việc đất đá, nước thải công trường xuống ao nuôi trồng thủy sản.

- Việc điều tiết nước ra vào vùng NTTS và sản xuất nông nghiệp rất quan trọng do vậy cần lưu ý, tính toán, phù hợp với địa phương, hàng việc điều tiết nước phục vụ thi công của nhà thầu.

- Khu vực thi công nằm trên vùng NTTS nên rất nhạy cảm về môi trường, chất thải xây dựng, máy móc thiết bị, dầu mỡ chảy tràn... Do người nhà thầu phải thu gom thường xuyên các chất thải và ban chốt dầu mỡ rơi vào xuống ao nuôi.

- Thi thi công sẽ gây bụi, ồn ảnh hưởng trực tiếp đến các hộ sống dọc tuyến kênh, đặc biệt là tuyến đường vào chuyên sát nạo vét lòng sông sẽ xảy ra rơi vào bụi bẩn thải xuống đường. Nhà thầu cần thường xuyên dọn dẹp các tuyến đường và phun nước dập bụi thường xuyên.

* Ông Tô Xuân Thạch - Thôn Yên Lạc

- Chúng tôi hoàn toàn ủng hộ và nhất trí cao việc đầu tư dự án. Dự án giúp địa phương phát triển bền vững vùng NTTS cũng như gia tăng giá trị sản xuất nông nghiệp.

- Khu vực tuyến kênh từ công Quỳ Có đến công

mạng không có 7 hàng N.T.T.S đã được quy hoạch, hiện nay có 7 công lũy nước, khi đi an lâm đường quản lý vào hành đi qua sẽ ảnh hưởng đến 7 công này, đề nghị dự án thiết kế hoàn trả cho người dân.

- Các loại cây trồng trên hành lang tuyến đường khi thi công bị ảnh hưởng đề nghị dự án bồi thường, trả trả cho người dân.

- Nếu thi công vào thời điểm tháng 11 đến tháng 2 vì đây là thời điểm người dân chưa thả giồng.

- Nếu trong quá trình thi công xảy ra hiện tượng vỡ nứt trong ao bị chết do nhà thầu gây ra đề nghị bồi trả cho người dân để đỡ thiệt thòi.

* Ông Vũ Xuân Trung - thôn Xín Lát

- Hiện nay khu vực N.T.T.S chưa có tuyến đường để người dân đi vào ao của mình, việc đi lại gặp nhiều khó khăn, người dân phải bắc cầu tạm để đi, do vậy dự án đầu tư làm tuyến đường quản lý vào hành lang người dân rất phấn khởi.

- Hiện nay toàn bộ bán thôn làm rất nhiều các công việc tuy nhiên chất lượng xây dựng không được tốt, đến đến các công trình mà dùng 1 thời gian đã hư hỏng. Đề nghị dự án khi đầu tư xây dựng cần giám sát chặt chẽ quá trình thi công để đảm bảo chất lượng công trình bền vững nhất.



3. Kết luận.

- Chính quyền và người dân đồng tình ủng hộ các chủ trương đầu tư xây dựng dự án
- Tích cực, phối hợp với địa phương trong việc triển khai nước phục vụ thi công của nhà thầu khi cần và thuận lợi.
- Nhà thầu phải lưu ý thường xuyên các chất thải và hạn chế đầu mả sả xả xuống ao nuôi, thi công phải đảm bảo vệ sinh môi trường khu vực công trình

3. Biên bản kết thúc cùng ngày và đã được cuộc họp nhất trí thông qua.

Xác nhận của UBND xã.....



HỌ CHỦ TỊCH
Bùi Văn Thái

Đại diện đơn vị tư vấn

[Signature]

Lê Đức Hưng

Đại diện hộ dân

Thao

Tô Xuân Thao

[Signature]

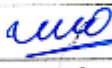
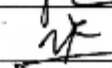
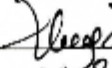
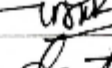
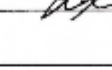
Vũ Xuân Tường

DANH SÁCH THÀNH PHẦN THAM DỰ LÀ CÁN BỘ UBND CẤP XÃ
Họp tham vấn cộng đồng dân cư, cá nhân chịu tác động trực tiếp bởi dự án
về các tác động môi trường và xã hội của dự án

Tên dự án: "Dự án phát triển thủy sản bền vững tỉnh Thanh Hóa, vốn vay WB".

Thời gian họp: ngày 13 tháng 11 năm 2024

Địa chỉ nơi họp: Hội trường UBND xã Đại Lộc, huyện Hậu Lộc

TT	Họ và tên	Chức vụ	Chữ ký	Ghi chú
1	Nguyễn Hải Nam	CT. UBND xã		
2	Bùi Văn Thái	PCT. UBND xã		
3	Đoàn Văn Hùng	CT. HĐND xã		
4	Trần Văn Trường	CC. Địa chính		
5	Trần Thị Tuyên	CC. Địa chính NN		
6	Vũ Thị Dung	PCT. Hội Phụ nữ		
7	Trần Thị Hằng	PR. Đoàn TN		
8	Bùi Văn Duẩn	PCT. MTTQ xã		
9	Trần Chí Công	CT. Hội Lũn niên		
10	Bùi Văn Vĩnh	TT. Liên Lạc		
11				
12				
13				
14				
15				

Xác nhận của địa phương



PHÓ CHỦ TỊCH

Bùi Văn Thái

DANH SÁCH THÀNH PHẦN THAM DỰ

Hợp tham vấn cộng đồng dân cư, cá nhân chịu tác động trực tiếp bởi dự án về các tác động môi trường và xã hội của dự án

Tên dự án: "Dự án phát triển thủy sản bền vững tỉnh Thanh Hóa, vốn vay WB".

Thời gian họp: ngày 13. tháng 11. năm 2024

Địa chỉ nơi họp: Hẻm 103 Ngõ 10 Xã Lạc Huyện Hàm Lạc

TT	Họ và tên	Địa chỉ	Chữ ký	Ghi chú
1	Vũ Xuân Tùng	Xã Lạc	Tùng	
2	Đặng Văn Hào	"	Hào	
3	Bùi Thị Tú	"	Tú	
4	Hai Văn Phước	"	Phước	
5	Vũ Thị Huyền	"	Huyền	
6	Bùi Thị Thiên	"	Thiên	
7	Tô Xuân Thành	"	Thành	
8	Phạm Văn Bảo	"	Bảo	
9	Nguyễn Văn Sơn	"	Sơn	
10	Vũ Hoàng Năm	Đông Tiến	Năm	
11	Tôn Thanh Cường	Xã Lạc	Cường	
12	Vũ Thị Anh	Hồng Tân	Anh	
13	Vũ Thị Quý	Xã Lạc	Quý	
14	Bùi Thị Tú	"	Tú	
15	Hoàng Văn Đức	"	Đức	
16	Phạm Văn Trung	Ninh Phú	Trung	
17	Bùi Văn Thiên	Xã Lạc	Thiên	
18	Đỗ Thị Hòa	Xã Lạc	Hòa	
19				

CỘNG HÒA XÃ HỘI CHỦ NGHĨA VIỆT NAM
Độc lập - Tự do - Hạnh phúc

BIÊN BẢN

Họp tham vấn lấy ý kiến cộng đồng dân cư, cá nhân chịu tác động trực tiếp về các tác động môi trường và xã hội của dự án

Tên dự án: “Dự án phát triển thủy sản bền vững tỉnh Thanh Hóa, vốn vay WB”.

Thời gian họp: ngày..... tháng..... năm 2024

Địa chỉ nơi họp: Hội trường UBND xã Đa Lộc, huyện Hậu Lộc, tỉnh Thanh Hóa.

1. Thành phần dự họp

1.1. Đại diện Ủy ban nhân dân cấp xã nơi thực hiện dự án.

Ông (bà): Bà. Văn Thái Chức vụ: PC.T UBND xã

Ông (bà): Bà. Văn Duân Chức vụ: PC.T UBND TT.G xã

Ông (bà): Trần Thị Tuyết Chức vụ: CC địa phương NN

1.2. Đại diện chủ dự án.

Ông (bà): Nguyễn Đông Sơn Chức vụ: Cán bộ kỹ thuật

Ông (bà): Chức vụ:

1.3. Đơn vị tư vấn lập báo cáo đánh giá tác động môi trường xã hội.

Ông (bà): Nguyễn Thị Thuý Chức vụ: Tư vấn trưởng

Ông (bà): Lê Đức Huy Chức vụ: Chuyên gia xã hội

Ông (bà): Nguyễn Thị Mai Hoa Chức vụ: Chuyên gia môi trường

1.4. Thành phần tham dự họp: Cộng đồng dân cư, cá nhân chịu tác động trực tiếp bởi dự án (danh sách được đính kèm theo biên bản này).

2. Nội dung tham vấn và tóm tắt kết quả tham vấn cộng đồng

2.1. Nội dung:

(i) Giới thiệu và phổ biến thông tin về dự án và trình bày tóm tắt các tác động môi trường và xã hội đến các hộ dân bị ảnh hưởng bởi “Dự án phát triển thủy sản bền vững tỉnh Thanh Hóa, vốn vay WB”.

(ii) Tham vấn ý kiến, nguyện vọng của các hộ dân liên quan đến bồi thường, hỗ trợ, tái định cư, vấn đề về giới và nhóm dễ bị tổn thương khác và tham vấn các biện pháp hỗ trợ phục hồi thu nhập cho người bị ảnh hưởng...

(iii) Tham vấn ý kiến, nguyện vọng của các hộ dân liên quan đến các tác động môi trường của dự án, các tác động tích cực và tiêu cực của dự án đến môi trường và sức khỏe cộng đồng, các biện pháp giảm thiểu tác động môi trường...



(iv) Thảo luận, trao đổi giữa cộng đồng dân cư chịu tác động trực tiếp bởi dự án, UBND cấp xã về các tác động môi trường và xã hội của "Dự án phát triển thủy sản bền vững tỉnh Thanh Hóa, vốn vay WB".

2.2 Tóm tắt kết quả tham vấn và ý kiến của những người tham dự

* Ông Bùi Văn Thái, Phó CT UBND xã

- Chính quyền và người dân đồng tình ủng hộ các chủ trương đầu tư xây dựng dự án Công trình khi hoàn thành giúp các thôn môi trường, tăng năng suất cây trồng và đàn bò nguồn nước phục vụ NTTS.

- Vì tư thiết kế dự án sát khu dân cư và khu vực ao đầm của hệ dân, khi triển khai thi công sẽ ảnh hưởng đến quá trình NTTS của các hộ dân do vậy khi triển khai thi công nhà thầu cần có các biện pháp thi công ban chốt tối đa việc đất đá, nước thải công trình xuống ao nuôi trồng thủy sản.

- Việc điều tiết nước ra vào vùng NTTS và sản xuất nông nghiệp rất quan trọng do vậy cần lưu ý, tính toán, phù hợp với địa phương, hàng việc điều tiết nước phục vụ thi công của nhà thầu.

- Khu vực thi công nằm trên vùng NTTS nên rất nhạy cảm về môi trường, chất thải xây dựng, máy móc thiết bị, dầu mỡ chảy tràn... Do người nhà thầu phải thu gom thường xuyên các chất thải và ban chốt dầu mỡ rơi vào xuống ao nuôi.

- Thi thi công sẽ gây bụi, ồn ảnh hưởng trực tiếp đến các hộ sống dọc tuyến kênh, đặc biệt là tuyến đường vào chuyên sát nạo vét lòng sông sẽ xảy ra rơi vào bụi bẩn thải xuống đường. Nhà thầu cần thường xuyên dọn dẹp các tuyến đường và phun nước dập bụi thường xuyên.

* Ông Tô Xuân Thạch - Thôn Yên Lạc

- Chúng tôi hoàn toàn ủng hộ và nhất trí cao việc đầu tư dự án. Dự án giúp địa phương phát triển bền vững vùng NTTS cũng như gia tăng giá trị sản xuất nông nghiệp.

- Khu vực tuyến kênh từ công Quay Lá đến công

mạng không có 7 hàng N.T.T.S đã được quy hoạch, hiện nay có 7 công lũy nước, khi đi an lâm đường quản lý vào hành đi qua sẽ ảnh hưởng đến 7 công này, đề nghị dự án thiết kế hoàn trả cho người dân.

- Các loại cây trồng trên hành lang tuyến đường khi thi công bị ảnh hưởng đề nghị dự án bồi thường, trả trả cho người dân.

- Nếu thi công vào thời điểm tháng 11 đến tháng 2 vì đây là thời điểm người dân chưa thả giồng.

- Nếu trong quá trình thi công xảy ra hiện tượng vỡ nước trong ao bị chết do nhà thầu gây ra đề nghị bồi trả cho người dân để đỡ thiệt thòi.

* Ông Vũ Xuân Trung - thôn Xín Lát

- Hiện nay khu vực N.T.T.S chưa có tuyến đường để người dân đi vào ao của mình, việc đi lại gặp nhiều khó khăn, người dân phải bắc cầu tạm để đi, do vậy dự án đầu tư làm tuyến đường quản lý vào hành lang người dân rất phấn khởi.

- Hiện nay toàn bộ bán thôn làm rất nhiều các công việc tuy nhiên chất lượng xây dựng không được tốt, đến đến các công trình mà dùng 1 thời gian đã hư hỏng. Đề nghị dự án khi đầu tư xây dựng cần giám sát chặt chẽ quá trình thi công để đảm bảo chất lượng công trình bền vững nhất.



3. Kết luận.

- Chính quyền và người dân đồng tình ủng hộ các chủ trương đầu tư xây dựng dự án
- Tích cực, phối hợp với địa phương trong việc triển khai nước phục vụ thi công của nhà thầu khi cần và thuận lợi.
- Nhà thầu phải thu gom thường xuyên rác chất thải và hạn chế đầu mả rác vào xung quanh, thi công phải đảm bảo vệ sinh môi trường khu vực công trình

3. Biên bản kết thúc cùng ngày và đã được cuộc họp nhất trí thông qua.

Xác nhận của UBND xã.....



HỌ CHỦ TỊCH
Bùi Văn Thái

Đại diện đơn vị tư vấn

[Signature]

Lê Đức Hưng

Đại diện hộ dân

Thao

Tô Xuân Thao

[Signature]

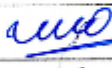
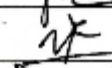
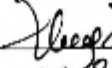
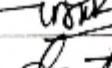
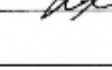
Vũ Xuân Tường

DANH SÁCH THÀNH PHẦN THAM DỰ LÀ CÁN BỘ UBND CẤP XÃ
Họp tham vấn cộng đồng dân cư, cá nhân chịu tác động trực tiếp bởi dự án
về các tác động môi trường và xã hội của dự án

Tên dự án: "Dự án phát triển thủy sản bền vững tỉnh Thanh Hóa, vốn vay WB".

Thời gian họp: ngày 13 tháng 11 năm 2024

Địa chỉ nơi họp: Hội trường UBND xã Đa Lộc, huyện Hậu Lộc

TT	Họ và tên	Chức vụ	Chữ ký	Ghi chú
1	Nguyễn Hải Nam	CT. UBND xã		
2	Bùi Văn Thái	PCT. UBND xã		
3	Đoàn Văn Hùng	CT. HĐND xã		
4	Trần Văn Trường	CC. Địa chính		
5	Trần Thị Tuyên	CC. Địa chính NN		
6	Vũ Thị Dung	PCT. Hội Phụ nữ		
7	Trần Thị Hằng	PR. Đoàn TN		
8	Bùi Văn Duẩn	PCT. MTTQ xã		
9	Bùi Chi Công	CT. Hội Lũn niên		
10	Bùi Văn Vĩnh	TT. Liên Lạc		
11				
12				
13				
14				
15				

Xác nhận của địa phương



PHÓ CHỦ TỊCH

Bùi Văn Thái

DANH SÁCH THÀNH PHẦN THAM DỰ

Hợp tham vấn cộng đồng dân cư, cá nhân chịu tác động trực tiếp bởi dự án về các tác động môi trường và xã hội của dự án

Tên dự án: "Dự án phát triển thủy sản bền vững tỉnh Thanh Hóa, vốn vay WB".

Thời gian họp: ngày 13. tháng 11. năm 2024

Địa chỉ nơi họp: Hẻm 103 Ngõ 10 Xã Lạc Huyện Hàm Lạc

TT	Họ và tên	Địa chỉ	Chữ ký	Ghi chú
1	Vũ Xuân Tùng	Xã Lạc	Tùng	
2	Đặng Văn Học	"	Học	
3	Bùi Thị Tú	"	Tú	
4	Hai Văn Phước	"	Phước	
5	Vũ Thị Huyền	"	Huyền	
6	Bùi Thị Thiên	"	Thiên	
7	Tô Xuân Thành	"	Thành	
8	Phạm Văn Bảo	"	Bảo	
9	Nguyễn Văn Sơn	"	Sơn	
10	Vũ Hoàng Năm	Đông Tiến	Năm	
11	Tôn Thanh Cường	Xã Lạc	Cường	
12	Vũ Thị Anh	Hồng Tân	Anh	
13	Vũ Thị Quý	Xã Lạc	Quý	
14	Bùi Thị Tú	"	Tú	
15	Hoàng Văn Đức	"	Đức	
16	Phạm Văn Trung	Ninh Phú	Trung	
17	Bùi Văn Thiên	Xã Lạc	Thiên	
18	Đỗ Thị Hòa	Xã Lạc	Hòa	
19				

APPENDIX 4: LIST OF CONSULTED STAKEHOLDERS

Community Consultation Meeting with Directly Affected Households on Environmental and Social Impacts of the Project

Subproject: “Sustainable Fisheries Development Project in Thanh Hoa Province, financed by the World Bank (WB)”.

Date: November 13, 2024

Location: Meeting Hall of Da Loc Commune People's Committee, Hau Loc District, Thanh Hoa Province.

No.	Name	Position	Signature	Note
1	Nguyen Hai Nam	Chairman		
2	Bui Van Thia	Vice Chairman		
3	Đoan Van Hung	Chairman of the Farmers' Association		
4	Tran Van Truong	Land Administration Officer		
5	Tran Thi Tuyen	Land Administration Officer		
6	Vu Thi Dung	Chairwoman of the Women's Union		
7	Tran Thi Hang	Secretary of the Youth Union		
8	Bui Van Duan	Vice Chairman of the Fatherland Front Committee		
9	Bui Chi Cong	Chairman of the Gardeners' Association		
10	Bui Van Vinh	Head of Yen Loc Hamlet		

Confirmation by Da Loc CPC

Vice Chairman

Bui Van Thai

LIST OF PARTICIPANTS

Community Consultation Meeting with Directly Affected Households on Environmental and Social Impacts of the Project

Subproject: “Sustainable Fisheries Development Project in Thanh Hoa Province, financed by the World Bank (WB)”.

Date: November 13, 2024

Location: Meeting Hall of Da Loc Commune People's Committee, Hau Loc District, Thanh Hoa Province.

No.	Name	Address	Signature	Note
1	Vu Xuan Tung	Yen Loc Hamlet		
2	Dang Van Hanh	Yen Loc Hamlet		
3	Bui Thi Tu	Yen Loc Hamlet		
4	Mai Van Phuoc	Yen Loc Hamlet		
5	Vu Thi Luyen	Yen Loc Hamlet		
6	Bui Thi Thieu	Yen Loc Hamlet		
7	To Xuan Thach	Yen Loc Hamlet		
8	Pham Van Bao	Yen Loc Hamlet		
9	Nguyen Van Son	Yen Loc Hamlet		
10	Vu Hoang Nam	Dong Tan Hamlet		
11	Tran Thanh Cuong	Yen Loc Hamlet		
12	Vu Thi Oanh	Dong Tan Hamlet		
13	Vu Thi Que	Yen Loc Hamlet		
14	Bui Thi Tu	Yen Loc Hamlet		
15	Hoang Van Duc	Yen Loc Hamlet		
16	Pham Van Trung	Thôn Ninh Phu		
17	Bui Van Tham	Yen Loc Hamlet		
18	Doan Thi Ha	Yen Loc Hamlet		

Confirmation by Da Loc CPC

Vice Chairman

Bui Van Thai