

Environmental and Social Management Plan (ESMP) Koh Lanta Bridge Project, Krabi Province Thailand Resilient Transport Connectivity and Irrawaddy Dolphin Conservation Project (P509460)

May 2025

Prepared by the Department of Rural Roads, Ministry of Transport, The Royal Thai Government

TABLE OF CONTENTS

TABLE	E OF CONTENTS ii
ABBRE	EVIATIONSiii
1.	INTRODUCTION 1
2.	ROLES AND RESPONSIBILITIES 1
3. AND N	SUMMARY OF ENVIRONMENTAL AND SOCIAL IMPACTS, MITIGATION MEASURES
4.	ENVIRONMENTAL AND SOCIAL ACTION PLANS
4.1.	Action Plan for Prevention and Mitigation of Impacts on Fresh Water Quality . 49
4.2.	Action Plan for Prevention and Mitigation of Impacts on Marine Water Quality 53
4.3.	Action Plan for Prevention and Mitigation of Impacts on Noise
4.4.	Action Plan for Mangrove Replantation77
4.5.	Action Plan for Forest Replantation (National Reserved Forest)
4.6. Accide	Action Plan for Prevention and Mitigation of Impacts on Transportation, ents, and Safety
4.7.	Action Plan for Prevention and Mitigation of Impacts on Dolphins
4.8.	Stakeholder Engagement Plan (SEP)
5.	MONITORING PROGRAMS
5.1.	Monitoring Plan for Impact on Fresh Water Quality106
5.2.	Monitoring Plan for Impact on Marine Water Quality
5.3.	Monitoring Plan for Impact on Air Quality111
5.4.	Monitoring Plan for Impact on Noise113
5.5.	Monitoring Plan for Impact on Vibration116
5.6.	Monitoring Plan for Impact on Marine Aquatic Ecology
5.7.	Monitoring Plan for Impact on Flora (Nation Reseved Forest)120
5.8.	Monitoring Plan for Impact on Fauna121
5.9.	Monitoring Plan for Impact on Rare Species122
5.10.	Monitoring Plan for Impact on Transportation, Accidents and Safety124
5.11.	Monitoring Plan for Impact on Water Drainage and Flood Control
5.12.	Monitoring Plan for Impact on Socio-Economic
5.13.	Monitoring Plan for Impact on Public Health, and Occupational Health and Safety 128
6.	REPORTING
6.1.	Contractor Report
6.2.	Construction Supervision Consultant (CSC) Report149
6.3.	PMU Report
7.	Cost Estimate

8.	ESMP Integration to Bid Document	158
9.	Review of the ESMP	158
ANNE	X 1 CHANCE FIND PROCEDURES	160

ABBREVIATIONS

Acronym	Description
AO	Administrative Organization
BOD	Biological Oxygen Demand
СО	Carbon Monoxide
CR	Critically Endangered with extinction
DMCR	Department of Marine and Coastal Resources
DO	Dissolved Oxygen
DRR	Department of Rural Roads
EIA	Environmental Impact Assessment
EN	Endangered with extinction
ESF	Environmental and Social Framework
ESS	Environmental and Social Standards of the World Bank ESF
IBAT	Integrated Biodiversity Assessment Tool
IUCN	International Union for the Conservation of Nature
MoNRE	Ministry of Natural Resources and Environment
NEB	National Environment Board
NGO	Non-governmental Organization
NO2	Nitrogen Oxide
NT	Near Threatened species
ONEP	Office of Natural Resources and Environment Policy
OSH	Occupational Safety, Health and Environment
PEA	Provincial Electricity Authority
PM10	Dust Particulate Matter
PPE	Personal Protective Equipment
RFD	Royal Forestry Department
ROW	Right of Way
SLIP	Supplementary Lenders Information Package
SS	Suspended Solids
тот	Thai state-owned telecommunications company
TSP	Total Suspended Particulates

TTNHA	Thung Thale Non-hunting Area
VU	Vulnerable to extinction

1. INTRODUCTION

This Environmental and Social Management Plan (ESMP) described measures and actions that can be used to reduce potential adverse environmental and social impacts to acceptable levels and include compsensatory measures, where applicable. The management of impacts on environment and social components for pre-construction/construction phases and implementation phase will include standard mitigation measures that are applicable throughout the Project Affected Area, and specific mitigation measures to be applied at specific locations or a specific component of the environment or affected community/ies in the project areas.

2. ROLES AND RESPONSIBILITIES

The institutional arrangements and responsibility in this Environmental and Social Management Plan presents a discussion of the environmental and social management structure and activities that will be undertaken as part of overall Project implementation.

The roles and responsibilities of various agencies in undertaking these activities are then defined, include identification of the institutional strengthening activities that will be required to allow those organizations to fulfill their nominated roles and responsibilities. Environmental and social action plans and monitoring programs have been prepared and the cost associated with its implementation has been identified. The roles and responsibilities of the proponent and the institutions are identified in Table 2.1.

Table 2.1. Responsibilities for Environmental and Social Management & Monitoring

Agency	Responsibilities
Project Management Unit (PMU), the Department of Rural Roads (DRR)	 Overall responsibility for project construction and operation; Ensure that funds are available to properly implement all agreed environmental and social safeguards measures; Ensure that the project, complies with both the provisions of the National EIA, the ESCP and the SLIP; Ensure that Project comply with the Royal Thai Government (RTG) environmental and social laws and regulations applicable to the Project including Lanta EIA requirements, ; Ensure that tender and contract documents for civil works include all relevant parts of the environmental and social management plan and project agreements; Prepare and submit to the World Bank regular monitoring reports on the environmental, social, health and safety (ESHS) performance of the Project, including but not limited to the implementation of the Environmental and Social Commitment Plan (ESCP), status of preparation and implementation of E&S instruments, which also included the OHS requirements, required under the ESCP, stakeholder engagement activities, and functioning of the grievance mechanism(s). Prepare annual EIA monitoring report for submission to the Office of National Environmental Policy and Planning (ONEP) per Thai EIA requirements; Promote institutional cooperation with General Labor Inspectorate to Enforce compliance with labor laws, including occupational health and safety rules:

	 Ensure that necessary environmental license(s) from the relevant agencies are obtained prior to award of civil works contracts; Per Thai EIA requirement, form Project Environmental and Social Mitigation and Monitoring Committee consisting representative from DRR, ONEP, Pollution Control Department, Krabi Provincial Natural Resources and Environment office, the Office of Environmental Regional 15, Krabi Provincial Office, Local Administrative Office, local CSOs and experts, etc; Take immediate action to solve E&S Grievance related to the Project and report to the ONEP, concerned agencies, and WB; Establish Project Public Relation Unit prior to start of civil works and inform general public and concerned agencies about project information including construction schedule and method, E&S impacts and management and monitoring measures. The PMU will be equipped with one senior ESOHS specialist, who will be responsible for providing overall guidance on E&S and OHS issues and carry out the necessary ESOHS activities for the project including integrating inputs from the two bridge sites and prepare Component 1 E&S progress report. Ensure that environmental and social protection and mitigation measures in the ESIA and ESMP are incorporated into the detailed design including climate change adaptation measures; Undertake environmental and social management capacity building activities for PIUs and orientation and awareness training for contractors; Work with the relevant consultant to undertake any additional environmental and social assessment for Projects, if required, and submit to WB for review and clearance. Ensure that Third-Party Compliance, Auditing, and Reporting are contracted and carried out as mandated in the project's mitigation and monitoring plans, both during the construction and
Project Implementation Unit (PIU)	 operational phases. Ensure that ESMP provisions are implemented to mitigate environmental and social impacts to acceptable levels; Ensure that Project complies with WB's ESF and government laws and regulations; Ensure issues related to sexual harassment and gender-based violence between workers and with communities are effectively dealt with respect to the applicable laws and rules; Ensure that contractors obtain a necessary environmental license(s) from the relevant agencies prior to the commencement of civil works contracts. Assist PMU to establish a Grievance Redress Mechanism, as described in the ESIA and SLIP, to receive and facilitate resolution of affected peoples' concerns, complaints, and grievances about the Project's environmental and social performance; Undertake monitor of the implementation of the ESMP (mitigation and monitoring measures); Based on the results of ESMP monitoring, identify environmentally corrective actions and prepare a corrective action plan, as necessary, for submission to WB as necessary; The Lanta bridge Project Implementing Units (PIU) will has one dedicated ESOHS specialist based locally to oversee and carried

		out necessary Environmental and Social, and OHS activities including coordinating and reporting on E&S implementation to the PMU.
Construction Consultant (CSC)	Supervision	 Provide training and capacity building to PMU and PIU and provide training to contractors on Project ESMP; Engage and retain safety engineer, safety officer, environmental specialist, environmental officer, and public engagement specialist to oversee, and monitor the necessary ESOHS activities including reporting to PIU throughout the construction phase. Incorporate into the project design the environmental and social protection and mitigation measures identified in the ESMP for the design stage; During the pre-construction phase provide all necessary information to the DRR to facilitate obtaining environmental licenses from the relevant authorities prior to award of civil works contracts; Update, based on detailed design, the ESMPs and other environmental and social protection and management measures to be incorporated in bid and contract documents; Assist PMU, PIU to undertake monitoring of the implementation of the ESMP (mitigation and monitoring measures) including the incorporation of reports from the contractors; Assist PMU to prepare and submit to the World Bank biannually monitoring reports on the environmental, social, health and safety (ESHS) performance of the Project, including but not limited to the implementation of the ESCP, stakeholder engagement activities, and functioning of the grievance mechanism(s). Based on the results of CESMP monitoring, identify environmental and social corrective actions and prepare a corrective action plan, as necessary, for submission to WB.
Contractor		 Participate in the induction training on ESMP provisions and requirements delivered by the PMU and /CSC; Prepare the CESMP and submit to PMU for approval; Obtain necessary environmental license(s) for the ancillary facilities, if required, from the relevant authorities prior to the commencement of civil works contracts; Ensure that all workers, site agents, including site supervisors and management participate in training sessions delivered by PMU and/ CSC. Maintain a record of training and conduct of awareness sessions for staff to ensure compliance with environmental and safety statutory and contractual obligations including the approved CESMP; Ensure compliance with environmental and social statutory and contractual obligations and proper implementation of WB requirements including approved CESMP; Establish and maintain site records of: Daily and weekly site inspections using checklists based on the CESMP;

	 Environmental and health and safety accidents/incidents including resolution activities; Non-compliance notifications issued by the Engineer; Corrective action plans issued to the CSC in response to non-compliance notices; Community relations activities including maintaining complaints register; Based on the results of CESMP monitoring, cooperate with the CSC and PIU, PMU to implement environmental and social corrective actions and corrective action plans and environmental and social monitoring, as necessary; Respond promptly and efficiently to requests and instructions from PIU, PMU for environmental corrective actions and corrective actions and social mitigation measures, as necessary; Provide sufficient funding and human resources for the proper and timely implementation of required mitigation measures in the Environmental and Social Management Plan. The construction contractor must establish a specialized team for Environmental and Social (E&S) as well as Occupational Health and Safety (OHS) to guarantee adherence to E&S and OHS standards
	throughout the entire construction duration.
Third Party Environmental and Social Mitigation Compliance Audit and the Monitoring Reporting	 Conduct the compliance audit of the project construction and operation activities to ensure compliance with the proposed ESMP; Conduct the monitoring per the environmental and social monitoring programs committed in the ESMP; Prepare the ESMP compliance and monitoring report to be submitted to the DRR, WB and the ONEP (noting that report to the ONEP shall follow ONEP monitoring reporting guideline and report will be in Thai)

a. Organizational and Capacity Requirements

The Project Management Unit's (PMU) responsibilities range from overall project management to compliance with environmental and social frameworks and regulations. ESOHS specialist and project engineers play a vital role in making sure that ESOHS measures are incorporating into tender documents. ESOHS specialist will be responsible to provide guidance and work with PIUs to conduct regular monitoring, engage with stakeholders, and address grievances. PMU will collaborate with labor inspectorates and obtain environmental licenses. Their involvement extends to capacity building, training, and overseeing third-party EIA monitoring, integrating inputs from the two PIUs and prepare regular reporting on E&S at the Project level (for Component 1).

Lanta bridge Project Implementation Unit (PIU) requires E&S and OHS expertise to ensure compliance with national EIA and ESCP and SLIP requirements. PIU will have one dedicated ESOHS specialist based locally to oversee and carried out necessary Environmental and Social, and OHS activities including monitoring of contractor day-to-day implementation with support from CSC, addressing grievances, engaging with stakeholders and relevant government agencies, coordinating and reporting on E&S implementation to the PMU.

The organizational and capacity requirements for the Construction Supervision Consultant (CSC) are critical for effectively managing ESOHS responsibilities. CSC requires a well-rounded and skilled team to effectively manage environmental, social and OHS responsibilities throughout the project. Key requirements include the ability to provide comprehensive training, engagement of specialized

staff (National safety engineer, safety officer, environmental specialist, environmental officer, and public engagement specialist), expertise in integrating protection measures into project design, coordination with authorities during pre-construction, reviewing and approving contractor plans, robust monitoring and reporting capabilities, and identification and follow up of corrective actions. These requirements ensure the CSC's effectiveness in implementing environmental and social measures during construction phases.

Construction contractors and sub-contractors shall have the primary responsibility to fulfil all project requirements with adequate and qualified personnel working under an appropriate organizational structure and further to ensure that their sub-contractors also comply with the project requirements. Adequate and qualified personnel will be employed by the Contractor to allow the proper management of environmental and social issues including occupational, community health and safety (OCHS), community relations and natural resources within the scope of its operations. Within this context, the organizational structure shall include dedicated personnel/units which manage environmental and social matters, and promote the implementation of its operations to support the project in harmony with its scope and national and international standards.

In order to provide a solid application of E&S requirements on site, Contractor will be responsible for ensuring that all of its personnel (including contractor and sub-contractor personnel) are aware of their E&S responsibilities. To this aim, the Contractor will develop and implement an E&S training programme to ensure that all site personnel fully understand all the aspects of E&S requirements of the project particularly in terms of potential impacts of activities, mitigation measures, sensitivities in study area, plans/procedures other project documents to be followed, action required in case of unforeseen incidents and roles and responsibilities of Contractor staff and DRR representatives with respect to E&S issues.

The E&S training programme should be submitted to DRR for review and approval within periods defined in related tender documents. Records of the trainings will be kept by the Contractor and will be submitted to DRR when required for auditing purposes.

The Contractor will ensure that all Contractor personnel participate in all training programme including regular site-specific training sessions on E&S issues throughout the course of their contract.

The contractors will ensure that the following competencies are included in their teams as relevant to their scope of work:

- 1. Social / Public Relations Specialist
- 2. Environmental Specialist
- 3. OHS Specialist

3. SUMMARY OF ENVIRONMENTAL AND SOCIAL IMPACTS, MITIGATION MEASURES AND MONITORING PROGRAM

This chapter presents a summary of the environmental, social and health impacts, mitigation measures and monitoring requirements for each impact provided within the Koh Lanta Bridge EIA and the SLIP documents. However, it should be read in conjunction with SLIP documents particularly the Stakeholder Engagement Plan, Labour Management Plan, Resettlement Policy Framework, and Cumulative Impact Assessment. The SLIP encompasses additional studies, management plans and frameworks, supplementing the project's EIA document, include:

• Non-Technical Summary (NTS) of the Lanta EIA

- Cumulative Impact Assessment (CIA)
- Critical Habitat Assessment (CHA)
- Environmental and Social Management Plan (ESMP)
- Stakeholder Engagement Plan (SEP)
- Labor Management Plan (LMP)
- Resettlement Policy Framework (RPF)

The Environmental and Social Management Plan (ESMP) is an integrated outcome of the Lanta Bridge Project's Environmental Impact Assessment (EIA) and the SLIP. Stakeholder consultations and document disclosure for Lanta Bridge EIA which include mitigation measures and monitoring program described in this ESMP took place during August 2020 to March 2021 as part of Thai EIA requirements. It, started from the scoping phase up to the development of mitigation measures and monitoring plan that incorporated stakeholder inputs and concerns. Participation activities carried out is summarized in the Lanta Bridge SEP. Relevant stakeholders including local government agencies, affected shop owners, ferry operators, local NGOs had also been consulted during preparation of the SLIP and their feed backs were included in relevant SLIP documents. The Non-Technical Summary (NTS) of Lanta Bridge EIA was disclosed on the World Bank's website and DRR's website on September 14 and 15, 2023, respectively. Other SLIP documents were disclosed on the DRR website¹ during September – November 2023. The final consultation on SLIP package including ESMP will be carried out in end of April /early May 2024 and before Project appraisal. The final package the SLIP document and EIA will be re-disclosed on DRR's website and the World Bank's website upon finalization. Stakeholder engagement and document disclosure is an ongoing process and will be continued during pre-construction, construction and operation phases following strategies developed in the Lanta Bridge SEP.

Details of key mitigation measures and monitoring program are provided in chapter 4 and 5. A total of 243 mitigation measures are listed although limited overlap does occur (approx. 5%). Responsibilities are not provided in the EIA but have assigned between the Department of Rural Roads (DRR) and the Contractor. Analysis reveals that 72% measures are the contractor's responsibility and 28% the responsibility of DRR and associated government institutions. The summary of the environmental mitigation measures and management controls as well as the monitoring requirements of the Lanta Island Bridge project is presented in **Table 3.1**.

¹ <u>https://xn--12clj9bgle6dub5byb0bogff9e3hfe9noa.com/index.html</u>

Table 3.1: The summary of environmental, social and health impacts, mitigation measures and monitoring program of the Koh Lanta Bridge project

Environment and Social Components/ Impacts	Mitigation measures/ Responsibility	Area of Implemen
1. Physical environmental resources 1.1 Soil resources		
<u>Construction phase</u> Soil loss from excavation/pile drilling and impacts from spoil disposal	Contractor's Responsibilities	Area of Implementation
 The bridge foundation construction activities will generate approximately 5,750 cu.m. of excavated soil, which needs to be moved out of the construction area, moderately affecting soil loss or displacement. Soil debris (spoil) obtained from drilling work in the sea contains a considerable amount of salt soluble in soil solution or saline soil which are inappropriate for the growth of plants. Hence, measures must be taken to prevent adverse impacts on soil. Spoil must be placed on suitable locations. Impacts on soil erosion Construction activities, such as excavation, drilling, and embankment filling, can lead to the loss of vegetative ground cover and soil erosion, particularly during the rainy season. The severity of soil erosion is influenced by the volume and speed of run-off water, as well as human activities in the area. To assess the potential for erosion caused by the Koh Lanta Bridge construction, the EIA considered rainfall erosivity, soil erodibility, slope length, and crop management factors. The results indicate a moderate soil erosion rate of 0.256 tons/rai/year (1.6 tons/ha/year), which falls within the Thai erosion classification's moderate range (< 2-5 tons/rai/year) as issued by the Land Development Department (B.E. 2545). However, a high volume of soil washing into the water drainage system or spillway could pose obstructions to water drainage in the area. As a result, the construction impact is assessed as moderate due to the potential for soil sediments washing off into the sea. 	 Sediment/Spoil Disposal The contractor must prepare proper pontoons/barges to transport spoil collection trucks from the bridge construction areas to Ban Khlong Mak pier and vice-versa. Soll debris and gravel from drilling works in the sea must be transferred to the onshore soil pile site in Koh Lanta Noi via pontoon and material-transporting trucks. A large crane must be prepared at Hua Hin pier to lift the materials will be stored at the material storage plant. Transport soil debris to the following two spoil disposal sites: Spoil from drilling works onshore shall be disposed off at spoil disposal site located in Koh Klang Sub-district Administrative Office (SAO)'s area. Spoil from drilling works on shore shall be disposed off at disposal site located in Koh Klang Sub-district Administrative Office (SAO)'s area. Spoil from drilling works on a small pontoon to transport between the drilling site and Ban Klong Mak Pier. The pontoon must be equipped with an adjustable ramp to facilitate docking during the rise and fall of sea levels. Before disposal of the spoil from the sea sections, apply mixture of gypsum and lime (at 1:1 ratio or as recommended by the Department of Land Development) at the bed of spoil disposal site. Build 0.5 m soil berm and drainage trench to prevent discharge of saline water and soil to the adjacent lands. Cover spoil transport truck with canvas to prevent spillage and dust. Transports out outside the rush hour (7.30 - 9.00 am. and 5.00 - 6.00 pm) in order to minimize impacts on land and water transportation. Soll Eosion Obline the exact boundary of the construction area and limit site clearance to areas necessary for construction. Solis to be used in the area must be compacted as soon as they brought to the site to prevent soil leaching from the proreet site. Soli to busued in the area must be co	1) Project site 3) Two spoil disposal sites Noi SAO (approximately 2 the project site) and the k (approximately 4.6 rai, 4.2 project site) Cost Included in the overall mi

² This column summarized monitoring program that will be carried out by a third-party to be hired by DRR. The third-party firm shall hold a license from the ONEP to conduct EIA compliance monitoring. Chapter 5 described in more detail the requirements for these monitoring program, including to provide detailed cost estimate and required methodology. This monitoring program does not replace the daily/weekly supervision and monitoring that need to be carried out by Contractor and Supervision Consultant during project construction to supervise and monitor Contractor implementation of all mitigation measures included in Chapter 3.

tation/Cost	Monitoring Program/Responsibility/Cost ²		
	-None ³		
at the Koh Lanta rai, 9.1 km from oh Klang SAO 2 km from the			
igation budget			

³ None = Instrumental monitoring is not required. Implementation of mitigation measures will be monitored and reported in EIA/ESMP compliance report.

Environment and Social Components/ Impacts	Mitigation measures/ Responsibility	Area of Implementation/Cost	Monitoring Program/Responsibility/Cost ²
 Operation Phase The impact on soil erosion is not expected to be significant since the area where the soil surface was previously excavated for construction will turn into a road surface. Land subsidence at the foot of the bridge slope may occur after the opening of the project road. However, since the project structure is designed to support soil ubsidence at the foot of the bridge slope by using piles with needle length descending from the area along the semis to the embankment and construction of a retaining wall to support the weight of the soil, soil subsidence is not affected. 	None	None	None
1.2 Geology and earthquakes			
 Pre-construction/Construction phases Impacts of earthquakes The geology will be unaffected by the construction of the project. The project is located in the lowest earthquake intensity zone according to Thailand Seismic hazard map and are 70 km from active geological faults. While project will not be the cause of seismic activity, the consequence of an event during the construction phase is considered a moderate significant impact due to unpredictable nature of seismic hazard event. Effects of Tsunami Tsunamis or groups of waves originating in the sea usually appear after a large earthquake, underwater earthquake, volcanic eruptions, landslides, land collapses, or large meteorites have fallen into the sea. On December 26, B.E. 2547 [A.D.2004] after a tsunami caused by an underwater earthquake hit the southern coast of Krabi Province, where the project is located, Krabi, including Lanta island, was one of the affected provinces from the tsunami waves that destroyed coastal areas, resulting in the loss of both life and property. Since tsunami is an unpredictable natural disaster event, the impact is considered to be high. 	Design Consultant's Responsibilities - In designing the bridge structure, the PGA seismic intensity level of approximately 0.02g in the case of a 10% chance shall be considered during the project design process. - The bridge structure must be designed to support vibration caused by earthquakes according to AASHTO LRFD standards. The uniform load method is applied in calculating seismic load as specified in the AASHTO Guide Specifications for LRFD Seismic Bridge Design, 2nd Edition, 2011 (Article CS.4.2). - The construction must be designed to support earthquakes according to Ministerial Regulations by ensuring that the building's weight, resistance, durability, and the ground shall support the building in resistance to vibration, announced on January 28, 2021, issued under the Building Control Act B.E. 2522. [A.D.1979] DRR's Responsibilities - Project site and structures to be surveyed immediately after occurrence of earthquake event. Damaged structure to be fixed as soon as possible. Contractor's Responsibilities - Instal warning signs in Tsunami-prone areas at the edge of Ban Hua Hin Pier on the side of Koh Klang sub-district and on the coastline in Koh Lanta Noi sub-district each. - Instal is pis indicating the Tsunami evacuation route, along with directions distance of evacuating to safe areas as follows: • Tsunami evacuation route signs must be installed in two areas of Koh Klang sub-district, one on the right of the bridge at km. 0+400, indicating the distance to the safety point of 400m. (in case of driving on the bridge, drive down from the bridge to the paved road area of Koh Klang Sub-district, namely one sign on the left of the bridge at km. 0+400, indicating the distan	Area of Implementation Throughout the construction route Cost Included in the overall mitigation budget	- None

Environment and Social Components/ Impacts	Mitigation measures/ Responsibility	Area of Implementation/Cost	Monitoring Program/Responsibility/Cost ²
	 Lanta Noi sub-district, and the other on the left, km.1+900, to notify people who evacuated from Koh Lanta Noi that they have arrived at the safe location on the slope of Highway Gor Bor.5035. Strictly follow the government Tsunami evacuation procedures as indicated on measures for operation phase 		
Operation Phase The Koh Lanta Bridge is designed to resist in the event of a strong earthquake or tsunami and remain operational. The bridge, once operational will serve as an important emergency route for Koh Lanta and other islands allowing fast and effective rescue operations and subsequent restoration of affected areas. The implementation impact is therefore assessed as positive.	 DRR's Responsibilities Project site and structures to be surveyed immediately after occurrence of earthquake event. Damaged structure to be fixed as soon as possible. Carry out a detailed survey of bridge damage as stipulated in the Underpass Maintenance Manual of the Department of Rural Roads B.E.2562 [A.D.2019]. 	Area of Implementation Throughout the bridge route Cost Included in the overall mitigation budget	DRR to prepare monitoring report.
Pre-construction/Construction phases Wastewater impacts have the potential to occur throughout the construction period but are contained within the nearby surrounding areas. Approximately 23 m³/day of wastewater will be produced from daily activities of construction workers and staff include from toilets, canteen, concrete mixing plant, equipment maintenance facility and leachate from solid waste. Wastewater from the concrete mixing plant will range from 12 to 20 m³/day with a higher alkalinity than the standard of greywater. This wastewater will be processed through two coagulation pits before being recycled or discharged. Potential locations of the workers camp, site office and concrete mixing plant are located on Road 4206 in close proximity to the project site. No surface freshwater sources occur within 500 meters of the project area although project activities will affect water quality. The pre-mitigation significance of the negative impact is assessed as moderate.	 Contractor's Responsibilities Wastewater from site office and workers camp Treat wastewater to meet effiluent standrds before discharge to nearby recieving water body/darinage. Installed septic-anaerobic tanks to treat wastewater from toliets (10.0 cu.m. x 1 unit), canteen (10.0 cu.m. x 1 unit), and mainteance shop (1.50 cu.m. x 1 unit) at canteen and maintenance shop (0.5 cu.m. x 1 unit). Pour concrete slabs with berm in the area that oil and grease spills may occur at workers camp and the maintenance area. Oil contaminated water should be drained to oil/grease trap and finally treated at wastewater treatment tank. Ensure that machinery plant, maintenance plant, storage of fuel, engine oil tank and used oil tank, and cleaning area for vehicles, machinery and construction materials are located 100 m. away from water sources and drainage channels to prevent contamination into water sources. Gather used oil containers at the maintenance plant and have them disposed of properly. Contractor sare responsible for providing waste segregation bins with closed lids, without water leakage (refrain from using baskets in collecting solid waste). The bins provided must be sufficient in number and appropriate in size to accommodate waste generated each day. They shall be placed at various points of the construction site, such as worker's residences, canteen, offices, buildings, and maintenance plant. Staff are to be assigned for collecting waste and transferring them to the collection site. Contractor shall contact Koh Klang SAO to collect waste and disposed off at approved disposal site. Wastewater from construction site Provide 1 set of mobile toilet equipped with onsite septic-anaerobic tank (4 toilets/tank) at both side of construction areas (Koh Khlang and Koh Lanta Noi) and corrodinate with Koh Khlang and Koh Lanta Noi SAOs to collect wastewater for further treatment each day. W	Area of Implementation 1)Site office, and workers camp 2) Construction sites at Km. 0+000-km. 0+500 (Ko Klang sub-district side) and Km. 2+000-Km. 2+527(Koh Lanta Noi sub- district aide) 3) Concrete mixing plant Cost 2,845,749 Thai Baht (THB) (Covered under the action plan to prevent and mitigate the impact on fresh water quality) Details of mitigation measures and monitoring program are provided in chapter 4 and 5.	DRR's Responsibilities DRR to hire a third party-monitoring firm to carry out moitoring program Monitoring locations: - Effluent from septic-anaerobic tanks at site office, and workers camp before discharge outside Monitoring Parameters: - pH - BOD - Suspended solids - Oil and grease - Total nitrogen - Total phosphorus Monitoring Period: - Quarerly throughout the construction period Cost: 120,000 THB (40,000 THB / Year)
Operation Phase During the implementation phase, bathroom and toilet facilities will be available at the parking space below the bridge structure in Koh Klang Sub-district for tourists who visit the viewpoint area. The continuous	Contractor's Responsibilities - Construct toilet facilities at bridge parking space in Koh Khlang Sub-district.	Area of Implementation	None

arrival of tourists will generate wastewater and solid waste that could cause pollution and spread of diseases, and the pre-mitigation significance of the impact is assessed as moderate. - Cla - Ins DRR - Cc - Cc M 16 - I	 Provide 240-liter waste bin with a lid and a steel mesh cage to prevent monkeys from digging through garbage at parking space near bridge view points entrance (on both left and right side). Each set should comprise separated bin for 4 categories of waste: biodegradable waste, hazardous waste, general waste and recyclable waste. Clearly label waste bins with signs or symbols of waste type. Install signs encouraging entrepreneurs and tourists to refrain from using plastic and foam containers. Rr's Responsibilities Coordinate with Koh Klang Subdistrict Administrative Organization to operate and maintain toliet facilities. Coordinate with Koh Klang sub-district Administrative Organization to collect wastes and dispose at Krabi Municipality's Waste-to-Energy Plant. The suggested waste collection frequency is 1 – 2 trips/day (during 08.00 – 16.00) for low tourism season and 3 – 4 trips/day (07.00 – 17.00) for long holidays and high tourism season (November – March). 	Koh Klang Sub-district Cost 605,000 Thai Baht (THB) (Covered under the action and mitigate the impact o quality) Details of mitigation meas monitoring program are p 4 and 5.
1.5 Marine water quality and Oceanography		
Pre-construction/Lonstruction phases Commission Impacts on Marine water quality Commission Marine water quality could be impacted during the construction phase by increased turbidity resulting from construction of bridge pier structures and approach slabs. Sediments may also originate from land construction leading to soil erosion and run-off into the sea. Water drainage from the maintenance facility, construction sites and workers camp as accidental minor spill from bridge construction activities and transportation in the sea can also introduce oil and other contaminants into coastal water sources. - Vulnerable receptors include the benthic environment, corals and sea grass. Marine fauna such as fish, crabs, mollusks and other benthic fauna can adjust their behavior and/or move away. The impacts will occur over a limited period and localized to specific areas in response to the transport of sediments by the tide (see Oceanography assessment). The significance of this impact prior to mitigation is assessed as moderate. - Prev Prev - - - - Us - - - - Impacts - - - - Impacts - - - - Impacts - - - - Vulnerable receptors include the benchic environment, corals and sea grass. Marine fauna such as fish, crabs, mollusks and other benchic fauna can adjust their benavior and/or move and/or move and/or move and/or move and	httactor's Responsibilities anagement of sediment erosion into the sea Clearly define the boundary of the construction area and open the construction area only as necessary. Avoid site clearance/soil removal during rainy season and keep the construction period as short as possible to reduce soil erosion and sediments on water runoff. Compact soil as soon as they are brought to the site. Compact soil as soon as they are brought to the site. Compact soil as soon as they are brought to the site. Compact soil as soon as they are brought to the site. Compact soil as soon as they are brought to the site. Compact soil as soon as they are brought to the site. Compact soil as poor the are 12 water sources, namely Koh Klang sub-district (km.0+000-km.0+500) and Koh Lanta Noi sub-district (Km. 2+000-Km. 2+527) to prevent leaching from rain water into water sources. evention of concrete mixture spill into the sea Prevent leakage of polymers into the sea during underwater foundation pile casting by installing an extended casing on top of the foundation pile steel casing. Examine the strength of the formwork and bracing before pouring concrete and caulking with rebar plugging out to prevent lime water from flowing out while pouring concrete. Use waterproof steel formwork. Inspect the formwork before pouring concrete and caulk existing holes to prevent exement leakage from the formwork. Evention of fall at sea (material/objects and staff/workers) Provide training for staff involve working at height. Provide halth inspection for staff/workers. Make sure PPEs are used. Instal net fences and equipment to prevent material from falling into the sea throughout the construction period. Imit working from height as necessary. Store scraps of materials and construction equipment orderly, not obstructing the walkway and constantly clean staff. Provide warning sign/barricade or close opening on floor where it could cause trip /fall hazards. Evention of sediment distribution Use steel piles and vibratory piling method for installation of t	 Area of Implementation 1) Connecting roads (Km 0+500) and Km 2+000 2) Temporary jetties 3) Bridge piers constructi - P32) Cost Silt curtain installation (Temporary silt fences co (300,000 THB) (Covered under the action and mitigate impact on m quality) Details of mitigation meas monitoring program are p 4 and 5.

ation/Cost	Monitoring Program/Responsibility/Cost ²
plan to prevent n fresh water sures and rovided in chapter	
	<u>DRR's Responsibilities</u> DRR to hire a third party-monitoring firm
0+000 – Km – 2+527) on in the sea (P17	 Monitoring locations Station 1 Coast of Ban Hua Hin, Koh Klang sub-district Station 2 Coast of Koh Pling Station 3 Coast of Thung Toh Yum, Koh Lanta Noi sub-district
3,346,450 THB) onstruction plan to prevent arine water	 15 Seawater quality indexes Floating matters, odour, oils and fats, temperature, pH, transparency, turbidity, suspended solids content, dissolved oxygen (DO), salinity, lead, total mercury, arsenic, coliform bacteria, faecal coliform bacteria
sures and rovided in chapter	 Duration and frequency Quarterly, covering the rainy and dry seasons throughout the construction period, especially during construction activities Cost: 216,000 THB (72,000 THB / Year)
	Contractor's Responsibilities Oil Spill Incident – report oil spill incident starting from the minor of observation of oil sheen on the water surface to other spill into the sea in contractor progress reporting.

Environment and Social Components/ Impacts	Mitigation measures/ Responsibility	Area of Implementation/Cost	Monitoring Program/Responsibility/Cost ²
	 Construct a 200 m-long temporary jetty at Koh Lanta Noi side along bridge alignment. Construction of temporary jetty should be carried out section by section in totally three sections, covering bridge pier F3 Type 3 No. 1-4 (<i>Figure 1.5-8 in the final EIA report</i>). Install silt curtains made from flexible materials, anchored to the sea floor around construction areas before construction at each section start and remove it after competion of piling and underwater foundation works and move to the next section until complete in all 3 sections. Construction platform will be used as jetty for construction of bridge pier F3 Type 3 No. 5-13. Construction of bridge piers F1 type 1 (P16, P17), F2 type 2 (P18) and F3 type 3 (P19-P32) will be carried out from construction barge hence construction platform will not be required. Contractor shall install silt curtain at 5 m distance around bridge piers and anchored it to the sea floor before start of construction. 		
	Oil Spill Prevention		
	 Monitor and maintain the condition of various machinery used in construction to prevent oil from spilling into the sea according to machinery and equipment maintenance guidelines. Refueling of machinery and vessels used in construction activities is to be carried out from a 200-liter tank with secondary containment. This means that in the event of a spill, there is a container to catch the leaked oil. Additionally, when transferring the oil, there must be a tray underneath the oil tank and the refilling point of the machinery to ensure proper containment and prevent spills. This precaution shall be consistently maintained during the process of refueling. During the refueling process, it is essential to have oil spill response and control equipment readily available in the vicinity at all times to ensure that immediate actions can be taken if a spill occurs while refueling. Before operating the machinery, a daily pre-use inspection must be conducted as a routine practice. If any oil leakage is detected from the machinery during the inspection, repairs must be carried out, and the leaked oil must be properly managed before proceeding with operating the machinery. During machinery maintenance activities in construction, it is necessary to have containment trays to prevent oil, chemicals, or other liquids that may potentially leak from flowing onto the construction barge's surface and have the chance to reach the sea. Additionally, during the machinery maintenance process, spill response and control equipment must be present in the vicinity at all times. This ensures that they can be immediately utilized if a spill occurs while refueling, preventing oil from flowing into the sea. Maintenance activities for large machinery are strictly prohibited within the construction area located in or adjacent to the sea, such as temporary docks. These maintenance tasks must be carried out in designated maintenance areas located at least 300 meters away from the sea or water		
Impacts on Oceanography			
 Water flow was modelled with results supplemented from field measurements. Results of modelling reveal similar results for both temporary jetties with changes in water current velocity and flow direction greatest during the westward outflowing current (low tide), but changes will be minimal (1.33% for velocity and 0.4 – 0.7% within 20 m for flow direction) and will not influence coastal erosion. 	Design Consultant's Responsibilities Design bridge pier structures in the sea to have the least possible cross-sectional area in order to minimize obstructions of water currents. Contractor's Responsibilities	Area of Implementation Throughout the construction route Cost	None
 Sediment dispersion resulting from the drilling of steel piles for the temporary jetties will occur in an oval shape according to the direction of the current, towards the southwest for low tide and northeast for high tide. The highest concentration of sediment will be 6.3 ppm within 1 meter from the position of pile drilling. The Koh Klang temporary jetty has the worst impacts with a sediment plume 	 Temporary jetties to be dismantled once bridge pier construction is completed started from jetty at Koh Lanta Noi side and Koh Khlang side, respectively. Install safety nets undrneath temporary jetties to prevent material from falling into the sea throughout the construction period. Removal of steel piles for temporary jetties should be carried out during low tide to minimize sediment dispersion. 	Included in the overall budget	

Environment and Social Components/ Impacts	Mitigation measures/ Responsibility	Area of Implementa
that extends of 67 meters (in the absence of mitigation) from the during low tide but will return to normal within 20 minutes after pile drilling is completed. The maximum dispersion from the Koh Lanta Noi jetty will be marginally less (65 meters at low tide). Sediment dispersal will also occur from the bored piles for construction of pier structures. The sediment load will be 6 ppm within 3 meters of the pile drilling and will extend to a maximum distance of 70 meters during low tide with conditions returning to normal within 20 minutes after the pile drilling is completed. The significance of this is premitigation impact during construction is assessed as low.		
Operation PhaseImpact on Marine Water QualityWhen the construction of the project is completed, there shall be no impacts on the quality of sea water because the bridge structure in the sea is composed of ready-mix concrete with a mixture of type 5 cement, containing a low amount of Tricalcium aluminate (C3A). Therefore, it is resistant to sea water and sea vapour corrosion.	- None	None
Impacts on Oceanography Assessment of the impact of changes in the velocity and the direction of the current from the underwater pier bridge suggested that the changing currents are located near the bridge piers, with maximum increase and decrease of change equivalent to 7.2 degrees at 20 m distance, 0.1-4.3 degrees at 50 m, and less than 1 degree at > 50 m when comparing to baseline scenario. The significant of impact is considered as low.		
1.7 Air quality		
Construction phases Air quality modelling on impacts from project construction activities revealed that the predicted concentration of air pollution that could be generated by the project construction include Total Suspended Particulate (TSP), Particulate matter smaller than 10 micrometres (PM10), Carbonmonoxide (CO), and Nitrogendioxide (NO2) fall well within Thailand Ambient Air Quality Standards. The significant of impact is considered as low.	 Contractor's Responsibilities Coordinate with Koh Klang SAO and Koh Lanta Noi SAO in publicizing the construction plan to raise awareness among the people. At least one month prior to the construction, ensure that signs with details on the construction plans are installed. Open construction areas as necessary, limit the area of stripping at intervals to reduce the diffusion of dust and accelerate the construction to be completed as soon as possible. Regular spray the road surface and construction areas with water at least two times per day, especially sensitive areas and communities, which are affected by dust dispersion exceeding the standards. These include areas with soil excavation near the road towards bridge approach slab in Koh Klang Sub-district and road towards bridge approach slab in Koh Lanta Noi Sub-district. Clean the wheels of every vehicle before leaving the construction area. Allocate an area specifically for the cleaning of wheels and vehicle bodies using a high-pressure water injection equipment to prevent dirt particles attached to the wheels from falling off to the road. Cover the rear of the truck with canvas to avoid falling objects and the diffusion of dust. Ensure there is no piling of debris or materials on traffic surface. Ensure there are trucks waiting to transport sediments and debris during the drilling of bridge pier structures work. Trucks are to transport debris from the construction areaa to the debris disposal site. Control the speed limit for trucks of no more than 30 km/h while passing communities and environmentally sensitive areas 	Area of Implementation Throughout the construction Cost Included in the overall bud

entation/Cost	Monitoring Program/Responsibility/Cost ²
	-None
	<u>DRR's Responsibilities</u>
on	DRR to hire a third party-monitoring firm
uction route	Monitoring Locations
	 Moo 8, Ban Hua Hin (Ban Tha Reua) Thung Toh Yum Cemetery
budget	Monitoring Parameters
	 Total Suspended Particulate (TSP) Suspended particulate smaller than 10 microns (PM10) Carbon monoxide (CO) Nitrogen dioxide (NO2) Wind speed and direction
	Duration and frequency
	 2 times/year for 5 consecutive days, covering rainy and dry seasons throughout the construction period

Environment and Social Components/ Impacts	Mitigation measures/ Responsibility	Area of Implementation/Cost	Monitoring Program/Responsibility/Cost ²
	 Check and maintain machines used for construction following the machine and equipment maintenance manual to reduce air pollution emissions and prevent the spread of dust, such as black soot, dust, carbon monoxide (CO) and nitrogen dioxide (NO2) Provide masks for construction workers and staff during soil excavation work, relocation, clearing of areas/wood, and soil filling work. Do not pile up soil mass or construction materials on road surfaces; provide trucks to pick them up during foundation drilling and transport them from construction sites to the project sediment storage areas Place stickers at the back of trucks and machines of project detailing company name, contact person and contact number for complaints. Should there be complaints regarding dust dispersion from the construction activities, the contractor shall examine the issue and mitigate the issue accordingly. 		Cost: 750,000 THB (250,000 THB / Year) Details of monitoring program are provided in chapter 5.
Operation Phase According to the forecast of the traffic volume along the route of the project in B.E.2570-2590 [A.D 2027-2047], the air quality shall be affected as follows: Air quality modelling on impacts for project operation phase based on the forecast traffic volume during 2027 – 2047 revealed that the predicted concentration of Total Suspended Particulate (TSP), Particulate matter smaller than 10 micrometres (PM10), Carbonmonoxide (CO), and Nitrogendioxide (NO2) fall well within Thailand Ambient Air Quality Standards. The significant of impact is considered as low.	 <u>DRR Responsibilities</u> Ensure that the pavement, especially on the bridge, is cleaned. This can be done by having a vacuum truck collect and haul away dust at least once a week or having a cleaning staff handle the leftover garbage to prevent dust accumulation. Facilitate the traffic flow by installing traffic signs indicating directions, and specifying the type and speed of vehicles to prevent contaminating pollutants in the area. Should complaints regarding impacts on air quality arise, the Department of Rural Roads must investigate and correct what happened immediately. 	Area of Implementation Throughout the bridge route Cost Included in the overall budget	Implementation period - None
1.8 Noise			
Pre-construction/Construction phases A model was developed to predict the noise emissions from 33 types of mechanical equipment used for construction and transportation of materials. The model was based on a 24-hour period and a distance of 15 meters from the construction activities. The results were compared against the national standard for noise emissions provided by the Notification of the NEB, which stipulates a maximum safe sound limit of 70 decibels. The analysis of the results indicates that the Moo 8 Ban Hua Hin pier (Koh Klang) and the Muslim cemetery of Ban Tung Toh Yum (Koh Lanta Noi) will experience noise impacts during the construction phase that exceed the recommended limit. Overall, the pre-mitigation significance of the construction noise impact is assessed as moderate.	 Contractor's Responsibilities A consultation survey should be conducted once again during the Construction Preparation phase. If the homeowner wants to have a sound barrier installed in the front of the house, the Department of Rural Roads must be responsible for the additional installations. Conduct project communication and inform details of construction methods, construction schedule and coordination channels in case of inconvenience or complaints in the community at least 1 month before the start of construction. Coordinate those people and with Koh Klang Sub-district Administrative Organization and Koh Lanta Noi Sub-district Administrative Organization. Noisy construction activities must only be operated during day time (8.30 am5.30 pm.). to avoid disturbing people living in the area and near construction sites. In case of working after 5.30 pm. local people must be notified in advance, and the construction should not generate loud noise and construction activities must be limited, and workers operating in excessive noise areas must be switched to avoid near those machines must be limited, and workers operating in excessive noise areas must be switched to avoid narmful Noise. During the construction period, a temporary noise barrier made of metal sheet or a more efficient material are to be installed, 3.0 meters high, 0.64 millimeters in width, and 100 meters long from milestone 0+290 to milestone 0+390. From milestone 1+920 to milestone 2+005, a sound proofing wall of 85 meters length shall be installed as well. Two areas affected by sound levels that exceeded the noise standards include Moo 8 Ban Hua Hin (Ban Tha Rua) and Thung Toh Yum Cemetery. Temporary stop all construction activities in the vicinity of Thung Toh Yum Cemetery during religious ceremonies. 	 Area of Implementation Moo 8, Ban Hua Hin (Ban Tha Reua) Thung Toh Yum Cemetery Cost 1,517,925 THB (Covered under the action plan to prevent and mitigate impact on noise) Details of mitigation measures and monitoring program are provided in chapter 4 and 5. 	DRR's Responsibilities DRR to hire a third party-monitoring firm Implementation areas Moo 8, Ban Hua Hin (Ban Tha Reua) Thung Toh Yum Cemetery Measurement Index 1-hr average noise level (Leq 1 hr) 24-hr average noise level (Leq 24-hr) Maximum noise level (Lmax) Average day-night noise level) (Ldn) Duration and frequency Quarterly for 5 consecutive days, covering rainy and dry seasons throughout the construction period Cost: 72,000 THB (24,000 THB / Year)

Environment and Social Components/ Impacts	Mitigation measures/ Responsibility	Area of Implementation/Cost	Monitoring Program/Responsibility/Cost ²
	 Install fences/barriers around the construction site from the beginning of the project at milestone 0+150 to milestone 0+500 in Koh Klang Sub-district and from milestone 2+050 to milestone 2+200 in Koh Lanta Noi Sub-district. Limit the speed of trucks at 30 km/h when driving through community areas and environmentally sensitive areas. Contractor shall maintain regular checkup and maintenance of machines, equipment and construction tools to be in good conditions. Provide or install noise-reducing device to reduce the sound of machines during operation or consider changing to newer machine in order to minimize impact from sound. Avoid using several large machines at the same time in the same areas. Provide staff and workers working in noisy construction sites with hearing protection devices, e.g., ear plugs, ear muffs, etc., and instruct them to use such devices in case of working in noisy areas. Should there be complaints from the local population regarding loud noises from project activities, the contractor shall examine the causes of issues and mitigate accordingly. The contractor is required to communicate with the local population regarding loud noises from ground to communicate with the local population regarding loud noises from project activities, the contractor shall examine the causes of issues and mitigate accordingly. The contractor is required to communicate with the local population regarding the root cause, mitigation measures, and monitoring results through the project's Grievance Mechanism (GRM). 		
Operation Phase According to the traffic volume forecast results along the route of the project in 2027-2047 will affect the 24-hour average noise level in the range of 57.5-70.7 decibels (A), which is not higher than the specified standard (not exceeding 70 decibels (A)). Therefore, it does not affect noise.	 Contractor's Responsibilities Noise barriers made of acrylic glass or a higher quality material shall be installed after the project route is completed at the bridge railing. The total distance of the noise barrier wall is 85 meters, 15 millimeters in width and 2 meters in height. This is to prevent sound impact on Thung Toh Yum Cemetery as there often are religious ceremonies. Install No Horn traffic signs at the bridge railing before approaching Thung Toh Yum Cemetery to minimize impact from noise during religious ceremony. DRR Responsibilities Conduct checkup and maintenance of the traffic surface to be in good conditions in order to minimize impact between wheels of vehicles and traffic surface. Maintain and check the conditions of the acrylic glass noise barrier at the bridge railing. Coordinate with local police in Krabi Province to strictly enforce laws on vehicles causing loud noises and to control the speed of vehicles using the project route according to the law. Should there be any complaints from the local population regarding loud noises from project activities, the DRR shall examine the causes of issues and mitigate accordingly. The DRR is required to communicate with the local population regarding the root cause, mitigation measures, and monitoring results through the project's Grievance Mechanism (GRM). 	Area of Implementation Throughout the bridge route Cost 1,236,070 THB (Covered under the action plan to prevent and mitigate impact on noise) Details of mitigation measures and monitoring program are provided in chapter 4 and 5.	DRR's ResponsibilitiesDRR to hire a third party-monitoring firmImplementation areas- Moo 8, Ban Hua Hin (Ban Tha Reua)- Thung Toh Yum CemeteryMeasurement Index- 1-hr average noise level (Leq 1 hr)- 24-hr average noise level (Leq 24-hr)- Maximum noise level (Lmax)- Average day-night noise level) (Ldn)Duration and frequency2 times/year for 5 consecutive days, covering rainy and dry seasons and 1 time/year Ein Year 1, 2, 3, 5, 10, 15, and 20 of the implementation phase.Cost:84,000 THB (12,000 THB / Year)
1.9 Vibration			
Pre-construction/Construction phases Construction activities that could cause vibration include land work, soil excavation, drilling of bored piles, and use of heavy trucks for transportation of materials and equipment. The assessment of vibration impact from construction activities followed the Guidance Manual for Transit Noise and Vibration Impact Assessment of the U.S. EPA (2006). Data was applied for 11 types of machinery ranging from a impact device pile driver, a jackhammer and small bulldozer, with	 <u>Contractor's Responsibilities</u> Construction activities that produce high vibration level must be operated only during the daytime between 8.30 AM – 17.30 hrs. Use suitable machinery, equipment and construction methods to reduce the impact of vibration. Strictly control the payload of trucks to be according to legislation. Conduct maintenance of damaged traffic surface, cracks or potholes on the project route as well as on temporary roads for diversion throughout the construction period. Ensure that machines and equipment are in good conditions. Control the speed of trucks while transporting through environmentally and socially sensitive areas. 	Area of Implementation The beginning of the project km. 0+000 to km. 0+500 Cost Included in the overall budget	DRR's Responsibilities DRR to hire a third party-monitoring firm Implementation areas - Moo 8, Ban Hua Hin (Ban Tha Reua) - Thung Toh Yum Cemetery Measurement Index

Environment and Social Components/ Impacts	Mitigation measures/ Responsibility	Area of Implementation/Cost	Monitoring Program/Responsibility/Cost ²
vibration effects (peak particle velocity or PPV) calculated at 7.62 meters (25 feet). Results were compared against national, German and British standards (Section 6.1.1). The results of the vibration analysis reveals the highest levels of vibration will be associated with construction of the lower and upper bridge structures. The Moo 8 Ban Hua Hin Pier (Ban Tha Rua) in Koh Klang is an area of concern and vibration impacts will need to be mitigated. The pre-mitigation significance of the negative vibration impact is assessed as moderate.	 Use bored piles instead of driven piles for construction near areas with a high density of households and communities. Install speed limit signs so that trucks transporting construction materials and equipment can decelerate prior to reaching communities zone and environmentally sensitive areas in order reduce vibration. Coordinate with highway police in controlling the speed limit and a load of trucks passing the project routes following the law by checking them continuously and strictly to mitigate vibration impacts. Contractor shall inspect the area, take photos and record data on the conditions of buildings and structures from the beginning of the project route at milestone 0+000 to milestone 0+500 prior to construction. The information regarding characteristics of buildings prior to construction can be used for verification and examination should there be complaints. Should there be complaints or damage to buildings or structures due to vibration levels caused by project activities, the contractor shall examine the issue and carry out mitigation measures immediately. 		 Peak Particle Velocity (PPV) (mm/sec) Frequency (Hz) Duration and frequency Quarterly for 5 consecutive days, covering rainy and dry seasons throughout the construction period Cost: 432,000 THB (144,000 THB / Year) Details of monitoring program are provided in chapter 5.
Operation Phase Vibration was assessed for 12 heavy vehicle types up to a weight of 50.5 tons driving at speeds from 45 to 80 km/h during the implementation phase. The maximum PPV ranged from 0.032 to 0.367 mm/s, which does not present a threat based on the national, German or British standards. This was assessed as a negative impact with low significance pre-mitigation.	 DRR Responsibilities The Department of Rural Roads control the payload of all vehicles using the road and conduct frequent monitoring. Check traffic surface conditions such as roughness, joints on the road surface or rough road surface. If found to be damaged, ensure that the road surface is repaired to be in good condition in order to minimize the shock between vehicle wheels and road surface. Conduct maintenance of traffic surface, road shoulder, traffic markings, milestones, bridge, lighting to be in good conditions. Inspect the installation of traffic signs and symbols that they are sufficient and in good conditions and can be viewed from a far distance. This shall be in place especially at key areas such as road intersections. There shall be warning signs of distances to the intersection so that road users can select traffic lanes accordingly. There shall be designations of traffic signs, road diversions, speed limit of vehicles prior to the start of road maintenance in order to facilitate convenience for transportation and prevent accidents of road users. The contractor/companies shall install warning signs at least 1,000 meters prior to the position of maintenance work should there be maintenance of traffic surface, road shoulder, or road embankment, in order to minimize accidents on the route. The Department of Rural Roads shall coordinate with relevant agencies comprising of Krabi Provincial Police Station and Highway Police to allocate officials to monitor that road users do not exceed the speed limit as prescribed by law. 	Area of Implementation The beginning of the project km. 0+000 to km. 0+500 Cost Included in the overall mitigation budget	- None
2. Biodiversity 2.1 Ecosystem 2.2.1 Terrestrial ecosystem			
 Pre-construction/Construction phases The project passes through a habitat that transforms into a mangrove and is declared as the Thung Thale Non-Hunting Area. The area is also recognized as a Mangrove Forest and a National Forest Area. Mu ko Lanta National Park occurs nearby but is outside of the project footprint. These areas support a wide diversity of species and represent sensitive biodiversity features. Construction of the project will involve increased presence of people, transportation of materials, heavy vehicle movement, air quality, noise and vibration impacts, potential pollution from oil spillage, lighting, felling of trees and clearing of vegetation. A construction workforce of 170 people will be accommodated on site for 3 years and will create a demand for natural resources. Workers may engage in illegally harvested products. The wildlife species will need protection from hunters but 	 Contractor's Responsibilities The impact on terrestrial ecosystems is interlinked to the impact on plants and animals of the ecosystem. Therefore, there shall be mitigation measures implemented along with mitigation measures to prevent impact on plants and animals of the ecosystems. Contractors must develop vegetation clearance plans for submission to the PMU/PIU before clearing forest/mangrove vegetation. This involves a preclearance survey conducted by the Contractor's environmental specialist to confirm the absence of sensitive flora/fauna species or to identify those requiring relocation. The Contractor Responsibility section should also explicitly prohibit hunting and fishing. Clearly designate construction sites and control construction workers to only operate within the designated site. Chopping of trees and clearing of plants/groundcover plants shall be done only in areas that are necessary. Specify regulations prohibiting staff of the contractor company or relevant persons in the area from committing any act that will inflict damage upon forest resources, wildlife and other natural resources. The regulations shall be strictly abided by. 	Implementation Areas Projet construction sites and ancilary facilities Cost Included in the overall mitigation budget.	-None

Environment and Social Components/ Impacts	Mitigation measures/ Responsibility	Area of Implemen
are small, agile, can hide well and able adapt to changes in the environment. The disturbance created by construction activities is assessed as a negative impact with moderate significance pre- mitigation. Impacts on mangrove and trees are discussed in the <i>Section</i> <i>on Flora</i> .	 In case of wildlife sighting in the project area during the construction period, the animal shall be allowed to leave the area through a safe route, or the project can seek assistance from relevant organizations such as Mu Koh Lanta National Park, Krabi Natural Resources and Environment Office, and the 12th Forest Resources Management Office in Krabi Province so that the wild animals can be released in appropriate ecosystem in the vicinity. 	
Operation Phase Activities during the implementation phase will include regular maintenance of the bridge and road conditions to improve or add facilities for road users. There will be no cutting of trees or use of forest areas. No direct impacts to the terrestrial habitat and associated protected areas are expected.	DRR Responsibilities For the road operation and maintenance, strictly comply with prevention and correction measures for impacts on plants and animals in the ecosystem.	Implementation Area Project site
2.2.2 Marine Aquatic Ecology		
 Pre-construction/Construction phases Results from the marine aquatic ecology survey indicated medium-high abundance for phytoplankton, medium-high for zooplankton, low-medium for benthic fauna and low for fish and fish larvae. A total of 13 families, 16 genera, and 18 species of fish were found. Commonly found species in the area include Scaly Goby, Gray Mullet, Striped Cone Mushroom, Dok Mak, Pan-shaped Snapper, Striped Snapper, etc., A specie of near-threatened fish was detected, i.e. Brown-spotted grouper (Epinephelus coioides) Development of the bridge requires construction of 17 pier structures in the marine environment. This will cause turbidity and dispersal of sediments which will disrupt the growth of sunlight dependent plants and corals. Polymer solution used to bind soils for boring piles could spill and contaminate the marine environment, similarly oils could spill from machinery, but the likelihood is low. Impacts will be short term and localized but influenced by the velocity and flow direction of currents as described under the Oceanography impacts. The premitigation significance of this negative impact is assessed as moderate. 	Contractor's Responsibilities - Strictly adhere to mitigation measures for soil and erosion, surface water, marine water quality and oceanography impact. - Adhere to the Marine Mammal Observation measure requirements outlined in Section 2.4.	Implementation Arear Bridge construction route Cost Included in mitigation me surface water, marine of oceanography impact
Operation Phase During the implementation phase there will be movement of vehicles, bridge maintenance and emergency work. These activities will be restricted to the existing infrastructure and there will be no changes to the marine ecosystem, including coral reefs and sea grass meadows. In	DRR Responsibilities - DRR shall provide sufficient trash cans for solid waste at parking areas in Koh Klang and shall coordinate with Koh Klang Sub-district Administrative Organization for regular waste collection.	Implementation Areas Project area

nplementation/Cost	Monitoring Program/Responsibility/Cost ²
Area	- None
	DRR's Responsibilities
Arear	DRR to hire a third party-monitoring firm
ion route	Implementation areas: Three Stations
ation measures for erosion, marine water quality and npact	 Station 1: Coast of Ban Hua Hin, Koh Klang sub-district Station 2: Coast of Koh Pling Station 3: Coast of Thung Toh Yum Measurement Indexes: Five Indexes
	 Phytoplankton Zooplankton Benthic Fauna Aquatic Plant Species Fish
	Implementation period:
	Quarterly, covering the rainy and dry seasons throughout the construction period, especially when construction activities are taking place near the water source.
	Cost:
	702,000 THB (234,000 THB / Year)
	Details of monitoring program are provided in chapter 5.
Areas	None

vent spills of chemicals or types of fuels in the event of accidents of vehicles transporting	
or example, there shall be appropriate absorbent materials and containers on the highway o contain the severity of the accident.	Cost Included in the overall bud
on measures for impacts on wildlife. earing plants shall only be executed as required by the construction project. e forests shall be implemented following the regulations of Department of Marine and 56 and 2564) [2013 and 2021] as follows: budget for the Department of Marine and Coastal Resources DMCR for replantation of is of not less than 20 times of the affected areas (1x20 = 20 rai). Competent officer/s of sponsible for a survey, selection of replantation areas and mangrove species. rate budget for the DMCR for 5 years operation and maintenance of the replantation elect situable replantation areas to offset the affected mangrove forest areas. rest or mangrove habitat will occur in Krabi Province, ideally near the project site (see .:.3). on requirements and budget is presented in the Section on Flora. grass lilities pridge pier, ensure that the pier orientation does not occupy coral and seagrass territories. and correction measures for impacts on Marine water quality and soil resources. ndition of various machinery used in construction to prevent oil from spilling into the sea requipment maintenance guidelines. Is ha anvigation route or campaign to avoid navigation through the sea grass line and ea grass boundary line. astewater into the sea and ensure that the discharged wastewater is treated and complies 'standards, supported by documented proof of testing. n activities in corals and sea grasses areas. tromotion of Marine and Coastal Resources Management B.E. 2558 [A.D 2015]. by the coral reefs and sea grass oras. traste, sewage, wastewater, and pollution into the sea that may affect the quality of sea the coral. channels in coral reefs. at cause sediment that could cause damage to corals and sea grass.	Included in the overall bud Implementation Areas Project area Cost Included in the overall bud
	n measures for impacts on wildlife. aring plants shall only be executed as required by the construction project. forests shall be implemented following the regulations of Department of Marine and 6 and 2564) [2013 and 2021] as follows: udget for the Department of Marine and Coastal Resources DMCR for replantation of i of not less than 20 times of the affected areas (1x20 - 20 rai). Competent officer/s of ponsible for a survey, selection of replantation areas and mangrove species. ste budget for the DMCR for 5 years operation and maintenance of the replantation lect situable replantation areas to offset the affected margrove forest areas. est or mangrove habitat will occur in Krabi Province, ideally near the project site (see 3). <i>n requirements and budget is presented in the Section on Flora.</i> grass litics ridge pier, ensure that the pier orientation does not occupy coral and seagrass territories. and correction measures for impacts on Marine water quality and soil resources. didition of various machinery used in construction to prevent oil from spilling into the sea quipment maintenance guidelines. sh a navigation route or campaign to avoid navigation through the sea grass line and a grass boundary line. stewater into the sea and ensure that the discharged wastewater is treated and complies standards, supported by documented proof of testing. activities in corals and sea grass locations. aste, swage, wastewater, and pollution into the sea that may affect the quality of sea he coral. charges and sea grass locations. at cause sediment that could cause damage to corals and sea grass. n area and ensure the contractor carries out construction only within the designated

ation/Cost	Monitoring Program/Responsibility/Cost ²
dget	
	Details of mangrove replantation monitoring and budget is presented in the Section on Flora.
dget	

Environment and Social Components/ Impacts	Mitigation measures/ Responsibility	Area of Implementation/0
	 Refrain from feeding fish and other marine life in the coral reefs. Refrain from stepping on corals and sea grass. Install safety net and equipment to prevent falling of materials /objects into the sea. Prevent leakage of polymers into the sea during underwater foundation pile casting by installing an extended casing on top of the foundation pile steel casing. Construction workers are prohibited from dumping wastes and material scraps and machine washing water into the sea. DRR to provide financial support for the DMCR to carry out awareness raising on corals and seagrass through educational program/ campaigns/and disseminate knowledge about coral and seagrass. Public relations materials should be produced to approach targeted groups such as fishermen or those exploiting coral, seagrass and the general public to create awareness regarding the significance of corals, seagrass and coastal resources, as well as encourage participation in conserving, preventing and correcting any issues or threats, to preserve the condition of the coral and seagrass. 	
2.2.3 Coastal ecology	None	
Operation Phase		
There will be no cutting of trees during the implementation phase therefore no impact to the marine coastal environment is expected.		
2.2.4 Terrestrial Fauna		
Pre-construction/Construction phases	DRR Responsibilities	
- Field surveys have identified 80 species of amphibians, reptiles, birds and mammals in the project area. The majority are associated with wetland or human-modified habitats. Out of 80 species found, 59 of them are protected species as classified by Thai laws. These including Smooth-coated otter and Long-tailed Macaque.	 Coordinate with concerned agencies include DMCR, Koh Lanta National Park, Thung Thale Non-Hunting Areas, Krabi Provincial Natural Resources and Environment Office, and Forest Resources Management Office 12 Krabi to provide information on construction plan, project areas, construction activities, and improtant measures to manage environmental and social impacts. 	Implementation Area The project construction areas wl include community areas, agricult areas, mangrove forests and shall
Smooth-coated Otter is designated Vunerable (VU) status on IUCN Red List and per the Office Natural Resources and Environment Policy and Planning (ONEP) criteria (2017). They have an elusive behavior and are able to avoid areas of human activity. Construction activity will create considerable noise and vibration disturbance which will	 The Department of Rural Roads allocates budget for the Thung Thale Non-hunting area to control the population of long-tailed macaque and the restoration of ecosystems and habitats of monkeys as appropriate. This is to prevent effects on the residents and tourists. <u>Contractor's Responsibilities</u> 	Cost Included in the overall mitigation
 drive otters away from their local habitats and foraging areas. Vibration impacts could also impact fish which are the food source for otters. The impact to otters is assessed as moderate. Long-tailed Macaque is protected species under Thai laws and is recently designed of EN status on the WCN Bad Lite (2022). However, long-tailed 	 Strictly comply with prevention and correction measures for impacts on rare species (marine mammal), terrestrial ecosystem and flora. Contractors shall strictly comply with forest resources, wildlife and environment regulations enforced in the area. They shall refrain from inappropriate behaviors such as shooting guns, setting off firecrackers, hunting wild animals in the project and adjacent areas, lighting fires that may spread to adjacent areas, allow other people do anything on their 	
designated EN status on the IUCN Red List (2022). However, Long-tailed Macaque are abundant at both ends of the bridge and their presence is considered a problem as they steal food and injure tourists and the Thung Thale Non-Hunting Areas authorities have requested funds for ethical management of the population through sterilization to minimize the human-macaque conflict. During construction, a camp will be established to accommodate 229 workers at the project site. Long-tailed Macaque could be exposed to limited impacts through scavenging from	 behalf without informing the DRR and relevant administrative authorities. Clearly define the construction area and ensure the contractor carries out construction only within the specific area. Cutting down trees and clearing plants shall be executed as required by the construction project. Refrain from cutting down trees where birds are nesting (for both nests use various materials and hollow nests on the trunk). Birds shall be allowed to carry on with activities such as laying eggs and raising their youngsters until completed. Officials or construction workers are prohibited from trapping or hunting wild animals in the project area throughout the project's construction period. 	
the construction camp, however mitigation can be applied to avoid significant impacts.	 In case of wildlife sighting in the project area during the construction period, the animal shall be allowed to leave the area through a safe route, or the project can seek assistance from relevant organizations such as Mu Koh Lanta 	

lementation/Cost	Monitoring Program/Responsibility/Cost ²
	None
ea Iction areas which areas, agricultural rests and shallow waters	DRR's Responsibilities DRR to hire a third party-monitoring firm Monitoring locations 500 m strips from project alignment
rall mitigation budget	 Monitoring parameters Diversity Distribution & abundance Status Landuse and state of habitat and food sources Records of animal injuries & deaths (animal species, number, incident location, cause of injuries & death, etc.)
	 Duration 2 times/ year covering rainy and dry seasons throughout construction period

Environment and Social Components/ Impacts	Mitigation measures/ Responsibility	Area of Implementation/Cost	Monitoring Program/Responsibility/Cost ²
	 National Park, Krabi Natural Resources and Environment Office, and the 12th Forest Resources Management Office in Krabi Province so that the wild animals can be released in appropriate ecosystem in the vicinity. In case of sighting of young animal of mammals such as the smooth-coated otter or long-tailed macaque, they shall be left alone as usually the mother hides in the vicinity, and they will return to their young at night time and bring them to safety. Provide useful equipment for construction workers and employees working in the area in case wild animals are found as follow: Provide gloves to minimize injuries from bites or scratches of wild animals. Provide brooms, brushes made from soft natural materials for using to push, poke, or brush small wild animals such as small mammals, amphibians and reptiles. Provide clean towels that are not contaminated with chemicals or dust. Provide small, ventilated plastic containers with a lid to keep small wild animals/young animals that are injured or abandoned before sending them to relevant authorities. Small paper boxes can be used as temporary shelter for small birds. Put up signs prohibiting the feeding of monkeys in order to minimize conflict between humans and wild animals. This shall mitigate impact on changes of animal behavior due to viewpoints from the project. Install warning signs for deceleration or speed limit to prevent accidents of crashing into wild animals or monkeys crossing the road. Provide bins that do not allow monkeys to delve in to take trash. Install signs to avoid honking or prohibiting honking to minimize sound impact for wild animals and habitats. Contractor shall consider methods to cause the least possible vibration, especially at the level from ground surface to the depth of 50 centimeters which is where there is the distribution of benthic animals. Control traffic within the project area and outside the project area, manage the		Cost: 900,000 THB (300,000 THB/Year) Details of monitoring program are provided in chapter 5.
Operation Phase During the implementation phase, there are activities of transportation, regular maintenance, scheduled maintenance, special maintenance, rehabilitation, or emergency work. These activities only occur on the road surface within the project road zone. There are no construction activities nor land use in the forest areas. Otters may benefit from reduced disturbance within their foraging areas from reduced movement of ferries. The Koh Lanta Bridge is designed to attract tourists and during the implementation phase the project may exacerbate the Macaque-tourist conflict and raise additional pressure on TTNHA authorities to further control the numbers of Long-tailed Macaque. However mitigation can be applied to avoid significant impacts. The monkey groups are territorial and there is a low likelihood of individuals moving between the sub-districts as a result of the bridge construction and operation.	 DRR Responsibilities Strictly comply with prevention and correction measures for impacts on air, noise and vibration to minimize impacts on communities and wildlife. Limit vehicle speed to 80 km/hr to reduce noise disturbance from interaction of vehicle tire and road surface on wildlife especially during birds migratory season (October – November and March – April). Install lighting sources on the bridge connecting Lanta Island as necessary for road safety. Ensure that the lighting sources feature sodium light, which wavelengths attract insects the least and is a focused light beam. Additionally, use highway traffic signs and/or symbols, including lines, edge lines, and lane dividers that reflect light from vehicle lights. Provide 240-liter waste bin with a lid and a steel mesh cage to prevent monkeys from digging through garbage at parking space near bridge view points entrance (on both left and right side). Each set should comprise separated bin for 4 categories of waste: biodegradable waste, hazardous waste, general waste and recyclable waste. 	Area of Implementation throughout the bridge route Cost Included in the overall mitigation budget	DRR's ResponsibilitiesDRR to hire a third party-monitoring firmMonitoring locations500 m strips from project alignmentMonitoring parameters- Diversity- Distribution & abundance- Status- Landuse and state of habitat and food sources- Records of animal injuries & deaths (animal species, number, incident location, cause of injuries & death, etc.)Duration2 times/ year covering rainy and dry seasons in Year 1, 2, 3, 5, 10, 15 and 20 of project operation periodCost: 2,100,000 THB (300,000 THB/Year)

Environment and Social Components/ Impacts	Mitigation measures/ Responsibility	Area of Implementation/Cost	Monitoring Program/Responsibility/Cost ²
2.3 Flora			
 Pre-construction/Construction phases The project route at km. 1+958 - km. 2+527 will negatively impact 4.0 rai (0.282 km) of forest resources in Pa Lang Sot / Pa Kuan Ba Kan Ko National Conserved Forest. During construction, the project will need to remove 40 large trees for construction of the bridge approach slabs. These do not include any threatened species according to national and IUCN Red List. Trees in the adjacent areas will be trimmed to a size not more than 4 meters to avoid branches grating against utility poles and suspended wires. The trees needing to be cleared include 37 mangrove trees from six species (Rhizophora apiculata, Xylocarpus granatum, Xylocarpus moluccensis, Ceriops tagal, Dillenia obovata and Avicennia alba) and three terrestrial trees. The terrestrial and mangrove habitat in the construction footprint is relatively open and is also considered a modified habitat. The mangrove species are listed as restricted woods by the Department of National Parks, Wildlife and Plant Conservation (DNP 2017). Removal of restricted woods requires a logging permit issued by the Director-General of the Royal Forest Department (RFD). The project route at km.1+828-km. 1+957 will cut through 1.2 rai (0.129 km) of mangrove forest area according to the cabinet resolution B.E. 2543 (2000) on Koh Lanta Noi. A healthy mangrove ecosystem exists in the greater area of Lanta District, however mangrove vegetation associated with the project route has been anthropogenically affected and is relatively exposed. 	 Contractor's Responsibilities Coordinate with the staff of the Royal Forest Department in examining strictly-defined boundaries for the construction area prior to start of construction/site preparation. Clearly define the construction area and ensure the contractor carries out construction only within the construction area. The contractor shall establish a list of plant species in the road zone for examination of number of trees and positions of trees that have to be removed from the area. The coordinates, species, number, size, height, and area found shall be clearly detailed. There shall be markings on trees to be removed in order to avoid an unnecessary cutting of trees outside the construction zone. Clearance of trees should follow good logging practices. The direction/position for tree felling shall be contained within the construction areas to avoid damage to other trees outside of construction areas. Debris and scrap materials shall be completely cleared from the area. Specify regulations prohibiting staff of the contractor company or other relevant persons in the area from committing any act that will inflict damage upon forest resources, wildlife and other natural resources. The regulations shall be strictly abided by. The cutting down of five types of restricted wood under criteria A (general restricted wood) namely, Rhizophora apiculata Blume, Xylocarpus granatum Koen, Xylocarpus moluccensis (Lam.), Ceriops tagal (Perr.) C.B.Rob., and Dillenia obovata (Blume) Hoogland, shall follow regulations of the Royal Forest Department and the Ministerial Regulation on Seeking Permission and Issuing Permission on Logging of Restricted Wood, B.E. 2560 (2017). 	 Implementation Areas Project Areas including worker camps, other anciliary facilties. Cost Include in overall mitigation cost 	DRR Responsibilities DRR to hire a third party-monitoring firm under DRR supervision or the Thai Forest Industry Organization (FIO) supervision in case of felling of restricted tree species. Monitoring area: - Project construction route Km1+958 – Km 2+527 (0.569 Km distance) Monitoring parameters: - Record of number and type of trees removed from the construction area. Timeline: - Keep track of logging within the construction site every time the timber is cut and hauled out of the area. Cost: 30,000 THB (10,000 THB/Year)
 Overall negative impacts on flora is assessed to be of moderate significant. National EIA requires the Project to replant the affected forest and mangrove forest with a ratio of (3:1) for terrestial forest affected and 20:1 for mangrove forest affected. This mitigation is therefore expected to exceed the scope of the impact and yield a net gain outcome for mangroves and forest as a result of the project. 	 DRR Responsibilities (with Support from DMCR and RFD) Mangrove Replantation (More Details are presented in the Action Plan for Mangrove Replantation) DRR to allocate budget for the DMCR for replantation of mangrove forests of not less than 20 times of the affected areas (1x20 = 20 rai). Competent officer/s of DMCR will be responsible for a survey, selection of replantation areas and mangrove species. DRR to also allocate budget for the DMCR for 5 years maintenance of the replantation plots. DMCR to select situable replantation areas to offset the affected mangrove forest areas. Priority should be given to mangrove replantation areas located within the project province or nearby province, respectively. Mangrove replantation shall follow DMCR Order on Replantation and maintenance of mangrove forests for conservation or environmental preservation B.E. 2556 (2013) and DMCR Order on Mangrove Plantation and Maintenance B.E. 2564 (2021). Reforestation (National Reserved Forest) (More Details are presented in the Action Plan Forest Replantation (National Reserved Forest) The Department of Rural Roads must set a budget for the Royal Forest Department to implement the reforestation three times (4x3 = 12 rai) of the lost forest. The reforestation will be undertaken in the project area or other degraded forests especially in the National Reserved Forest near the project development. There shall also be the maintenance of planted seedlings, replanting to replace dead plants, and preventing wildfires that may occur. The Department of Rural Roads to coordinate with the Royal Forest Department in supporting the expenses for the reforestation in the first year of implementation phase and maintenance phase (Age 2-10 years) for 9 years. The 	 Implementation areas Mangrove replantation areas to be identified by the DMCR. Forest replantation areas to be identified by the RFD. Cost (The estimated cost covers both construction and operation phases) Mangrove replantation: 698,640 THB (Covered under the action plan on mangrove replantation) Forest replantation in National Reserved Forest: 274,624 THB (Covered under the action plan on forest replantation (national reserved forest) Details of mitigation measures and monitoring program are provided in chapter 4 and 5. 	DRR Responsibilities Requirements for monitoring and reporting and cost for mangrove replantation and forest replantation are covered in "Action Plan for Mangrove Replantation" and "Action Plan Forest Replantation (National Reserved Forest").

Environment and Social Components/ Impacts	Mitigation measures/ Responsibility	Area of Implementation/Cost	Monitoring Program/Responsibility/Cost ²
	Royal Forest Department will consider the suitable areas for the reforestation due to the lost forest from the project development.		
Operation Phase Most transportation and maintenance work operated on the road surface do not require cutting of trees are cut and clearing of the area. No significant impacts to plants are anticipated during the implementation phase.	DRR Responsibilities (with Support from DMCR and RFD) Mangrove Replantation (More Details are presented in the Environmental Action Plan – Mangrove Replantation Action Plan) Department of Rural Roads to set up a budget for the Department of Marine and Coastal Resources for maintenance of mangrove trees. After planting, weeds must be cleared around the base of the tree at least once a year and other pests shall be eliminated as deemed necessary. Count the survival rate and immediately plant trees to replace the dead ones or the dying trees after clearing, weeding or other pest control. Reforestation (National Reserved Forest) (More Details are presented in the Environmental Action Plan – Reforestration Action Plan) Department of Rural Roads to set up a budget for the Royal Forest Department for maintenance of reforestration plots. Efforts should be made to ensure that trees are proper maintained with sufficient watering, weed control, fertilization. Regular fertilization with 15-30-15 fertilizer every 2-3 weeks for the 1st three months period should be applied to accelerate growth and the expansion of the roots. In case of dead plants, the repair or replanting to replace dead trees must be undertaken.	 Implementation areas Mangrove replantation areas to be identified by the DMCR. Reforestration areas to be identified by the RFD. Cost Covered in the above costing 	DRR Responsibilities DRR to hire a third party-monitoring firm Monitoring area: - At the areas where there are replanting of trees in the Project road Right-of-Way and Project forest replantation areas. Monitoring parameters: - Number and growing conditions of replanted trees. - Tree mortality number - Size of replantation areas Timeline: Once a year in Year 1, 2, 3, 5, 10, 15, and 20 of the implementation period. Cost: 70,000 THB (10,000 THB/Year) Requirements for monitoring and reporting and cost for mangrove replantation and forest replantation are covered in "Action Plan for Mangrove Replantation" and "Action Plan Forest Replantation (National Reserved Forest").
2.4 Rare Species			
Pre-construction/Construction phases Impacts on Marine Mammals Field survey conducted during EIA preparation (in February 2021 (dry season) and June 2021 (monsoon season)) did not observe rare animal species in the project route and nearby areas. A pod of 13 Indo-Pacific dolphins and females with infants were observed in area close to the eastern coast of Lanta Yai Island away from the project site. However, the interview with fishing communities and the Thung Thale Non- Hunting Areas authority indicated that a pod of 4-5 to 6-7 Indo-Pacific humpback dolphins (Sousa chinensis), and a pod of Indo-Pacific bottlenose dolphins (Tursiops aduncus) were observed near the project site during monsoon season. Both Indo-Pacific humpback dolphins and Indo-Pacific bottlenose dolphins are listed as protected wildlife, according to the Wildlife Preservation and Protection Act B.E. 2562 (2019). Indo-Pacific humpback dolphins and Indo-Pacific bottlenose dolphins are considered Vulnerable (VU) and Near Threatened (NT), respectively under IUCN Red List of Threatened Species.	DRR's responsibilities • DRR to develop the Terms of Reference (ToR) for a Marine Mammal Observation (MMO) Plan for clearance by the Bank before commencement of pile installation. Contractor's Responsibilities Measures for Impacts on Marine Mammals • The contractor must prepare a Marine Mammal Observation (MMO) Plan for approval by the DRR PIU/PMU and the Bank before start of construction. • Avoid the construction of bridge foundations during the monsoon months of May-September to prevent impacts on the swimming path of bottlenose and humpback dolphins. • If dolphins are seen within 500 m of the construction site, all construction activities shall be immediately put on hold until the dolphins move to more than 500 m outside of the construction area. • Contractor shall follow the following measures to prevent impacts on bottlenose dolphin and the Indo-Pacific humpbacked dolphin:	Implementation areas Dolphins observation zone including bridge construction areas Cost - For dolphins observation: 345,000 THB - For terrestrial animals: included in overall budget. Details of mitigation measures and monitoring program are provided in chapter 4 and 5.	 DRR's Responsibilities DRR to hire a third party-monitoring firm Implementation area: Area along the project route, km. 0+000-km. 2+527, within 500 m. from the project route, especially in the north and south of the Koh Lanta Bridge construction site, including the area along the project bridge Monitoring Index: For terrestrial animals Species diversity Relative abundance Status of Wildlife

Environment and Social Components/ Impacts	Mitigation measures/ Responsibility	Area of Implementa
During construction the drilling of bridge pier structures the noise and vibration will have an underwater impact which could affect the hearing and behavior of dolphins. They could be injured by boats from the water transportation of materials and equipment. Dolphins can flee the area, but the impact is assessed as moderate.	 Establish dolphins observation zone (bridge route and two roles of 500 m strips along both sides of brdige route). Conduct boat survey in the observation zone and stop to observe dolphins at every 500 m. The observer shall use a binoccular to survey on the water surface onboard the ship. Contractor shall also construct elevated platforms at least 5 meters above the water line on each end of the bridge construction site and position observers searching with hand-held binoculars on elevated platforms. 	
Impacts on Rare Terrestrial Animals Field survey during EIA preparation observed 5 terrestrial mammal species including Smooth-coated otter and Long-tailed Macaque. Smooth-coated Otter is designated Vunerable (VU) status on IUCN Red List and per the Office Natural Resources and Environment Policy and Planning (ONEP) criteria (2017). They have an elusive behavior and are able to avoid areas of human activity. Construction activity will create considerable noise and vibration disturbance which will drive otters away from their local habitats and foraging areas. Vibration impacts could also impact fish which are the food source for otters. The impact to otters is assessed as moderate. Long-tailed Macaque is protected species under Thai laws and is recently designated EN status on the IUCN Red List (2022). However, Long-tailed Macaque are abundant at both ends of the bridge and their presence is considered a problem as they steal food and injure tourists and the Thung Thale Non-Hunting Areas authorities have requested funds for ethical management of the population through sterilization to minimize the human-macaque conflict. During construction, a camp will be established to accommodate 229 workers at the project site. Long-tailed Macaque could be exposed to limited impacts through scavenging from the construction camp, however mitigation can be applied to avoid significant impacts.	 Establish communication procedures between the observers and piling crew/construction team, including a formal chain of communication between the observers and the person who can stop the piling operation. The observation zone should be monitored visually by observers for an agreed period prior to the commencement of piling. Piling should not be commenced if dolphins are detected within the observation zone. If a dolphin is found entering the observation area, the observer shall immediately notify the construction team by phone to suspend construction activities temporarily. Continue the observation and note-taking until dolphins leave the surveillance zone. If there is a pause in the piling operations for a period of greater than 10 minutes, then the pre-piling search should be repeated before piling recommences. A 20 km/hour speed limit should be established for boats under normal conditions and 10 km/hour when dolphins are detected in the area. Washing/cleaning of tools/machines and disposing of garbage, chemicals and used engine oil in sea water is prohibited. Store materials and equipment used in construction in an orderly and neatly manner and in a suitable place to prevent them from falling into the sea. If rare marine animals such as dolphins, and sea turtles, are found stranded, contact the 10th Office of Marine and Coastal Resources for further actions and assistance. Measures for Impacts on Smooth-coated Otter (Lutrogale perspcillato) Strictly comply with preventive and corrective measures for impacts on the aquatic ecosystem, aquatic and terrestrial fauna and flora. Clearly define the construction area and ensure the contractor carries out construction only within the construction neae. Cutting down trees and clearing plants shall only be executed as required by the construction period. They shall be given opportunities	

tation/Cost	Monitoring Program/Responsibility/Cost ²
	 The frequency of wild animals entering the project area Instances of accidents among wildlife The damage pertains to the type/number of wild animals involved in each accident, injury, death, and accident area.
	For dolphin: Contractor to implement dolphin observation measures in mitigation section .
	Monitoring period:
	- For terrestrial animals: 2 times/Year
	 For dolphin observation: Throughout bridge foundation construction period especially rainy season (Jun – Dec)
	Cost:
	Terrestrial animals: 2,070, 000 THB (690,000 THB/Year)

 Provide clean towels that are not cor containers with a lid to keep small wi sending them to relevant authorities Contractors consider reducing vibrations especially from the surface level lane to a Smooth-coated Otter are commonly foun Arrange parking areas for vehicles transport construction area, especially to be distant of smooth-coated otters are found. This is disturbances. Onenings (if any) caused by the finished of 	taminated with chemicals or dust. Provide small, ventilated plastic ld animals/young animals that are injured or abandoned before Small paper boxes can be used as temporary shelter for small birds. mentioned above passing through such a medium to the minimum, depth of about 50 cm., where benthic animals that are food for d. prting workers/mechanics and construction materials to be in the	
A subscription of the minister of animals from falling (especially smooth-co Measures to mitigate impacts on Long-tailed Maca	from wildlife areas where, foot marks, dung piles, and tumble traces to reduce the impact of visualized appearance and noise iling work must be covered or closed immediately to prevent wild bated otters). gue are included in mitigation measures for Terrestrial Fauna.	
Operation Phase None		
There will be no underwater noise emissions during the implementation phase and there will be reduced boat activity as there will be reduced dependence on ferry services. The bridge could therefore have a positive impact on dolphins. Most transportation and maintenance activities are conducted on the road/bridge surface. No sigficant impacts is anticipated from the Project operation.		

ementation/Cost	Monitoring Program/Responsibility/Cost ²
	DRR's Responsibilities DRR to hire a third party-monitoring firm
	 Monitoring locations: Area along the project route, km. 0+000- km. 2+527, within 500 m. from the project route, especially in the north and south of the Koh Lanta Bridge construction site, including the area along the project bridge
	Monitoring Index:
	For terrestrial animals:
	 Species diversities Relative abundance Status of Wildlife The frequency of wild animals entering the project area Instances of accidents among wildlife The occurred damage pertains to the type/number of wild animals involved in each accident, injury or death and accident area.
	For Dolphins:
	Follow dolphin monitoring measures in mitigation section.
	Monitoring period:
	2 time/year in Year 1, 2, 3, 5, 10, 15, and 20 of implementation period.
	Cost:
	- Terrestrial animals: 1,330,000 THB (190,000 THB/Year)

Environment and Social Components/ Impacts	Mitigation measures/ Responsibility	Area of Implement
3. Human use value		
3.1 Transportation		
Pre-construction/Construction phases		
Land transportation Site preparation and project construction activities could disrupt traffic on the project transport routes include Highway No. 4206 which is the main transportation routes to Koh Lanta and rural road Gor Bor. 5035 which is one of the main transportation routes in Koh Lanta. Currently, Service Level of these two roads are classified as Level C (stable flow, at or near free flow). The ability of road user to maneuver through Level C lanes is noticeably restricted. The estimated incremental traffic from project activities (22 trips/day of heavy trucks and 3 trips /day of workers transport car) will not change the road service level. However, project construction activities include site preparation, piling of construction materials, construction equipment, construction vehicles/machinery movement could pose adverse impacts and disrupt road transport. Therefore, negative impacts significance on land transportation is considered as moderate. Impacts on water transport At present travels from Koh Klang sub-district to Koh Lanta Noi sub-	 Land transportation Contractor's Responsibilities Regularly keep local communities informed about project work plan/construction plan throughout Pre-construction and Construction Periods. Prepare a large and visible PR signboards with details including a map of the construction area, construction schedule, construction period, the construction ocntractor company, budget, address, and telephone number of the contractor and the owner (Department of Rural Roads). The signboards shall be Installed 2 months before construction, at 2 locations, namely at the beginning of project construction (km. 0+000) and the end of construction (km. 2+527). Preparing a traffic management plan prior to the project construction by installing barriers, cones, traffic signs on the road surface, and warning signs in the construction area, as well as installing visible lights both during the day and at night, following guidelines for traffic control signs in construction work to prevent traffic hazards. The contractor must separate work zones from traffic zones with temporary concrete wall or barrier. Refelctive signs or flashing lights must be installed at the fence/barricade to ensure that they are clearly visible at night according to the guideline for traffic control signs in construction work to prevent traffic hazards. Safety nets must be installed below the bridge structure throughout the construction period, especially for bridge 	 <u>DRR Responsibilities</u> Area of Implementation Public relations target a Public Relation Section. Public relation: 260,00 under construction but
At present, travels from Koh Klang sub-district to Koh Lanta Noi sub- district require taking Highway No. 4206 and boarding a car ferry. Construction of the bridge piers at sea, which is a large structure, and water transportation of construction materials or large materials and other water transport of the project may obstruct or pose accident risks to local fishing boats, tourist boats and car ferry at the project route and nearby. The significance of risks and impacts on water transport is assessed to be at moderate level.	 works on the ground to prevent construction debris from falling and harming road users. Provide flagmen to facilitate the travel of vehicles along the project routes during construction activities in order to stop those transporting construction materials and equipment while entering and exiting or in areas where machines are moved, especially when passing community areas. Place stickers that provide information on contractor company, contact persion and phone number at the back of project construction vehicles and machines. Should the transportation of construction materials and equipment damage roads outside the project area, the project shall rehabilitate the roads back to its previous conditions immediately upon receipt of complaints from residents. The contractor is required to prepare a traffic management plan before starting the project construction. This includes providing barriers, cones, traffic signs on the road surface, and installing warning signs for the construction area, as well as installing light signals that are visible both during the day and at night, at least 500m. before reaching the construction area, especially at the intersection. Install a detour sign 300 m. before reaching the detour point. Ensure that the measures are continuously imposed throughout the construction period to reduce the impact of traffic as follows: At a distance of 1 km. before reaching the construction area (in the even that construction occupies the roadway and the traffic lane is reduced), install construction area (in the even that construction occupies the roadway and the traffic lane is reduced), install construction area (in the even that construction occupies the roadway and the traffic lane is reduced), install construction area (in the even that construction occupies the roadway and the traffic lane is reduced), install construction area (in the even that construction occupies the roadway and the traffic lane is reduced), install construction area (in	Contractor's Responsibilities Area of Implementation - Land and water transpor - Along the project ro km 2+527 - Construction sites of and the bridge appry in both Koh Klang Su Lanta Noi Subdistric - The waterways betw and Koh Lanta Noi w constructions are im Cost - Land transportation: 1 - Water transportatior (covered under Action Plai mitigate impacts on Transy Accidents, and Safety)

plementation/Cost	Monitoring Program/Responsibility/Cost ²
	- Dolphin: 665,000 THB (95,000 THB /Year)
<u>ties</u>	DRR's Responsibilities
ntation	DRR to hire a third party-monitoring firm
ns target areas: refer to) Section. n: 260,000 THB (covered uction budget)	Monitoring locations Transport routes include: - Highway 4206 - Rural road Gor Bor. 5035
	Monitoring Index
ponsibilities ntation er transportation:	 Number of vehicles used for transporting construction materials, sediment and equipment in all construction stages that enter and leave the project. Damages on project construction and project routes. Records of road accident including location, time, and the cause of the accident in the project route. Accident statisitics from local traffic
project route km 0+000 -	Duration and frequency
on sites of the connection idge approach structures In Klang Subdistrict and Koh Subdistrict. ways between Koh Klang anta Noi where the bridge ons are implemented.	 Daily throughout the construction period and reported to the PMU/Bank Cost: 180,000 THB (60,000 THB/Year)
ntation: 1,609,853 THB portation: 3,400,000 THB action Plan to prevent and on Transportation, afety)	

Environment and Social Components/ Impacts	Mitigation measures/ Responsibility	Area of Implementation/Cost	Monitoring Program/Responsibility/Cost ²
	 At a distance of 20 meters before leaving the construction area, install a sign indicating the end of the construction area and cones. Along the construction boundary, a speed reduction sign must be installed, or a concrete wall or barrier must be placed around the construction area. Install a warning sign or flashing lights visible to motorists from a distance of not less than 500 m. in normal visibility, starting from the edge of the road shoulder, and moving 50-60 centimeters, not more than 30 m. apart, throughout the construction boundary. Provide traffic signs, temporary traffic lights, construction boundary signs and deviations in accordance with the standard so that communities and road users can see them clearly both at daytime and nighttime and use the routes safely according to construction engineering standards. Set up a complaint center, a complaint box and public relations board for issues associated with the project at three locations include Project Site office. Koh Khlang SAO and Lanta Noi SAO. Control the speed limit of vehicles transporting construction materials and equipment not to exceed 30 km/h while passing communities and ensure that drivers of project vehicles strictly abide by traffic rules. Control transport construction materials not to exceed the limit load to avoid damage to transport routes. Avoid transport construction materials during rush hours (7.00-8.00 and 17.00-18.00 mk). Proceed with caution not to cause and/or minimize damage to the road surface on Highway No. 4206 and Rural Highway Gor Bor. 5035 or obstruct traffic. Utilize tarpaulin to cover the truck bed during transportation of sediments and construction materials to prevent sediments from falling off and to prevent dispersion of dust and sediments. The ends of the tarp or other materials used shall be at least 30 centimeters extending from the truck bed. Provide security/safety staff or coordinate with	Details of mitigation measures and monitoring program are provided in chapter 4 and 5.	
	Water transportation		
	 Contractor's Responsibilities The contractor shall notify and inform local fisher people/long tail boats, ferries, speed boats providing services for tourists about the project construction plan and activities. During the construction phase, the contractor shall coordinate with the Krabi Marine Department on project communication, specification of navigation channels through construction areas for boats to be cautious and lower the navigation speed. Avoid construction activities during rush hours from 7.00-8.00 and 17.00-18.00 hrs. The contractor shall strictly follow all regulations concerning navigation and use of docks. The contractor shall consider appropriate procedures and methods of construction that would encroach upon navigation channels as little as possible, especially for the construction section across Khlong Chong Laad. Khlong Chong Laad is currently used as a transportation route of car ferries for transfer between Ban Hua Hin Pier in Koh Klang Sub-district and Ban Khlong Mak Pier in Koh Lanta Noi Sub-district. Therefore, the following mitigation measures shall be implemented from the preparation of construction phase: Install flashing lights for buoys in the areas where the construction of bridge pier structures and temporary jetties take place. This is to mark the construction zone and allow a visibility from a distance of 500 meters to prevent accidents of water transportation. 		

Environment and Social Components/ Impacts	Mitigation measures/ Responsibility	Area of Implementation/Cost	Monitoring Program/Responsibility/Cost ²
	 Construct temporary jetties or pontoon along the shore by choosing a suitable construction method for the area. Ensure that he jetty structures are strong enough to bear weight and allow the water to flow without obstructing the waterways. There shall be a flag line with lights on the jetty or pontoon to act as a landmark, both during daytime and inpittime, for transportation asfety. At the Ban that in Pier area in Koh Kang Sub-district, the temporary jetty shall be 20 meters in length. In Koh Lanta Noi Sub-district which is a shallow area, the temporary jetty shall be 20 meters in length. In Koh Lanta Noi Sub-district which is a shallow area, the temporary jetty shall be 20 meters in length. Machines used in construction will be on the jetty or pontoon throughout the time of operation. Contractor shall ensure that pumping of mud from bored holes, concrete pouring and chemical application during construction are carried out win hose connected from the shoreline banks without being transported by boat or dumped into water sources. Provide 20 dock spaces for fishing boats/long-tail boats to temporarily dock at the side of Ban Hua Hin Pier. There shall be 20 moorings with a length of 60 meters. Casting of beams and slabs of the bridge shall portrude from the piers on either side in a balanced outstretched arm without scaffolding obstructing the water way in the middle of Khong Chong Lad canal. The construction of bridge piers and girders shall be constructed with appropriate methods and construction procedures to orduce the impact on water current. Set up measures to control and supervise the management of water traffic according to the Navigation in Thai Waters Act 1931 [BE:2540] of the Marine Department To taickin, the water source, which has a traffic route or a public passageway within Thai waters, Violations agains this will expose living organisms and the environment to toxickin. Wareever, anayigation on thai waters willo be loogar		

Environment and Social Components/ Impacts	Mitigation measures/ Responsibility	Area of Implementation/Cost	Monitoring Program/Responsibility/Cost ²
	DRR Responsibilities - The Department of Rural Roads shall control and monitor the implementation of contractors concerning the impact to the local population. There shall be weekly consultative meetings and evaluation of mitigation measures on impact from the construction. This aims to prevent impact and minimize impact for residents in the project area and road users of the project route.		
Operation Phase During implementation, the Koh Lanta Bridge route will provide transportation connectivity from north to south and alleviate current challenges associated with the car ferry service. Road users will be able to commute with increased convenience and elevate the safety standards for the public. The project will also boost economic development at the local and regional level and increase the capacity to accommodate growing numbers of tourists in the future. The impact on land transportation is assessed as positive. The bridge will affect the vehicle ferry service Ban Hua Hin Pier (Koh Lanta) to Khlong Maak Pier operated by Songserm Tran Service Company Limited. The Krabi Provincial Administrative Organization granted a concession to Songserm Tran Service Company Limited for a 3-year duration which ended in 2022 but have extended the contract to allow the operator to continue the service during the project construction phase. However, operation of the bridge will reduce the disruption of other water transportation and thus have a positive impact.	 DRR Responsibilities Inspect and maintain road surfaces, road shoulders, traffic lines, kilometer markers, bridges, and lighting to always be in good condition. Additionally, examine and ensure that direction signs and symbols are sufficient in number and in good and visible condition so they can be seen from a distance, especially at important points such as the connection point of the road network. There should be a notification indicating the distance so that motorists can plan the use of traffic lanes properly and safely. Sign indicating direction change and speed limitation must be installed before starting route maintenance to facilitate transportation and prevent accidents among road users. In case of maintenance of surface, road shoulder and embankment, construction companies/contractors are required to install warning signs at a distance of 1,000 m. in advance to prevent accidents from using the route. Bureau of Rural Roads, Krabi shall coordinate with relevant agencies, including officers from Krabi Police Station and officers from the highway patrol, in arranging for officers to supervise and ensure that tollway users are not allowed to drive faster than the limits prescribed by law. 	Area of Implementation Through out the bridge route Cost Included in the overall mitigation budget	DRR's Responsibilities DRR to hire a third party-monitoring firm Monitoring Locations - Highway 4206 - Rural roads Gor Bor. 5035 - Project bridge line (Km. 0+000-km. 2+527) Monitoring Index - Traffic volume on the project route . - Damages on project route. - Records of road accident including location, time, and the cause of the accident in the project route. Duration and frequency 1 time/year in Year 1, 2, 3, 5,10, 15 and 20 of the Project operation period. Cost: 210,000 THB (30,000 THB/Year)
3.2 Utility			
 Pre-construction/Construction phases Various public utilities will be affected, the most important being PEA electrical power distribution lines 33 kV across Khlong Chong Laad towards Koh Lanta Noi. The development of the Koh Lanta Bridge Project requires the relocation of various public utilities on both sides of the bridge. On Highway 4206, Koh Khlang side, 24 electric posts, 8 streetlight posts, 4 traffic signboards, and 600 m of communication lines will be relocated. On Koh Lanta Noi side, 8 electric posts, 340 m of communication line, and cross drain (15 m of 0.80 m RCP pipe and 30 m of 1.0 m RCP pipe on local road Kor Bor 5035 will be relocated. Relocation of utilities could result in power outages and other services, but the duration of relocation processes is short. Electrical outage is expected to be in a range of minimum 1 hr and maximum 24 hrs. Therefore, impacts from utilities relocations during construction is considered moderate. 	 Contractor's Responsibilities The contractor shall coordinate with Krabi Rural Roads Office and authorities that own the public utility to inform details on construction type, positioning of public utility system that has to be relocated including the duration of the relocation. This is to allow the authority to plan the relocation and improvement of public utility to cause the shortest impact possible. The authorities can also discuss possibilities of using the Koh Lanta Bridge route for further building of public utilities in Koh Lanta. The contractor must continuously publicize the construction activities of the project among people in the area. The contractor shall continuously inform the general public of construction activities of the project. Before each relocation of public utility system in the construction area, the contractor shall inform the plan to relocate public utility system to the local residents at least one month in advance. Another alert shall be informed to the local residents at least seven days before the relocation. This is specified by the authority that own the public utility. An information board shall be installed at the construction site. The relocation of a public utility system shall be done at night during 22.00-05.00 of the following day or done during a public holiday to avoid causing disruption to local communities and businesses. There should be a dissemination of information and warning through various channels including flyers, website, warning sign in areas where the relocation will take place at least a month in advance for local residents and road users. Once public utility system relocation is done, the contractor has to ensure that the area is clear of soil/rock sediments, or construction scrap materials. 	Area of Implementation Koh Klang Subdistrict, Koh Lanta Noi Subdistrict Cost Included in the overall mitigation budget	None

Environment and Social Components/ Impacts	Mitigation measures/ Responsibility	Area of Implementation/Cost	Monitoring Program/Responsibility/Cost ²
	- Should a complaint be lodged from the local residents or road users on effects from the relocation of public utility, disturbance caused or damage to the current public utility system, the contractor shall address the issue immediately.		
Operation Phase The electricity distribution to Koh Lanta is not sufficient and communities currently face issues regarding electricity supply. There is also a shortage of water due to the lack of waterworks system and freshwater sources. The Koh Lanta Bridge has therefore been designed to support electrical power lines and two water pipes of the Provincial Waterworks Authority. These will be sufficient to accommodate the future needs of the Koh Lanta community and the impact of the bridge is therefore positive.	None	None	None
3.3 Flood and water drainage control			
Pre-construction/Construction phasesOn land ConstructionConstruction activities, such as excavation, drilling, and embankmentfilling, can lead to the loss of vegetative ground cover and soil erosion,particularly during the rainy season. The severity of soil erosion isinfluenced by the volume and speed of run-off water, as well as humanactivities in the area. To assess the potential for erosion caused by theKoh Lanta Bridge construction, the EIA considered rainfall erosivity, soilerodibility, slope length, and crop management factors. The resultsindicate a low soil erosion rate of 0.256 tons/rai/year (1.6 tons/ha/year),which falls within the Thai erosion classification's low range (0 -2tons/rai/year) as issued by the Land Development Department (B.E.2545). However, volume of soil washing into the water drainage systemor spillway could pose obstructions to water drainage in the area. As aresult, the construction impact is assessed as moderate due to thepotential for soil sediments washing off into the sea.Marine ConstructionDrilling of 17 large bridge piers in the sea during the foundationexcavation will cause sediment dispertion. Construction may obstructthe waterway, which can cause changes in the direction of the currentand the movement of coastal sediment. However, Lanta bridge hadbeen designed to avoid placing bridge pier in Chong Lad navigationchannel to minimize impacts on draiange and current. Impact isassessed as low.Two temporary transport bridges (Jetty) on Koh Klang and Koh LantaNoi, with the length of 45 meters and 235 meters, respectively, ar	Design Consultant's Responsibilities - Design drainage control on both sides of the road at ground level in the project area in Koh Klang Sub-district and Koh Lanta Noi Sub-district. Drainage sytem should use Reinforced concrete pipes with a diameter of 1.20 meters, slope of 0.001 mm and manholes at every 15 m. o Runoff return period of 50 years, 10 years and 25 years should be considered for the design of cross drain, side drain and bridge surface runoff, respectively. Contractor's Responsibilities On land Construction - Strictly follow all mitigation measures for soil resources and fresh water and seawater quality. - Verify and check the conditions of the drainage system and spillways prior to the construction of the project. - Piling of soil, sand and other building materials must be at least 100 m. from the water source. - Allocate staff to frequently clean soil, rock and sand sediments in the construction area to prevent runoff of sediments into the drainage system. - Conduct a survey of inundated areas along project route and nearby areas, sediment accumulation and weeds along the project route especially during heavy rain events to check efficiency of drainage control system and report as part of day-to-day site supervision and reporting. - Ensure that construction workers do not dispose of solid waste nor scrap materials into water bodies to prevent shallowness and clogged drainage system which could cause floods and excess water. - Upon the completion of construction, cond	Area of Implementation 1) Road construction on shore 2) Bridge construction at sea Cost Included in the overall mitigation budget	DRR Responsibilities DRR to hire a third party-monitoring firm Monitoring locations - The starting point of the project is at km. 0+000 of Koh Klang sub-district and the ending point is at km. 2+527 of Koh Lanta Noi sub-district, Krabi Province. Monitoring Index - Conduct a survey of inundated areas along project route and nearby areas - Survey sediment accumulation and weeds along the project route to check efficiency of drainage control system Duration and frequency - 2 times/year throughout the construction. In case of heavy rain, the urgent inspection must be carried out within 24 hours. Cost: 120,000 THB (40,000 THB/Year) Details of monitoring program are provided in chapter 5.

Environment and Social Components/ Impacts	Mitigation measures/ Responsibility	Area of Implementa
	 When the construction of the bridge pier is completed, demolish the temporary transport bridge (Jetty), located above and underground on Koh Klang and Koh Lanta Noi, as well as restore the condition of the ground to be as it was before the project. Design bridge pier structures in the sea to have the least possible cross-sectional area in order to minimize impact on drainage system. Install silt curtains to prevent dispersion of sediments at the depth of the seabed at temporay jetties and bridge piers. The silt curtains shall be 5.0 meters in distance from the bridge pier structures. Once the drilling of bored piles and casting of the first bridge pier structure is completed, the sediment curtain is dismantled and moved to the next area of bridge pier structure construction. Once the bridge pier structures are completed, the temporary jetties in Koh Klang and Koh Lanta Noi shall be dismantled and the areas shall be restored to their previous conditions. 	
 Operation Phase The bridge piers have the potential to alter current velocity and flow direction during implementation. Modelling results reveal a change of current velocity in a range of 1-2 mm/sec or 2-10 % of baseline condition at 20-100 m radious of bridge piers. The highest change of flow direction is in a range of 2° - 4° or 2 -10 % of baseline conditions. These changes will not cause coastal erosion and the oceanography impact of bridge pier structures is not significant. Drainage pipes (100 mm diameter) will be installed on both sides of the bridge at 3-meter intervals. These will drain into a clarifier at the base of every bridge pier which then drains into the sea. V-ditch drainage and manholes will be installed along the shoulder of the approach roads which drain into the the sea. Impacts on drainage during operation pahse is not expected. 	 DRR Responsibilities The Department of Rural Roads shall check the conditions and effectiveness of water drainage and issues of water clogging in areas on both sides of the project route (on land) in order to verify the capacity of water drainage and water drainage system of the project. Should the capacity be insufficient, corrective measures shall be implemented immediately. Maintain the conditions of drainage system along the project route, especially in rainy season when there is a large amount of runoff. Should there be any damage of spillways, corrective measures shall be implemented immediately. 	Area of Implementation Throughout the bridge rout Cost Included in the overall mitig
3.4 Land use		
Pre-construction/Construction phases Impacts on changes from current land use The project route is within an open land area for environmental protection and forest conservation. A review of the Department of Land Development's land use data within 500 m of the project route found that 17% of the area was dominated by mangrove habitat, followed by rubber tree plantations (16.7%), and oil palm plantations (5.1%). The remaining areas are used for residential purpose, shrimp farms, oil palm plantations, perennial trees, abandoned rice fields, and other uses. According to Koh Lanta Yai – Koh Lanta Noi Zoning (2016), the project site is located in Environmental Conservation for Tourism Zone and Rural and Agriculture Zone. The project is within Krabi province environmental protection areas and is designed to create the least possible impact on the environment although construction of the bridge approach slabs will change the land use to transportation. The significance of this negative impact is assessed as moderate.	 Contractor's Responsibilities Clearly define the construction area to minimize disturbance in agricultural areas and other areas outside of the project areas. Ensure that the contractor only carries out construction activities within the boundary specified. Coordinate with relevant authorities regarding the categorization of land use according to their mandate prescribed by law such as the Department of Lands, Agricultural Land Reform Office, Royal Forest Department, Land Development Department, Central Office of Land Consolidation, Treasury Department, Department of Public Works and Town & Country Planning, and local administrative organizations to specify urban planning measures. 	Area of Implementation Project area Cost Included in the overall mitig
Operation Phase	Concerned Goverment Agencies Responsibilties	

entation/Cost	Monitoring Program/Responsibility/Cost ²
	Nana
route	None
mitigation budget	
on	
	None
mitigation hudget	
initigation buuget	

Environment and Social Components/ Impacts	Mitigation measures/ Responsibility	Area of Implementation/Cost	Monitoring Program/Responsibility/Cost ²
Data collected regarding land use in Koh Lanta area suggested that there was a change in land use in Koh Lanta during B.E.2552-2561 [A.D.2009-2018], with a huge increase in community areas and buildings (224.76%). As for land use for various purposes, a drop of 23.59 percent was seen. Ko Lanta's area continually expands in terms of community and buildings. An efficient transportation network will help facilitate convenient and safe travel for the public and tourists. As a result, the economy of the area will be boosted. However, Koh Lanta is an environmentally protected area and has a comprehensive town plan. Communities in Koh Lanta Yai-Koh Lanta Noi, Krabi Province, supervise land use in the abovementioned area. The construction of residences or buildings must only be carried out within the designated area. Therefore, it is expected that in the future, land use will gradually change.	 The Krabi Provincial Public Works and Town and Country Planning shall control and develop areas in the city planning, especially areas in Koh Lanta Noi Sub-district, Saladan Sub-district and Koh Lanta Yai Sub-district, according to regulations. This is to prevent urban sprawl, increase of hotels and buildings, in restricted areas according to the city plan. The Krabi Provincial Public Works and Town and Country Planning shall update the Krabi city plan to be appropriate to the current situation and changing environment for the benefit of the state. The Krabi Provincial Public Works and Town and Country Planning and local administrative organizations as well as the local population shall monitor and notify in case of any land use violation and impact from activities outside of the control according to reasons specified. The Ministry of Natural Resources and Environment shall enforce and update the ministry's notification on designation of areas and environmental protection measures in Ao Leuk District, Mueang Krabi District, Nuea Khlong District, Khlong Thom District, and Koh Lanta District in Krabi Province, according to environmental conditions in the area. 		
During the implementation phase there will be no local impact, however the presence of the bridge will foster economic growth which will cause land use in Koh Lanta to gradually change in response to the social and economic development. Studies reveal that tourism of Koh Lanta is approaching the upper capacity with water availability being a limiting factor. A future water works system will connect to the Koh Lanta Bridge structure and will increase the tourism capacity of the greater area. Waste and wastewater management are also critical issues. There is a cumulative impact which needs to be alleviated through development of sustainable tourism. Krabi environmetnal protection areas, Koh Lanta Yai – Koh Lanta Noi zoning are the key regulatory frameworks to guide sustainable development of the areas. Lanta Declaration recently initiated in April 2023 also provided a strong platform among government agencies, tourism section, local communities, private sector, academia and local CSOs for sustainable development. The significance of the negative impact is currently assessed as moderate.			
4. Quality of life value			
4.1 Socio-Economic Conditions			
 Pre-construction/Construction phases Impacts on the social relationship structure of the community During the project's construction, parts of traffic may be blocked. As a result of limitations in travelling, interactions and social relationship structure between the communities of Koh Klang and Koh Lanta Noi may be affected. However, the effect is merely temporary during the construction period. Additionally, since the project has established traffic management measures to prevent and reduce the impact on transportation in the area, allowing people to travel to and from each other as usual; therefore, the impact is low. Community economic impacts The construction activities of the project require manual labor in conjunction with the operation of machinery. As a result, approximately 170 officers or workers will be employed for about 3 years or 900 working days (25 days per month). The case of an average spending of about 200 baht per person/day (40 percent of income) will result in a local money circulation of about 34,000 baht/day, contributing to the economy's growth. There is a slight 	 DRR Responsibilities Implement the stateholder engagement activities as committed in the project's Stakeholer Engagement Plans (See Section 4.8) Publicize and disseminate project information to the public in the project area at least 1 month in advance, including the boundary of the construction area, construction pattern, construction period to increase people's understanding and acceptance towards the project. Should there be any misunderstandings between the project and the community, the Department of Rural Roads shall immediately organize a meeting to clarify issues to the local population in order to declare accurate information and to demonstrate that the Department of Rural Roads is responsible and take the public opinion into consideration. Establish Project Grievance center including complaints box and information board of the project at three locations include Project site office, Koh Khlang SAO and Koh Lanta Noi SAO. Should there be complaints regarding impact from project activities including on annoucenance and accidents, DRR shall examine the causes of issues, mitigate and inform the complainant, accordingly. Mitigatin measures could be adjusted accordingly, if needed, to properly manage the concerns. Provide Grievance Redress Machanism (GRM) channels for receiving complaints as follows: DRR Public Website: www.drr.go.th Through "Complaints Center" menu. DRR Hotline: 1146 On-site information center at: the DRR Bangkok Office, Phahonyothin Road, Anusawaree Sub-District, Bangkhen District, Bangkok 10220, or at the provincial office of the Department of Rural Roads in Krabi Province and the Project site office. 	Implementation Areas Project area and nearby communities Cost Included in the overall mitigation budget	 DRR responsibilities DRR to hire a third party-monitoring firm Monitoring Locations Project study areas covering Koh Khlang Sub-district and Koh Lanta Noi Sub-district Target Groups: households, community leaders, groups of entrepreneurs, and environmentally sensitive areas Monitoring Index Conduct a questionaire survey on changes of socio-economic conditions, culture, difficulties, opinions and suggestions toward the project construction. Duration and frequency

Environment and Social Components/ Impacts	Mitigation measures/ Responsibility	Area of Implementation/Cost	Monitoring Program/Responsibility/Cost ²
 increase in community money circulation, which is expected to promote spending and benefit those employed in general. Therefore, the positive impact is moderate. Vendors or establishments near the project construction area are expected to be exposed to positive and negative impacts. While positive impacts include opportunities to sell of goods and services to the project, causing an increase in household income, negative impacts are expected to be associated with inconvenience in travelling or getting in and out area and may have to put their work on hold temporarily, especially during the construction activities in front establishments. However, the project requires that the construction be expedited to the shortest period. During the construction, a temporary entrance-exit must be spared for the establishments likely to be affected by the project operations. Therefore, the negative impact is low. Environmental impacts Concerns regarding environmental issues such as dust diffusion and noise from large machinery during construction. Vibration from bridge foundation construction activities may cause annoyance, frustration and mental health of the residents in the construction area or those exposed to the noise pollution. These negative impacts are assessed to be moderate. 	 Contractor's Responsibilities Follow the requirements and the control measures stipulated in the Labor Management Plans, provided in the SLIP document. Strictly observe prevention and correction measures impacts on air quality, noise, vibration. and transportation. The contractor is responsible for installing signs with details of the responsible person and telephone number on vehicles transportation damages public roads outside the project site, immediate repairs must be provided that the transportation damages public roads outside the project site, immediate repairs must be provided to recover the conditions as soon as the accident has occurred or the complaint is made. Noisy construction activities must only be operated during day time (8.30 am5.30 pm.). In the case that the activities are to be conducted after 5.30 pm., ensure that the construction should not generate loud noise and the construction period can be extended to 10 pm. However, advance notification shall be given. If it is necessary to conduct construction after 10 pm., ensure that the moving and transportation activities do not cause loud noise. If the people in the area make complaints, night-time construction shall be stopped immediately. The contractor shall foster understanding among workers and project staff regarding harmonious coexistence, building good relationships and proper way of treating the community. This will help reduce the anxiety of the locals regarding their property. Contractors shall prioritize hiring local workers to reduce social problems/reduce unemployment and labour migration problems and provide opportunities to people in the area to work with the project as much as possible. Contractors are required to register non-local workers to allow close supervision of migrant workers in order to minimize impacts to local communities. Construction activities in front of buildings/business shall be expedited to the shortest period and during the		1 time/year throughout the construction period Cost: 750,000 THB (250,000 THB/Year) Details of monitoring program are provided in chapter 5.
 Operation Phase The project will enable connection of routes in the area and enhance effectiveness of transportation network, allowing safe and convenient travels for the residents and those nearby. As a result, relationship between people in the community will be improved. Therefore, the positive impact is moderate. Project roads will be one of the factors that help promote the effectiveness of transportation, especially around the community areas of Koh Klang and Koh Lanta Noi. The roads will play role in the expansion of the community, the community economy trade and various services in the area, facilitating the road users and hence, contributing to the community economy. The project bridge tends to reduce the cost of consumer products brought from the mainland to be sold on Koh Lanta. It also helps lower the cost of transportation for transporting agricultural products such as medicine and oil palm from Koh Lanta to the main land. Traveling through the bridge project help in the reduction of cost of living of people in the area. Initially, travelling used to be costly and time-consuming. Thanks to bridge, the journeys shall be free of tolls and the travel time shall be lessened from 1 hour to less than 5 minutes. 	 DRR Responsibilities In case it has been found or complained that the public or residents in the construction area are affected by the project and the structure of social relationship of the community has been threatened, complaints must be handled. The order requires that the initial results of complaint processing be notified within 15 days from the date of receipt of the complaint. Any actions taken must be periodically notified until the complaint is resolved. Provide Grievance Redress Machanism (GRM) channels for receiving complaints as follows: DRR Public Website: www.drr.go.th Through "Complaints Center" menu. DRR Hotline: 1146 On-site information center at: the DRR Bangkok Office, Phahonyothin Road, Anusawaree Sub-District, Bangkhen District, Bangkok 10220, or at the provincial office of the Department of Rural Roads in Krabi Province and the Project site office. 	Mitigation Responsbility The Department of Rural Road Implemenation Area Througout the bridge route Cost Included in the overall mitigation budget	 DRR Responsibilities DRR to hire a third party-monitoring firm Monitoring Locations Project study areas covering Koh Khlang Sub-district and Koh Lanta Noi Sub-district Target Groups: households, community leaders, groups of entrepreneurs, and environmentally sensitive areas Monitoring Index Conduct a questionaire survey on changes of socio-economic conditions, culture, difficulties, opinions and suggestions toward the project operation. Duration and frequency 1 time/year in Year 1, 2, 3, 5, 10, 15, and 20 of the Project Operation period Cost:

Environment and Social Components/ Impacts	Mitigation measures/ Responsibility	Area of Implemen
4.2 Land dontation		
Pre-construction/Construction phases The land process review carried out from June to July 2023 indicated that donation of one plot of land (44 Square Wah or 176 square meter) donated for Lanta Bridge project meets ESS5. This is due to the fact that there was no physical or economic displacement or resettlement because of the land donation. This is since the land has not been utilized for several years. The area is not appropriate for agricultural activities as animals destroy plants or seeds planted on the land. Additionally, the soil is not suitable for any type of commercial plantation. There were no individuals using or occupying the land at the time of land donation. The land process review confirmed that the land owner was informed and consulted about the project and the choices available to him regarding donation of land. Beside benefits to the public, the land owner will also benefit from the land donation, as the bridge will make it easier for him to travel to the mainland and increase the value of the other part of the land that were not donated.	DRR Responsibilities The Department of Rural Roads shall cooperate closely with Koh Khlang SAO, Koh Lanta Noi SAO, and the landowner who donated propoerty to inform project construction plan 1 month in advance of the Project construction. Land ownership of the donated property shall be confirmed prior to Project construction commence. After defining the boundaries and land allocation, it is important to report the actual size of the utilized area for the construction of the bridge structure to the land donor. This ensures that the land donor is informed about the actual area utilized for the construction activities. Several meetings are scheduled to discuss the public relations activities and engagement plan for the project, including the initiation, construction, and pre-project ending phases. It is crucial to involve the owner of the donated land plot in all project phases to ensure his full engagement. It is crucial to involve the owner of the donated land plot in all project phases.	Area of Implementation House of the owner of th plot, Moo 2, Koh Lanta N Lanta Noi District Krabi Pr Cost Included in the overall mi
<u>Operation Phase</u> None	Implementation period - None	
4.3 Physical and economical displacement		
Pre-construction/Construction/Operation Phases		

plementation/Cost	Monitoring Program/Responsibility/Cost ²		
	1,750,000 THB (250,000 THB/Year)		
	Details of monitoring program are provided in chapter 5.		
	DRR Responsibilities		
ntation	The Department of Rural Road or the assigned third party.		
Lanta Noi Subdistrict Koh	Monitoring Group or Locations		
Krabi Province	House of the owner of the donated land plot, Moo 2, Koh Lanta Noi Subdistrict Koh Lanta Noi District Krabi Province		
verall mitigation budget	Monitoring Index		
	1. The areas of land dedicated for the bridge project		
	 Numbers of participation of land owner in the project's engagement activities including the concerns and complaint raised; 		
	 The compliant loadge by the land owner regarding to the land donation. 		
	Duration and frequency		
	From Pre-construction to Project Operation phases		
	Cost		
	Included in the overall monitoring budget		
	DRR Responsibilities		
	The Department of Rural Road or the assigned third party.		
	The actual size of land dedicated for the bridge construction.		
Environment and Social Components/ Impacts	Mitigation measures/ Responsibility	Area of Implementation/Cost	Monitoring Program/Responsibility/Cost ²
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Ferry Operator	DRR Responsibilities		DRR Responsibilities
The building of the Lanta Bridge will affect the ferry's operations located		Implementation Area/Stakeholder	DRR to hire a third party-monitoring firm
at Ban Hua Hin's pier area, resulting in the physical and economic	Pre-construction	1) The ferry operators	
Administrative Organization.	- The Department of Rural Road (DRR), through the established working team, is responsible for facilitating dialogue	2) Employee of the ferry's company.	Monitoring Group or Location
Overall the physical displacement would involve finding a new pier and	and acting as a liaison between the Krabi Province and Songserm Trans Service, the ferry operator at Ban Hua Hin		1) The form operators
adapting to the new operating environment, while the economic	Pier. Their objective is to reach a final resolution that addresses the demands put forth by Songserm Trans Service.		
displacement would involve dealing with the financial consequences of		Cost	2) Employee of the ferry's company.
contract termination and employee decisions not to relocate. Both aspects would require careful planning and mitigation strategies to	Construction		
minimize the negative impacts on the ferry operator and its employees.	- The Department of Rural Road (DRR) offers the ferry operator an alternative business opportunity during the bridge	None	Monitoring Index
To address the issues, the Department of Rural Road held a project	- The established working group, consisting of the Lanta District Mayor, a representative from Songserm Trans Services		1) Complaint made by Songserm Trans
meeting with authorities at central, regional, and local levels, observed	Co., Ltd, a representative from the Krabi Province Administration Office, and a representative from the Rural Road		Service Co., Ltd and its employee.
by representatives from the World Bank. The purpose was to review the information regarding the construction of Lanta Bridge Project. Based on	Sub-district of Krabi, to consider the agreement, not to terminate the Ban Hau Hin car and passenger ferry contract		2) Final agreement of the ferry operator and
the resolution of the meeting, a working group was formed to address			the Krabi PAO on the termination of the
the concerns raised by Songserm Trans Service Co., Ltd., the ferry			2) The number of forry operator employees
operator. The working group comprised the Lanta District Mayor, a representative from Songserm Trans Services Co., Ltd. a representative	- In line with the guidance of the established working group, as mentioned earlier, in the event of employee contract termination, resulting from either business termination or relocation to a new premise, the compensation		whose contracts are terminated either due
from the Krabi Province Administration Office, and a representative from	requirements outlined in the Thai Labor Protection Act, B.E.2544, shall be followed.		to the termination of the ferry concession or
the Rural Road Sub-district of Krabi.			relocation to a new business premise.
During the meeting on 22nd February 2023, Songserm Trans Service			
presented a range of issues and demands arising from the bridge construction. Their requests included compensation for their			Duration and frequency
investment, wages for unemployed employees, and alternative business			From Pre-construction to Project Operation
opportunities for the ferry service. The Krabi Rural Road Sub-district and			phases
gathered pertinent information. The Lanta District then compiled all the			
documentation and submitted it to the Krabi Province for review.			Cost
The province will consider the matter and subsequently present the final			Included in the overall monitoring budget
resolutions to the Department of Rural Road, ensuring compliance with			
meeting.			
If the ferry operator relocates to a new site and employees choose not			
to move with the company, resulting in termination of their employment			
contracts, the employees are entitled to special compensation as per the			
Thai Labour Protection Act. The compensation schedule is as follows:			
Length of Employment Minimum Compensation Rate*			
• From 120 days to 1 year Last wage rate for 30 days			
• From 1 year to 3 years Last wage rate for 90 days			
• From 3 years to 6 years Last wage rate for 180 days			
From 6 years to 10 years Last wage rate for 240 days			
From 10 years to 20 years Last wage rate for 300 days			
• 20 years and above Last wage rate for 400 days			
Shop owners at Ban Hua Hin Pier Area	DRR Responsibilities		DRR Responsibilities
Currently, there are four shop owners at Ban Hua Hin Pier who sell			DRR to hire a third party-monitoring firm
products and food to tourists and locals under lease contracts with the	Pre-Construction	Implementation Area/Stakeholder	
construction is completed, the shop owners will experience both physical		The shopowners at Ban Hua Hin Pier	Monitoring Group or Location

Environment and Social Components/ Impacts	Mitigation measures/ Responsibility	Area of Implementation/Cost	Monitoring Program/Responsibility/Cost ²
and economic displacement impacts. These impacts include the followings:	The Department of Rural Road (DRR) will collaborate with the Provincial Administration Office to enable the shop owners to continue their businesses until the expiration of their rental agreements in 2025.	Cost	The shopowners at Ban Hua Hin Pier
Physical Displacement:	Construction	None	Monitoring Index
1) Loss of Location: The shop owners would have to vacate their current premises at Ban Hua Hin Pier which is on the lease contract with the PAO, resulting in the loss of their established location and customer base.	The shop owner will stay throughout the duration of their lease. One the lease is up, the owner can negotiate with the relevant authority for moving into a new location. In cse the shop owners must relocate before the end of their lease, they will be compensated for their losses. The trader without leases will be assisted in line with the World Bank ESF and		1) The complaint filed by the shop owners at Ban Hau Hin Pier
2) Relocation Challenges: Finding and securing a new suitable location for their businesses would be a significant challenge. It would require identifying a new area with sufficient customer traffic and adjusting to the new operating environment.	project E&S document. The Department of Rural Road (DRR) will provide the opportunity for shop owners to sell general products and food to the workers and personnel in the project's construction camp, office, and designated areas at the construction site. However, the specific arrangements for implementing these measures will be determined between the shop owners and		2) The number of shops that have chosen to relocate to a new location, as provided by the Provincial Administration Office (PAO).
Economic Displacement:	the construction contractor.		Duration and frequency
1) Loss of Revenue: With the operation of the bridge, the foot traffic and customer demand at Ban Hau Hin Pier may significantly decrease or cease altogether. As a result, the shop owners would experience a loss of revenue from their businesses.	Operation The Krabi Province's Office of Organization Administration (PAO) has identified a designated area for the relocation of shops. However, the decision to move or not will ultimately rest with each individual shop owner. The arrangements regarding the relocation will be determined through discussions between the shop owners and the PAO.		From Pre-construction to Project Operation phases.
2) Financial Strain: The shop owners would face financial difficulties due to the loss of income and potential debt obligations, such as unpaid rent or loans associated with their previous businesses at Ban Hua Hin Pier.			Cost Included in the overall monitoring budget
3) Employment Impact: The closure of their businesses would result in job losses for the employees working in these shops, leading to further economic strain for both the shop owners and the employees.			
Shopownners in the Right of Way of the Highway Department	DRR Responsibilities		DRR Responsibilities
Currently, there are five shops located in the Righout of Way (ROW) of the Highway Department at beginning section of the bridge, who sell food to tourists and locals However, once the bridge construction is commenced, the shop owners will experience both physical and economic displacement impacts. These impacts include the followings:	<u>Pre-Construction</u> The Department of Rural Road (DRR) will collaborate with the Provincial Administration Office to enable the shop owners	Implementation Area/Stakeholder The shopowners in the Right of Ways of the Highway Department	DRR to hire a third party-monitoring firm Monitoring Group or Location
Physical Displacement:	to continue their businesses until the expiration of their rental agreements in 2025.	Cost	The shopowners in the Right of Ways of the Highway Department
1) Loss of Location: The shop owners would have to vacate their current	Construction	None	
premises in the Right of Way of the Highway Department, resulting in the loss of their established location and customer base.	The Krabi Province's Office of Organization Administration (PAO) has identified a designated area for the relocation of		Monitoring Index
2) Relocation Challenges: Finding and securing a new suitable location for their businesses would be a significant challenge. It would require identifying a new area with sufficient customer traffic and adjusting to	regarding the relocation will be determined		 The complaint filed by the shop owners in the Right of Way of the Highway Department
the new operating environment.			 The number of shops that have chosen to relocate to a new location, as provided
1) Loss of Revenue: With the operation of the bridge, the foot traffic and			by the Provincial Administration Office (PAO).
customer demand at Ban Hau Hin Pier may significantly decrease or cease altogether. As a result, the shop owners would experience a loss of revenue from their businesses.			Duration and frequency
2) Financial Strain: The shop owners would face financial difficulties due to the loss of income and potential debt obligations, such as unpaid rent or loans associated with their previous businesses at Ban Hau Hin Pier.			From Pre-construction to Project Operation phases.
3) Employment Impact: The closure of their businesses would result in job losses for the employees working in these shops, leading to further			Cost
economic strain for both the shop owners and the employees.			Included in the overall monitoring budget
	1	1	

Environment and Social Components/ Impacts	Mitigation measures/ Responsibility	Area of Implementation/Cost	Monitoring Program/Responsibility/Cost ²
Relocation of the Local Fishing Pier	DRR Responsibilities		DRR Responsibilities
 Ban Hua Hin is home to a fishing pier situated near the ferry pier. This fishing pier serves the local fishing community as well as speed boat operators engaged in fish transportation and tourist activities. With the construction of the bridge, a temporary pier will be built to facilitate the transportation of construction materials. This construction activity will have an impact on the local fishing pier. However, as part of the project, the fishing pier will be relocated to a nearby location that will not be affected by the construction activities. The relocation of the local fishing pier to a nearby area, away from the bridge construction site, would have several impacts: Continuity of Fishing Activities: The relocation would allow the local fishing community to continue their fishing activities without disruption. They can still access the sea and carry out their daily operations in a familiar environment. Minimized Disruption: By moving the fishing pier away from the construction operations can be avoided. This ensures that both the construction work and the fishing activities can proceed without hindering each other. Safety and Efficiency: The relocation may provide an opportunity to enhance safety measures and improve the infrastructure of the fishing pier. This could result in improved facilities, better access for fishermen, and overall increased efficiency in their operations. Preservation of Local Economy: The fishing industry plays a significant role in the local economy. By ensuring the continuity of fishing activities through the relocation of the fishing pier, the economic impact on the community can be minimized, preserving livelihoods and maintaining the local fishing industry. 	To minimize the impact of relocating the local fishing pier to a nearby location unaffected by the bridge construction activities, the following mitigation measures can be considered: 1) Adequate Communication and Engagement: Establish open lines of communication with the local fishing community and involve them in the decision-making process. Ensure that their concerns and needs are heard and taken into account throughout the relocation process. 2) Early Planning and Coordination: Begin the planning process well in advance of the relocation to allow sufficient time for assessments, consultations, and preparations. Coordinate with relevant stakeholders, such as fishermen, fishing associations, and local authorities, to ensure a smooth transition. 3) Identify Suitable Alternative Location: Conduct thorough assessments to identify a suitable nearby location for the fishing pier. Consider factors such as accessibility, availability of resources, and proximity to fishing grounds to ensure minimal disruption to fishing activities. 4) Infrastructure Development: Invest in the development and improvement of infrastructure at the new fishing pier location. This may include constructing sturdy and functional docking facilities, providing appropriate storage and processing facilities, and ensuring adequate access for fishermen and their vessels. 5) Safety Measures and Environmental Protection: Implement safety measures at the new fishing pier location to ensure the well-being of fishermen and the protection of the environment. This may involve installing safety equipment, establishing emergency protocols, and promoting sustainable fishing practices. 6) Undertake the engagement activities as explained in the project's Social Engagement Plan (detailed in Section 4.8)	Implementation Area/Stakeholder Local fishing pier at Ban Hau Hin and the fishing folks and speed boat operators who use the peir.	 Monitoring Group or Location Local fishing pier at Ban Hau Hin and the fishing folks and speed boat operators who use the peir. Monitoring Index 1) The complaint lodged by the local fishing community and speed boat operators regarding the relocation of the local fishing pier. 2) The number of engagement activities conducted with the affected local fishing community and speed boat operators, along with details of their participation. 3) The satisfactory survey to be conducted with the fishing folks and speed boat operators regarding the new fishing peir. Duration and frequency Throughout Construction Phase for index 1) and 2). 1 time within 1-3 months after completion of the new local fishing pier construction for index 3) (satisfactory survey). Cost Included in the overall monitoring budget
4.4 Construction noise impact – individual level	DRR Responsibilities		DRR Responsibilities
Pre-construciton/Construction			DRR to hire a third party-monitoring firm
along the project route.	Landowners were consulted individually to address the issue of noise pollution. The homeowners expressed disagreement with the proposed measure of installing soundproofing walls to reduce noise impact from the project. However, it was suggested to carry out construction activities during daytime as a means to minimize noise. Construction To ensure timely communication with homeowners before the commencement of construction activities, they will be notified in advance. They will also be provided with information regarding the channels through which they can file complaints and make recommendations. The construction activities shall be conducted within the identified or regulated buffer zone between the construction site and the nearest residence.	Residence of Moo 8, Koh Klang Subdistrict, Koh Lanta Noi District Krabi Province whose house is located 25 m from project route and has concern on noise impact. Cost Included in the overall mitigation budget	Residence of Moo 8, Koh Klang Subdistrict, Koh Lanta Noi District Krabi Province whose house is located 25 m from project route and has concern on noise impact. Monitoring Index: 1) Monitoring of construction hours when passing the house 2) Complaints made by the homeowner regarding the noise and other impacts 3) Numbers of participation of Mr. Samrit Sae-Kow in the project's engagement

Environment and Social Components/ Impacts	Mitigation measures/ Responsibility	Area of Implement
4.5 Construction air quality/noise/vibaration impacts – community level		
Construction Phase	DRR Responsibilities	
 Air Quality: The predicted average 24-hour emissions of TSP, PM10, CO, and NO₂ for all construction activities, including soil excavation, road construction, lower and upper structure of the bridge construction, and transportation of materials and equipment, do not exceed the Notifications of the NEB No. 10 B.E.2538, No. 24 B.E. 2547, and No.33, B.E.2552 (2009). Noise: The analysis of the noise modeling results indicates that the Moo 8 Ban Hua Hin pier (Koh Klang) and the Muslim cemetery of Ban Tung Toh Yum (Koh Lanta Noi) will experience noise impacts during the construction phase that exceed the recommended limit. Overall, the pre-mitigation significance of the construction noise impact is assessed as moderate. The noise generated by the bridge construction can have several negative impacts on the community located along the construction route. Firstly, prolonged exposure to high levels of noise can cause stress, sleep disturbance, hearing impairment, and other health problems. This can have a negative impact on the well-being and quality of life of community members. Moreover, the noise can cause disruptions to daily activities and routines, such as work, school, and rest. This can result in reduced productivity, increased stress, and other negative social impacts. Vibration: the vibration analysis, indicating that the construction of the lower and upper bridge structures will result in the highest levels of vibration. The Moo 8 Ban Hua Hin Pier (Ban Tha Rua) in Koh Klang is identified as an area of concern where vibration impacts must be mitigated. The pre-mitigation assessment rates the negative vibration impact as moderate in significance. 	 Pre-Construction Phase To ensure that the public in the project area is informed in advance, plans will be prepared for conducting public relations and disseminating project information. Coordination between the community and the project will be maintained if they are affected by the project during construction. A plan will be developed to survey opinions during the preparation phase of construction. If required, the Department of Rural Roads will install a sound barrier at the edge of the road adjacent to the house. Four complaint centers will be established for the project, and complaint boxes and project public relations boards will be installed at various locations. These include the project control office, Highway No. 4206, Krabi Rural Road Subdistrict, Ko Klang Subdistrict Administrative Organization Office, and the office of the Subdistrict Administrative Organization Koh Lanta Noi. Contractor's Responsibilities Construction Phase Strictly implement the environmental mitigation measures to prevent and correct any impact on air quality, noise, and vibration. Strictly enforce transportation requirements for all vehicles employed for the project A superintendent will be assigned to oversee construction activities and ensure that they do not interfere with religious activities in the Kubor Thung To Yum area. Construction activities near the Kubor will be temporarily halted until the religious activity is completed. Operations Phase To install a clear acrylic sound barrier or a high-performance material to prevent noise from affecting Kubor Thung To Yum (Muslim Cemetary) and avoid any interference with religious ceremonies. 	Area of Implementation 1) Two sensitive areas: Mo Hin (Ban Tha Ruea) and Ku Yum (Muslim Cemetary) 2) Thirty-nine residents loc project area within 500 me residents are located in Tai Noi, Koh Lanta Yai, Koh Kla and Saladan Subdistrict. Th both at the beginning and project. Cost Included in the overall miti
 Operation Phase Air Quality: During the implementation phase, it is anticipated that traffic volume on the bridge will increase annually, resulting in increased emissions of TSP, PM10, CO, and NO₂ from traffic. However, these emissions are expected to remain within the air quality standards for normal circumstances. This negative impact is assessed as having low significance pre-mitigation. Noise: Noise level during the implementation phase were modelled based on forecasts of traffic volume for a 20-year period from 2027 		

ation/Cost	Monitoring Program/Responsibility/Cost ²
	activities including the concerns and complaint raised 4) Noise level monitoring during the construction (as detailed in the environmental monitoring plan)
	Implementation period:
	Throughout the construction period
	Cost
	Included in the overall monitoring budget
	DRR Responsibilities
	DRR to hire a third party-monitoring firm
oo 8, Baan Hua Ibor Thung To	Monitoring Gropu or Locations:
cated near the eters. These umbon Koh Lanta	1) Two sensitive areas: Moo 8, Baan Hua Hin (Ban Tha Ruea) and Kubor Thung To Yum (Muslim Cemetary)
ang Subdistrict, hey are situated end of the	2) Thirty-nine residents located near the project area within 500 meters. These residents are located in Tambon Koh Lanta Noi, Koh Lanta Yai, Koh Klang Subdistrict, and Saladan Subdistrict. They are situated both at the beginning and end of the project.
igation	Construction Phase
	Monitoring Index:
	1) Complaints made by the communities regarding the noise and other impacts
	 Numbers of participation of the communities' member or representative in the project's engagement activities including the concerns and complaint raised
	 Air Quality/Noise level/Vibration monitoring during the construction (as detailed in the environmental monitoring plan)
	Implementation Timeline:
	Throughout construction period
	Construction Phase

Environment and Social Components/ Impacts	Mitigation measures/ Responsibility	Area of Implemen [®]
 to 2047 (B.E. 2570-2590) for a broad range of vehicle types. The average sound level in a 24-hour period revealed the range of 57.6 to 70.7 decibels which slightly exceeds the safe noise limit (70 decibels) for the Moo 8 Ban Hua Hin (Ban Tha Rua) site. Vibration: Vibration was assessed for 12 heavy vehicle types up to a weight of 50.5 tons driving at speeds from 45 to 80 km/h during the implementation phase. The maximum PPV ranged from 0.032 to 0.367 mm/s, which does not present a threat based on the national, German or British standards. This was assessed as a negative impact with low significance pre-mitigation. 		
4.6 Public health		
Pre-construction/Construction phases	Contractor's Responsibilities	
The Koh Lanta Bridge EIA provides a detailed analysis of public health risks from air quality, noise, vibration, water quality, occupational health (accidents and sickness from work and inappropriate and unsafe	Impacts on community public health issues - Strictly comply with prevention and correction measures to prevent for impacts on air, noise, vibration, fresh water	Area of Implementation Construction sites and the
 environment), entry of migrant workers, transport accidents, waste management, water availability for consumption and communicable diseases from workers. Each of these risks is assessed as moderate. Mitigation measures to manage these impacts have been inlcuded in various aspects include air, noise, vibration, water quality, occupational health and safety/hygiene, sanitation, transportation and traffic safety and accidents. Impacts on community public health issues The construction activities of the project may affect the health of the population in the areas near the construction site due to various pollutants such as dust exhaust from trucks and machinery containing carbon monoxide (CO), nitrogen dioxide (NO2), noise levels exceeding the specified standards, vibration from project construction and transportation, and wastewater and solid waste from worker camps. Such pollution could cause health problems, especially respiratory diseases and the hearing system. Moreover, the arrival of migrant workers from other towns may be a carrier of infectious diseases in the community. Therefore, the impact is considered moderate. 	 and marine water quality, occupational health and safety/hygiene, sanitation, transportation and traffic safety and accidents. Pre-employment health screening must be conducted for potential employees before being allowed to start working in order to reduce the impact of contagious diseases or the spread of disease due to the increase of migrant workers and the potential impact on the public health service system in the area. Provide knowledge and guidance to construction workers on disease prevention, especially those related to health and hygiene in their accommodation or work practices. Establish basic first aid units within the construction area and project office to provide initial medical care, such as basic healthcare services, to employees and construction workers who fall ill. In the event of a severe accident occurring during work, prompt action should be taken to transfer the injured individual to the nearest healthcare facility. Maintain cleanliness and hygiene in the construction area and workers' camp. Provide adequate public utilities and services in project construction units. Provide workers with sufficient clean drinking water at the construction site. Arrange adequate bathrooms and toilets in the construction area in order to hold enough wastewater and serve the purpose of toilet sanitation for construction workers daily. Moreover, coordinate with the Koh Klang SAO to collect and dispose of daily waste. Set up a prefabricated grease trap, septic type anaerobic filter along with grease traps to support wastewater from activities within worker housing, offices, canteens and maintenance plant. Supervise the effectiveness of wastewater treatment and pumping sludge from the treatment system waste water every 3 months. 	Cost Included in the overall mit
Within the project area, there is still a moderate shortage of medical personnel and medical equipment. The utilization of services by construction workers may have an impact on the local population, as it adds to the service burden of healthcare agencies in the area, affecting the provision of services to the local population in the existing project area. This impact is assessed as moderate.	 Provide segregated trash bins with tightly closed lids to prevent water from leaking (baskets for collecting solid waste are not recommended) with a sufficient number and suitable size for the amount of waste generated each day. Ensure that the bins are placed at various points within the construction unit area, such as the workers' residence, canteen, building and office, the maintenance plant. Arrange for officers or workers to collect and transfer waste to the waste collection point. Contractor shall coordinate with the waste collection staff of Koh Klang SAO in requesting for garbage trucks to collect and transport waste to the disposal facility. Install clear signs or symbols on trash bins according to four types of waste: general, recycled, wet and hazardous. Promote understanding regarding types and separation of waste among officials and construction workers to help reduce the waste that must be disposed of to a minimum, such as types of recyclable dry waste, namely glass bottles, 	

ation/Cost	Monitoring Program/Responsibility/Cost ²	
	1) Complaints made by communities regarding the noise and other impacts	
	 Air Quality/Noise level/Vibration monitoring during the construction (as detailed in the environmental monitoring plan) 	
	Operation period:	
	Operation phase	
	Cost	
	Included in the overall monitoring budget	
	DRR Responsibilities	
worker camp site	DRR to hire a third party-monitoring firm to: (i) carry out monitoring program described below, and (ii) carry out Health Risk Monitoring Program.	
	Monitoring Locations:	
igation	 Communities located within 500 m from the Project route 	
	Monitoring Index:	
	 Conduct a questionaire survey together with the socio-economic survey to monitor health conditions and public health service in nearby communities 	
	Implementation period:	
	 1 time/ year throughout the construction period 	

Environment and Social Components/ Impacts	Mitigation measures/ Responsibility	Area of Implementation/Cost	Monitoring Program/Responsibility/Cost ²
Coronavirus disease (COVID-19) The influx of construction workers may be a source of transmission of the coronavirus disease 2019 (COVID-19), which, if infected, will display symptoms of coughing and sneezing. Without preventive measures, including wearing cloth masks, surgical masks or other protective equipment for operators such as gloves, and face shields at all times while working, depending on the nature of the job, the spread of the disease is likely.	 metal, plastic and wet waste that can be transformed to bio-fertilizer. Hazardous waste such as light bulbs, batteries, spray cans requires a safe disposal method. After the construction is completed, remove the construction supervision office and labor camps, and get rid of septic-anaerobic filters underground in accordance with sanitation principles. Measures and guidelines for the arrangement of construction sites and temporary accommodation for construction workers in preventing and controlling the Coronavirus disease 2019 (covid-19) outbreak (Bureau of Environmental Health, Department of Health, Ministry of Public Health & E.2564 (A.D. 2021)) Understand roles and mechanisms of coordination between relevant agencies (Social Dialogue), such as administrative agencies (e.g. Local Administration Organization, District Office, etc.), public health agencies (e.g. Public Health Service Center, SFHP, DPHO etc.), establishments (employers, foreme, workers, contractors, etc.) and surrounding communities to set mutual guidelines for cooperation and integration to empower the operations as assigned. Prepare mutual guidelines for comporation companies. Ensure that the company's policy is to allow for external support agencies and workers' participation in solving problems that may arise. Adopt practical measures for preventing and controlling COVID-19 outbreak on construction sites and temporary workers' residences. Monitor and supervise main basic guidelines measures, namely, reducing access to the construction site and adjusting the level of sampte of the construction site and apy attention to the health and safety of employees, surrounding, residential buildings, showers tolets, dining place, drinking water stations, management transage environmental health, including effective disease control by rights to earlie or abysis the level of optocheratia buildings, showers to the surbreak of COVID-19 by reducing risk actors through the practice		

Environment and Social Components/ Impacts	Mitigation measures/ Responsibility	Area of Implementation/Cost	Monitoring Program/Responsibility/Cost ²
	 Establish a policy on "prevention and control of the epidemic of COVID-19" as significant for health and safety for both construction sites and construction worker camps and aim for observation of the measures. Set up an operational team, and assign a person directly responsible for preventing and controlling COVID-19. This could be done by appointing safety officers (Safety Officers) or supervisors (Staff) or assigned persons to be leaders in monitoring the internal situation of construction sites and construction worker camps, and as a director who follow up on measures and guidelines for preventing COVID-19. Precisely determine entrances and exits to construction sites and worker camps, restrict entrances and exits to a single channel to control entry and exit and fetcively screen entry and exit. Operators, workers, contractors and all visitors must undergo screening by measuring body temperature before operating in the construction site and workers' camps. If the body temperature exceeds 37.5 degrees Celsius, the individual is suggested to wait and re-take the temperature. If the temperature does not decrease, the individual is considered to have a fever, prohibited from work, temporarily isolate themselves and report to the Provincial Security Office or the preson in charge of risk assessment to take further actions according to the risk level. Workers and visitors are required to wear a cloth mask or a hygienic mask all the time. Additional personal protective equipment for operators, such as gloves, face shields, etc., may also be provided depending on the nature of the work performed. Provide sufficient hand-washing stations with soap or alcohol or alcohol gel (containing at least 70 percent alcohol) at entry-exit points, wrious areas, and areas that are at risk from commo contacts, such as check-in points, information, talso be included. Adjust and oreganize the approach to operations so that crowds and work risk		
Operation Phase The Koh Lanta Bridge EIA provides a detailed analysis of public health risks from for the implementation phase for air quality, noise, vibrations, accident and safety and occupational safety and health from working conditions and environment. Such pollution could cause health problems/annoyance. Increased traffic could increase risks of traffic accidents. These risks and impacts are assessed as moderate.	 <u>DRR Responsibilities</u> Strictly comply with prevention and correction measures for impacts on air, flora, noise and vibration, transportation and traffic safety and accidents and occupational health and safety/hygiene. 	Cost Included in the overall mitigation budget	DRR Responsibilities DRR to hire a third party-monitoring firm to carry out Health Risk Monitoring Program for Operation Phase as described in Table ???.

Environment and Social Components/ Impacts	Mitigation measures/ Responsibility	Area of Implement
4.7 Occupational Health and Safety/Hygiene		
Pre-construction/Construction phases The impact of disease and injury on health and hygiene due to work accidents among workers	 <u>Contractor's Responsibilities</u> All contractors must adhere to the labor and occupational health and safety specifications outlined in the project's Labor Management Plans. 	Area of Implementation The Contractor's workers
 Accidents may occur at any time during project construction activities. In general, while 85 percent of accidents arising from work are caused by individuals lacking knowledge/ care/attention/ experience, the remaining 15 percent are caused by machines that are damaged or unfit for operation. Nevertheless, in the general construction process of roads, personal protective equipment such as safety helmets, earplugs, gloves, face masks or masks and safety shoes, etc. are provided for the staff and all workers throughout the construction period. This will help prevent and reduce the impact of accidents at work. Project office and housing for construction workers without good hygiene management will affect physical, mental and social health, causing illnesses and diseases resulting from personal hygiene behaviours. Environmental hygiene risk factors includes unclean water, solid waste, unhygienic sewage toilets, disease-carrying animals and insects that cause public health risks, such as rats, mosquitoes, flies, cockroaches, etc. Therefore, the contractor must be equipped with measures to manage environmental hygiene following sanitary principles. The Koh Lanta Bridge EIA provides a detailed analysis of occupation health and safety risks from air quality, noise, vibration, water availability for consumption and communicable diseases. Each of these risks is assessed as moderate. Mitigation measures to manage these impacts have been inlcuded in various aspects include air, noise, vibration, water quality, occupational health and safety/hygiene, sanitation, transportation and traffic safety and accidents. 	 Impacts of disease and injury on health and hygiene due to worker accidents Strictly comply with prevention and correction measures on impacts of noise, air quality, transportation and sanitation to enhance safety during construction. Provide oritation on Occupational Health and Safety and also Hygiene for all relevant contractors prior to commencing the construction work. Prepare preventive measures and comply with ministerial regulations. Establish standards for management and operations regarding occupational safety, health and working environment for the construction for the year 2021 to reduce exposure to dangers from construction activities. Establish a safety policy for operations in the construction area, formulation of construction plans and control measures for construction safety at various stages. Monitor and supervise employees and construction workers to strictly comply with safety regulations or laws in investigating the cause of various hazards. Provide suggestions and training to employees and construction workers to promote cautions at work per the policy-specified safety. Educate and advise construction workers before hiring them. They shall not be at risk of committing crimes or relating to drugs. Ensure that contractors supervise workers to comply with local operation regulations, schedule check-in and check-out time and impose a ban on alcohol and drugs to avoid conflicts with local people. Provide training for operators on using and maintaining machinery properly and appropriately, following the type of work before the actual operation. In addition, officers responsible for inspecting and maintaining machines and equipment should be assigned to ensure the functionality of the machinery. If damages are found, the machines are to be immediately repaired to prevent accidents at work. In case of at least 10 employees residing in the area, a first ald kit must be provided at worker camp to reat illness an	Cost Included in the overall mit

entation/Cost	Monitoring Program/Responsibility/Cost ²	
n ers	DRR Responsibilities DRR to hire a third party-monitoring firm to: (i) carry out monitoring program described below, and (ii) carry out Health Risk Monitoring Program of the project.	
	Monitoring Locations:	
mitigation budget	 Workers camp Communities located within 500 m from the Project route Cement mixing plant Project's construction office 	
	Monitoring Index:	
	 Conduct a questionaire survey together with the socio-economic and public helath surveys to monitor health conditions of the project construction workers. 	
	 Incident and accident statistic of the following events: Near-miss First aid case Medical treatment case Lost time accident Fatality Fire (minor and major) Spill Availability and read to use condition of safety equipment including Personal Floating Devices (PFD), safety harness and fall protection equipment, etc. Safety inspection of the construction sites over the water area including water traffic. Emergency response exercise covering all emergency situations such as drowning, etreme weather conditon and wave and current forces. Labor incident in related to child, foreced and misused labor and sexual harrassment 	
	 2 times/ year throughout the construction period – for the questionnaire survey to monitor health condition of the project construction workers Real time for other Indexes 	

Environment and Social Components/ Impacts	Mitigation measures/ Responsibility	Area of Implementation/Cost	Monitoring Program/Responsibility/Cost ²
	 The contractor is responsible for preserving the peace and order of the residence. Arrange for signs or warning announcements regarding dangers or penalty rates according to the law on drugs. Rotate workers who are exposed to vibration for a long time. Contractors must comply with the notification of the Labor Welfare Committee on the Standards of Labor Welfare for Construction Employees B.E. 2559 (2016) as follows: 		-
	 Contractor staff and workers accomodations The room size should have a width of no less than 4.50 m. on the narrowest side. The total area should be at least 9.0 sq.m. Its height should be at least 2.40 m. However, a residential space should be at least 3.0 sq. m. per person in compliance with the building control law. Foundations and structures must be safe and strong enough. Materials used for construction must also be suitable. Housing for workers in consecutive construction works or those with a total length of 45 m, there must be a space with a width of at least 2.50 m between side rows throughout the depth of those places. To ensure natural ventilation for accommodations in workers' residences, doors and windows must be provided at residential places, or air vents must be adjacent to external air for a total area of at least 10% of that room, excluding the area of doors, windows and air vents next to other rooms or corridors inside buildings. Arrange a sufficient number of rooms for employees residing on the site. 		
	Bathroom and toilet arrangement		
	- Ensure cleanliness, hygiene, safety, light and a sufficient number of toilets and bathrooms to facilitate all construction workers.		
	- Provide adequate bathrooms-toilets in construction sites at a ratio of one to 15 workers.		
	 Toilets can either be separated or installed in bathrooms. However, they must be separated by gender, easy to keep clean and have ventilation openings of no less than 10.0% of the room area or sufficient ventilation fans, with a vertical distance between the room floor to the top ceiling or the lowest part of the wall of no less than 2 m. In the case of separated bathrooms and toilets, the area of the room must be at least 1 sq.m. Its internal width must be at least 1 m. If they are in the same room, its internal area must be at least 1.50 m. Foundations and structures must be safe and strong enough. Materials used for construction must also be suitable. Upon the completion of the construction, the construction supervision office and workers' residence shall be dismantled, as well as wastewater and sewage treatment tanks located underground shall be removed to comply with sanitary principles. 		
	Solids waste management		
	 Install a waste collection station and classify types of trash bins into different colours according to each type of waste. Provide enough trash bins. Ensure that trash bins should be made of strong and durable materials that are easy to clean, do not leak, and have a tight lid. Trash bins shall be of proper size, suitable for the amount of waste, portable and preventive of disease-carrying animals and insects. Provide a bag inside the trash bin for convenience in storage and to prevent the trash from falling or spreading. Solid waste shall be encouraged by the contractor to help reduce the amount of waste from onset and trouble in the disposal process by relying on the 3 R principle as follows: Reduce the use of plastic and foam by turning to natural materials. Recycle used materials. For instance, use a cloth bag instead of a plastic bag. Coordinate with Koh Klang Sub-District Administrative Organization in collecting and disposing of solid waste generated daily in accordance with sanitary principles. 		
	Animal and insect vector management		
	- Get rid of mosquito breeding sites or use repellents, attach mosquito nets on windows and doors and provide mosquito repellent.		
	- Coordinate with sub-district hospitals in the area to eliminate mosquito larvae in labour camps.		

Environment and Social Components/ Impacts	Mitigation measures/ Responsibility	Area of Implement
	 Maintain cleanliness and tidiness of the living quarters, offices, cafeterias, material sheds and maintenance plant regularly. Dry foods such as flour and sugar shall be packed in containers or jars with a tight lid. Collect and dispose of solid waste which is a source of rat food and dwelling place in the garbage bin with a tight lid, with no leakage and dispose of the garbage daily. Close any holes or openings where rodents may enter residential buildings and dining rooms. Store food in covered cupboards and containers to prevent fly swarming. Water quality management for consumption Provide quality drinking water sources through standardized and sufficient drinking water production. Set up drinking water service stations in clean, non-wet areas, away from contamination sources, toilets, and waste collection points. Drinking water dispensers, coolers, and faucets must always be in good and clean condition. Personal mugs shall be cleaned after each use. 	
 Water Safety Risk Bridge Pile Boring activities can introduce specific water safety risks due to the nature of the work conducted in or near water bodies. Here are some water safety risks associated with bridge pile boring activities: Unstable Ground Conditions: Pile boring involves excavating the ground to create boreholes for the bridge piles. This process can potentially destabilize the surrounding soil or sediments, leading to collapse or subsidence. Workers near the boreholes or on unstable ground may be at risk of being trapped or injured due to ground movements. Inadequate Structural Support: Temporary structures such as casings may be used during pile boring to provide a safe working environment. If these structures are not properly designed, installed, or maintained, there is a risk of failure, causing flooding, collapse, or entrapment of workers. Limited Visibility and Waterborne Hazards: Working in or near water bodies during pile boring activities may be accompanied by reduced visibility due to murky water or poor lighting conditions. This can make it difficult to detect underwater hazards, such as submerged structures, debris, or uneven seabed terrain, increasing the risk of accidents or injuries. Drowning and Water-related Accidents: Workers involved in bridge construction may be exposed to the risk of drowning or water-related accidents due to the proximity to the sea. Adequate safety measures such as personal flotation devices (PFDs), safety harnesses, and trained rescue personnel should be provided on-site to mitigate these risks. Additionally, proper training and awareness programs should be implemented to ensure workers are familiar with water safety protocols. Extreme Weather Conditions: Sea environments are prone to extreme weather conditions such as storms, high winds, and tidal changes. These weather events can pose risks to the safety of workers, equipment, and the stability of the construction sit	Contractor's Responsibilities • All contractors must adhere to the labor and occupational health and safety specifications outlined in the project's Labor Management Plans. Bridge Pile Boring • Ensure all workers involved in pile boring are equipped with appropriate personal flotation devices (PFDs) and are trained in water safety protocols. • Establish exclusion zones or barriers to prevent unauthorized access and keep workers away from potentially hazardous areas. • Conduct geotechnical assessments to evaluate ground stability and determine appropriate support systems for the pile boring operation. • Implement proper dewatering and drainage systems to control groundwater and prevent flooding of the work area. • Ensure adequate lighting and visibility measures are in place to enhance safety in and around the water during pile boring activities. • Regularly inspect and maintain temporary structures, such as casings, to ensure their stability and integrity. Drowning and Water-related Accidents: • Provide adequate personal flotation devices (PFDs) for all workers near the water. • Establish emergency response protocols and trained rescue personnel on-site. • Conduct regular safety training and awareness programs for workers. Extreme Weather Conditions: • Track weather conditions; • Track weather conditions and receive timely alerts. • Develop protocols for suspending work during hazardous weather, including storms, high winds, or adverse sea conditi	Area of Implementation Construction area under a Cost Check These costs Life Vest Geotechnical assessme Dewater and drainnag bored pile Lighting in the boring a Inspection and mainte Saety harness and fa working over water Shelter during ex condition Engineering design to current force during co stability of the bridge of construction

ation/Cost	Monitoring Program/Responsibility/Cost ²
nd over the water	DRR Responsibilities DRR to hire a third party-monitoring firm to: (i) carry out monitoring program described below, and (ii) carry out Health Risk Monitoring Program of the proejct. Monitoring Locations: Construction area under and over the water
ent e system from the area mance of casing all protection for streme weahter protect wave and onstruction ent to ensure during	 Monitoring Index: Incident and accident statistic of the following events: Near-miss First aid case Medical treatment case Lost time accident Fatality Fire (minor and major) Spill Availability and read to use condition of safety equipment including Personal Floating Devices (PFD), safety harness and fall protection equipment, etc. Safety inspection of the construction sites over the water area including water traffic. Emergency response exercise covering all emergency situations such as drowning, etreme weather conditon and wave and current forces. Monitoring of weather and current and wave conditons
	 Monthly throughout the construction period

Environment and Social Components/ Impacts	Mitigation measures/ Responsibility	Area of Implementation/Cost	Monitoring Program/Responsibility/Cost ²
 conditions should be established to ensure the safety of personnel and the integrity of the project. Wave and Current Forces: Construction activities in the sea can be affected by wave action and currents, which may pose risks to workers and equipment. The bridge's design should consider these forces and be built to withstand them. Proper engineering techniques, including the use of appropriate foundations and structural reinforcements, should be employed to ensure the stability and safety of the bridge during its construction and operation. 	 Monitor wave and current conditions, promptly notifying workers to cease work in the event of severe wave and current activity. Workers will be directed to evacuate to the designated safe area or shelter. Conduct thorough engineering studies and incorporate appropriate design techniques to account for wave and current forces during construction. Implement proper foundations and structural reinforcements to ensure the stability and safety of the bridge. 		 Daily during the monsoon season (for monitoring of weather and current and wave conditons) Cost Included in the overall construction and monitoring budget
Operation Phase During project roadway maintenance, operators shall handle equipment/machinery/engine with ultimate care. Lack of caution, experience and expertise regarding workplace safety regulations may result in minor injuries such as abrasions, burns, fractures, and even death. However, since the nature of the activity is not different from the current project which is a normal operational activity of the DRR officers who are already experienced in the maintenance of roadways.	 DRR Responsibilities Provide and strictly enforce the use of personal protective equipment suitable for each type of work, such as hard hats, gloves, boots, and bright-colored vests or vests that can be seen from a distance among employees. Provide safety equipment such as led signs indicating work areas, maintenance work, road barriers, cones, and markings on the road surface as well as Illumination and flashing lights as a warning of the work area and pavement maintenance before reaching the operation site. 	Area of Implementation Througout the bridge route. Cost Included in the overall mitigation budget	None
4.8 Sanitation			
Pre-construction/Construction phasesImpacts from solid wasteConstruction supervision office and workers' residence accommodateapproximately 170 officers and construction workers. The dailygeneration of solid waste from workers' residence works out to beapproximately 0.17 tons/day (amount of solid waste generated is 1kg/person/day, referring to the information of the local environmentoffice, B.E. 2555)[A.D.2012]. If waste is unattended or improperlymanaged, the project's construction site will turn into a food source anda breeding ground for disease-carrying animals and insects, such as flies,mosquitoes and cockroaches, etc., resulting in contamination of watersources and land. Consequently, the surrounding area will be pollutedand cause nuisance from noise, smell, smoke, powder and dust. ThePollution Control Department found the area of Koh Klang SAO generates7.72 tons of waste per day which can be classified into 1.00 tons/day fordisposal waste and 6.72 tons/day of waste being utilized. Given thatresidual waste is not an issue in the Koh Khlang SAO area. Impacts fromwaste expected to be generated from the project (0.17 tons/day isassessed to be low.Impact from drainage of wastewater-Construction supervision office and construction workers' residenceare located along Highway No. 4206 (left side), 650 m. from theproject area, accommodating 170 workers. Each day about 23.03cu.m.of wastewater will be generated from various activities,including wastewater from bathrooms toilets, canteens,maintenance plants, and leachate. P	 Contractor's Responsibilities Solids waste management Contractors are responsible for providing waste segregation bins with closed lids, without water leakage (refrain from using baskets in collecting solid waste). The bins provided shall be sufficient in number and appropriate in size to accommodate waste generated each day. They shall be placed at various points within the construction unit area such as workers' residence, canteens, buildings and offices, including the maintenance plant by arranging for collection and transfer of waste to the collection point by officers or workers. The contractor shall coordinate with the solid waste collection staff from Koh Klang Subdistrict Administrative Organization to request garbage trucks to collect and transport to the waste disposal facility. Install clear signs or symbols on trash bins according to four types of waste: general, recycled, wet and hazardous. Strictly prohibit open burning of waste at labour camps or construction sites After the construction is completed, remove the construction supervision office and labour camps, and remove septic-anaerobic filters in the underground according to sanitation principles. Educate staff and workers on waste types and sorting to minimize waste for disposals, such as some types of dry waste that can be recycled, e.g., glass bottles, metal, plastic, and wet waste that can be used to make liquid biofertilizers. Hazardous waste, such as light bulbs, dry batteries and spray cans, must be safely disposed of. Guidelines for waste sorting are as follows: Biodegradable waste such as food scraps and leftover vegetables, can be composted to make fertilizer. This type of waste accounts for 46%. of the total solid waste. Biodegradable waste should be separated into the green bin to be processed into compost. Recyclable waste such as food scraps and leftover vegetables, such as plastic fod containers, straws, candy sachets, noodle sachets, tissue boxes,	Area of Implementation Construction area and worker camp Cost Included in the overall mitigation budget	DRR to hire a third party-monitoring firm to carry out Health Risk Monitoring Program of the project.

Environment and Social Components/ Impacts	Mitigation measures/ Responsibility	Area of Implementation/Cost	Monitoring Program/Responsibility/Cost ²
draining to the outside area, the wastewater could adversely impact ecosystem in the receiving environment and become a source of disease transmission. Therefore, the impact is considered as moderate.	• Toxic waste must be collected and disposed of properly, such as pesticide cans, light bulbs, and batteries. This type of waste which accounts for about 3% of the total solid waste should be separated into red bins for proper disposal.		
	Waste reduction		
	 Waste can be reduced by avoiding or reducing the generation of waste or pollution. For instance, use cloth bags instead of plastic bags, or reduce the use of straws by drinking water from a glass. Reusing of the product refers to the process of reusing materials used in their original form or repaired form or reusing for other purposes. There are two steps to reusing. On the one hand, the production process aims to generate minimum scrap or waste. On the other hand, the reuse process focuses on extending the functionality of a product before throwing it away, for example, reusing water bottles or using 2-sided paper. Remanufacturing is separating materials that cannot be reused from other waste and gathering them for use as raw materials. The production of new products is called recycling. Avoid using hard-to-remove materials such as Styrofoam boxes, plates or paper cups and relying on natural pesticides. Repairing involves fixing broken things, such as clothes, electrical devices, etc. so they regain their original functionality. 		
	Management of wastewater from the construction supervision office and workers' residence		
	 Manage wastewater or used water through septic tanks, anaerobic filters and grease traps to ensure the water quality complies with Wastewater Discharge Standards, announced by Ministry of Natural Resources and Environment as follows: Install septic-anaerobic tanks to treat wastewater from toliets (10.0 cu.m. x 1 unit), canteen (10.0 cu.m. x 1 unit), and mainteance shop (1.50 cu.m. x 1 unit) to meet the effluent quality standards before being drained into nearby water sources. pH range of 5.5-9.0 BOD (Biochemical Oxygen Demand) of no more than 20 milligrams/litre. In case the final treatment unit is a stabilization pond or an oxidation pond, the BOD value of the filtered water (Filtrate BOD) shall be used. Suspended solids of no more than 30 mg/l in case the final treatment unit is a stabilization pond or axidation pond, the BOD value of the filtered water (Filtrate BOD) shall be used. Fat, oil and grease of no more than 50 mg/l. Total Phosphorus of no more than 20mg/l. Follow Standard Methods for the Examination of Water and Wastewater jointly established by the American Public Health Association, the American Water Work Association and the Water Environment Federation or according to other methods announced by the Pollution Control Board in Royal Gazette for wastewater analysis. Install emporary drainage pipes (PVC-5) with a diameter of 1.20 meters around the construction area to collect treated wastewater from the septic tank-anaerobic filter to a water sump at a size of 6.5x6.5x1.0 meters before releasing water to the construction area to the clainage line at highway no. 4206. Provide four 240-liter trash cans with lids per set. One set shall be provided each at the construction worker camp, canteen, construction site office, and construction area to collect twaste produced each day. The project shall coordinate with the Koh Klang Sub-district Administrative Organization for daily		
	septic tanks/sumps underground shall be dismantled and disposed of according to sanitation guidelines.		

Environment and Social Components/ Impacts	Mitigation measures/ Responsibility	Area of Implement
	 Provide 1 set of mobile toilet equipped with onsite septic-anaerobic tank (4 toilets/tank) at both side of construction areas (Koh Khlang and Koh Lanta Noi) and coordinate with Koh Khlang and Koh Lanta Noi SAOs to collect wastewater for further treatment each day. 	
 Operation Phase The project has set up two viewpoints on the bridge, namely Km. 0+692 and Km. 0+892, with access to the viewpoint in the overpass and elevator layout located on the shore of Koh Klang sub-district area at Km. 0+512. A 500 meter-pavement connects the two viewpoints. According to the project plan, it is expected that tourists with varied characteristics and behaviours will constantly visit the viewpoints. Round-trip tourists travelling in a group generate relatively little waste production in the area. Rather than littering around or leaving trash by the trash can, this type of tourist generally throws waste directly into the trash can provided bins are overflowing and waste sorting and segregating bins are available. However, the wrong types of garbage may be mixed in each type of bin, possibly due to tourists' lack of knowledge regarding waste sorting and its benefits. The project requires a bathroom a toilet at km. 0 + 500 and a parking space under the bridge structure in Koh Klang sub-district area which 	 Contractor's Responsibilities Construct toilet facilities at bridge parking space in Koh Khlang Sub-district. Provide 240-liter waste bin with a lid and a steel mesh cage to prevent monkeys from digging through garbage at parking space near bridge view points entrance (on both left and right side). Each set should comprise separated bin for 4 categories of waste: biodegradable waste, hazardous waste, general waste and recyclable waste. Clearly label waste bins with signs or symbols of waste type. Install signs encouraging entrepreneurs and tourists to refrain from using plastic and foam containers. Install signs prohibiting waste disposal/littering at two viewpoints at milestone 0+692 and milestone 0+892 to prevent waste disposal into the sea. DRR's Responsibilities Coordinate with Koh Klang Subdistrict Administrative Organization to operate and maintain toliet facilities. Coordinate with Koh Klang Sub-district Administrative Organization to collect wastes and dispose at Krabi Municipality's Waste-to-Energy Plant. The suggested waste collection frequency is 1 – 2 trips/day (during 08.00 – 16.00) for long holidays and high tourism season (November – March).	Area of Implementation Project area Cost Included in the overall mit
drainage of wastewater and solid waste is expected. Therefore, the impact is moderate. 4.9 Traffic accidents and safety		
 Pre-construction/Construction phases Activities in the construction of bridges and at-level roads usually require the usage of machinery in the construction area which may slow down traffic in areas where activities are carried out and may. Moreover, traffic may also be blocked, jeopardizing the safety of road users and pedestrians alike as they are likely to be exposed to dangers from construction machines. While transportation of heavy parts or structures to the construction site, at certain times or periods there may be the need to block traffic and create detours, resulting in slow traffic in the area. Such consequences shall mostly occur during the construction period, which lasts relatively long. Therefore, the impact is moderate. Site preparation, transportation of construction materials and large machines and project construction activities could pose adverse impacts and disrupt traffic on the project transport routes include Highway No. 4206 which is the main transportation routes to Koh Lanta and rural road Gor Bor. 5035 which is one of the main transportation routes in Koh Lanta. Therefore, negative impacts significance on land transportation is considered as moderate. 	 <u>Contractor's Responsibilities</u> Strictly comply with prevention and correction measures for transportation to reduce risks of accidents for car users and risk points for accidents. Coordinate with Koh Khlang SAO and Koh Lanta Noi SAO to keep local communities regularly informed about project work plan/construction plan throughout Pre-construction and Construction Periods as follows: Prepare a large and visible PR signboards with details including a map of the construction area, construction schedule, construction period, the construction contractor company, budget, address, and telephone number of the contractor and the owner (Department of Rural Roads). The signboards shall be Installed 2 months before construction, at 2 locations, namely at the beginning of project construction (km. 0+000) and the end of construction (km. 2+527). Install traffic signs to provide warnings for road users with types and sizes of traffic signs in accordance with standards stipulated by the Department of Rural Roads. It is required that the signs are large and visible to road users, especially at intersections and curved roads connecting local roads and communities. Prepare a traffic management plan before the project construction by installing barriers, cones, and traffic signs on the road surface, warning signs in the construction area and installing visible lights both during the day and at night at least 500 m. before the construction site, especially at intersections. Install detour signs 300 m before reaching the detour area (Manual on traffic control of the Department of Highways (DOH), 2018) for construction, and providing traffic symbols, signs, temporary traffic lights, construction boundary signs and detours following the DOH standard so that communities along the routes and road users can see them clearly and use the routes safely during day and night time. Site clearance and drainage works at the access to public roads should start after road impr	Area of Implementation Construction area Cost Included in Environmental Mitigation Measures for T

ation/Cost	Monitoring Program/Responsibility/Cost ²
igation budget	None
Action Plan – ransportation	DRR's Responsibilities DRR to hire a third party-monitoring firm to conduct the monitoring of the following: Monitoring locations Project transport routes include: - Highway 4206 - Rural road Gor Bor. 5035
	 Monitoring Index As part of the monitoring on transportation impacts, collect statistic of land and water traffic accidents including information on location, time, and the cause of the accident in the project route. Duration and frequency 1 time/year throughout the construction period.

Environment and Social Components/ Impacts	Mitigation measures/ Responsibility	Area of Implementa
	 Officers are assigned to facilitate traffic for vehicles travelling through intersections and curves, considered risky points during construction activities. They are responsible for stopping the traffic during the entry-exit of vehicles used in transporting construction materials or moving machinery in order not to obstruct the travelling of the locals. Contractors must install flashing lights that are visible at a distance of at least 500 m. in normal visibility, in areas where traffic areas are used, and detours are created to alert drivers in advance before approaching the construction area. Dispose off the demolished materials according to the law. Trucks that are used for transporting soil debris and other construction materials must be tarped or other materials extending down at least 30 cm. longer than the load of the materials to prevent the falling of soil debris onto the road surface. Always examine the condition of trucks, equipment and machinery used in construction activities per the machine cycle. Determine the truck's weight to be per the law. Regularly inspect and repair the road surface of the road network. In case of damage due to the transportation of the project, the contractor is responsible for immediately recovering and restoring the condition of the road in order to prevent road accidents. Provide training for drivers of trucks used in transporting construction materials and equipment and ensure strict compliance with traffic rules and safe driving to prevent accidents among drivers, road users, and residents near the project route. Motor vehicle operators are prohibited from using psychotropic stimulants or being intoxicated while working. In case of violation, the immediate penalty is to be imposed to avoid accidents causing death or damage to property of others, which may jeopardize the project's reputation. Ensure decals are affixed on the back of trucks	
Operation Phase	DRR Responsibilities	
To facilitate pavement maintenance, machinery will be transported to the construction area. This may obstruct and slow down traffic in areas where activities are being operated. However, since the extent of the impact is limited to the route boundary and is temporary, the impact is low.	 Strictly follow mitigation measures of environmental impact on transportation to prevent accidents and increase safety for road users. Check and maintain the conditions of road surface, lights, traffic signs and warning signs on the bridge and ground-level roads. During the maintenance of the project route, there shall be warning signs of areas being renovated and road 	Area of Implementation Througout the bridge route
	 diversions. Warning signs shall be in place to alert road users prior to reaching the site. There shall be warning signs at three spots, at 1,000 meters, 500 meters and 200 meters before reaching the site. Bridge pier structures near navigation channels are areas prone to accidents. There shall be lights and flashing lights to warn vessels to take caution. 	Cost Included in the overall miti
4.10 Archaeology and History		
Pre-construction/Construction phases	DRR Responsibilities	
Impacts on destruction or damage to significant archaeological sites and antiques - As a result of the inspection of ancient and archaeological sites in the study area within 1 km along the project route with the 12th	- The Department of Rural Roads shall coordinate with the 12th Regional Office of Fine Arts in Nakhon Sri Thammarat Province before project construction starts. If any archaeological artifacts/evidence are found on land, underground or underwater during construction, the Department of Rural Roads shall immediately inform the 12th Regional Office of Fine Arts in Nakhon Sri Thammarat Province for further examination in order to prevent issues to any party.	Area of Implementation Refer to impacts on noise s
Regional Office of The Arts Department, Nakhonsithamarat, it was found that the project's study area does not comprise any ancient and archaeological sites. Additionally, the results of field surveys by archaeologists did not suggest any underwater archaeological sites in the project operation area and the study area, 1 km. from the project route. Moreover, the results of additional coordination of the Division of Underwater Archeology to examine underwater archaeological sites did not detect any archaeological sites in the project area.	 <u>Contractor's Responsibilities</u> Strictly comply with mitigation measures for impact on air quality, sound, vibration and transportation. During the construction period, a temporary soundproofing wall of metal sheet type or a more efficient material are to be installed, 3.0 meters high, 0.64 millimeters in width, and 100 meters long from milestone 0+290 to milestone 0+390. From milestone 1+920 to milestone 2+005, a sound proofing wall of 85 meters length shall be installed as well. Two 	Cost Refer to impacts on noise s

entation/Cost	Monitoring Program/Responsibility/Cost ²
n oute.	None
nitigation budget	
n	
se section	None
se section	

Environment and Social Components/ Impacts	Mitigation measures/ Responsibility	Area of Implemen
 However, since Thung Toh Yum Cemetry is located in the project area at a distance from from the middle of the project route at 34m. of which the assessment of impacts from air, noise and vibration suggested that the project activities may have noise impacts with values of 74.0-79.0 dB(A), which exceed the standard of general noise level according to the National Environment Board (B.E. 2540) [A.D.1997]. Therefore, the impact is assessed to be moderate, A clear acrylic-sheet noise barreir will be installed all around the bridge railing of the project to prevent noise impacts on Thung To Yum cemetry as religious ceremonies and rituals are held in the area regularly. 	 areas affected by sound levels that exceeded the safety standards include Moo 8 Ban Hua Hin (Ban Tha Rua) and Thung Toh Yum Cemetery. Project Chance Find Procedure (Annex 1) shall be followed. In the event that artifacts are discovered, all works must stop. The 12th Regional Office of Fine Arts shall be notified immediately. Works can only resume after confirmation from the 12th Office of Fine Arts Department. 	
Operation Phase	Contractor's Responsibilities	
 Impacts on archaeology and historical values due to transportation activities on project roads and maintenance work are not expected. 	- Noise barriers made of acrylic glass or a higher quality material shall be installed after the project route is completed at the bridge railing (milestone 0+290 to milestone 0+375). The total distance of the noise barrier wall is 85 meters, 15 millimeters in width and 2 meters in height. This is to prevent sound impact on Thung Toh Yum Cemetery as there often are religious ceremonies.	Area of Implementation km. 0+290km. 0+375
	- Install No Horn traffic signs at the bridge railing before approaching Thung Toh Yum Cemetery to minimize impact from noise during religious ceremony.	Cost Included in the overall bu
	DRR Responsibilities	
	 Conduct checkup and maintenance of the traffic surface to be in good conditions in order to minimize impact between wheels of vehicles and traffic surface. Maintain and check the conditions of the acrylic glass noise barrier at the bridge railing. 	
4.11 Aesthetics/Landscape/Tourism		
Pre-construction/Construction phases	Contractor's Responsibilities	
Impacts on changes in the landscape or depreciating the value of	Impacts on changes in the landscape or depreciating the value of landscape/scenery	Area of Implementation
 The construction of the project's bridge includes construction site preparation, soil/stonework, building material preparation and moving, bridge structure work, drainage system, public utility and safety management. The mentioned activities will affect the area's natural conditions, including the livelihood of humans, animals and plants. In addition, the issues of pollution are likely to be agitated. The area's scenery will also be transformed into an empty area with piles of materials/equipment used in the demolition in the construction area and the edge of the road, causing changes and damages in the physical scenery that are perceivable through the eyes. Therefore, the impact is moderate. Project construction activities do not affect the tourist attractions in Koh Lanta, as the project site is located far away from the tourist attractions. 	 The contract shall stipulate that the contractor shall regularly clean and maintain the orderliness of construction areas. Trash shall be regularly collected from the construction areas. Branches, scraps or debris from relocation of obstructions, land excavation, drilling, soil filling work or other materials from construction shall be removed from construction areas immediately after the construction is completed. This is to prevent obstructions to the use of routes in the vicinity and to prevent unpleasant scenery. If it is not possible to move the materials/debris immediately, there shall be an area allocated for storage and appropriate fences around the area to prevent impact on surface water sources in the vicinity. The contractor is responsible for restoring construction sites, including the workers' accommodation site, to their pre-project conditions through rehabilitation efforts. 	The project construction a Cost Included in the overall bu
Operation Phase	DRR Responsibilities	
 The landscape around the current project area composes communities with alternating agricultural and coastal and sea areas. The topography is flat with an open area. 	 Strictly comply with preventive and corrective measures for sanitation. Sustain and preserve the sculptures in the scenic area and preserve the cleanliness of the parking area, staircase to the bridge and pavement along the bridge in order to ensure tidiness, cleanliness and order of the project's landscape. 	Area of Implementation Throughout the bridge ro

ation/Cost	Monitoring Program/Responsibility/Cost ²
	Ners
	None
lget	
rea	None
lget	
-	
	Nopo
ite	וועווכ

Environment and Social Components/ Impacts	Mitigation measures/ Responsibility	Area of Implementation/Cost	Monitoring Program/Responsibility/Cost ²
 Environment and Social Components/ Impacts The pier of the bridge structure is positioned in the area of Khlong Chong Lad (sea) with the highest elevation point in the middle of the bridge at about 8.0-15.0 meters (above sea level). Since the structure is considered large and tall, the area's visibility shall be impacted and altered from its original. Residents within 100m are expected to inevitably be exposed to visual impacts and visibility. However, the bridge structure connecting Koh Lanta, Koh Klang sub-district Koh Lanta Noi sub-district, Koh Lanta district, Krabi Province is a transportation route with similar characteristics as the Siri Lanta Bridge, Krabi connecting Koh Lanta. People residing in the area are familiar with such structures. Therefore, the impact is low. The project's bridge, incorporating the uniqueness and identity of Koh Lanta in its design, can be developed as a new tourist attraction of Koh Lanta. Besides, the project's development will enhance the convenience of transportation between Koh Klang and Koh Lanta Noi, facilitating tourism on the island. Changes in land use of Koh Lanta are expected to occur gradually following economic and social development. The main factors driving changes in land use include population growth, urban expansion, industrial growth and increasing demand for food/agricultural 	Mitigation measures/ Responsibility	Cost Included in the overall budget	Monitoring Program/Responsibility/Cost ²
products. Consequently, various agencies involved must concentrate on integration, planning, resource management and allotment of land use in line with land use policy.			

4. ENVIRONMENTAL AND SOCIAL ACTION PLANS

Apart from the summary of mitigation measures and monitoring program outlined in Table 3-1 for the identified impacts, national EIA requires that action plan for key risks and impacts are developed to provide more details including on detailed cost estimate, conceptual drawing and layout or example photos (where relevant) to guide actual implementation. These action plans for key impacts were selected and prepared during the Lanta bridge Environmental Impact Assessment (EIA) preparation to provide comprehensive details on the mitigation measures essential for addressing key risks and impacts. It is important to note that these plans do not replace daily/weekly monitoring of all relevant E&S impacts identified in Chapter 3 (Table 3.1). These plans include the following:

- Action Plan for Prevention and Mitigation of Impacts on Fresh Water Quality
- Action Plan for Prevention and Mitigation of Impacts on Marine Water Quality
- Action Plan for Prevention and Mitigation of Impacts on on the Noise
- Action Plan for Mangrove Replantation
- Action Plan for Forest Replantation (National Reserved Forest)
- Action Plan for Prevention and Mitigation of Impacts on Dolphins
- Action Plan for Prevention and Mitigation of Impacts on on Transportation, Accidents, and Safety
- Stakeholder Engagement Plan Activities

Furthermore, the contractor is required to develop a comprehensive Occupational Safety and Health (OSH) plan, incorporating the emergency response plan as part of a Contractor-ESMP. This plan will form an integral component of the bidding document and will be assessed based on predetermined criteria. Details of the action plans listed earlier are discussed as follows

4.1. Action Plan for Prevention and Mitigation of Impacts on Fresh Water Quality

1) Objectives

The objectives are to prevent and minimize the impacts from the runoff of soil from construction into water sources.

2) Implementation Area

- **Construction Phase:** Project site office, workers camps, mobile toilets and concrete mixing plant
- **Operation Phase:** Project site at Bridge view point access, Koh Khlang District

3) Implementation Methods

a) Pre-Construction/Construction Phases

Wastewater from site office and worker's camp

- The discharge of wastewater into the environment necessitates two essential steps: first, thorough treatment, and second, adherence to pertinent Water Quality (WQ) standards. The outcomes of these processes must be meticulously documented.

- Treat wastewater to meet efffluent standrds before discharge to nearby recieving water body/darinage. Installed septic-anaerobic tanks to treat wastewater from toliets (10.0 cu.m. x 1 unit), canteen (10.0 cu.m. x 1 unit), and mainteance shop (1.50 cu.m. x 1 unit).



Figure 4.1-1 Example of Septic-anaerobic Tank

- Install oil/grease traps (0.5 cu.m. x 4 units) at canteen and maintenance shop (0.5 cu.m. x 1 unit).



Figure 4.1-2 Example of Oil/Grease Trap

- Pour concrete slabs with berm in the area that oil and grease spills may occur at workers camp and the maintenance area. Oil contaminated water should be drained to oil/grease trap and finally treated at wastewater treatment tank.



Figure 4.1-3 Example of concreat pavement with berm

- Ensure that machinery plant, maintenance plant, storage of fuel, engine oil tank and used oil tank, and cleaning area for vehicles, machinery and construction materials are located 100 m. away from water sources and drainage channels to prevent contamination into water sources.
- Gather used oil containers at the maintenance plant and have them disposed of properly.
- Contractors are responsible for providing waste segregation bins with closed lids, without water leakage (refrain from using baskets in collecting solid waste). The bins provided must be sufficient in number and appropriate in size to accommodate waste generated each day. They shall be placed at various points of the construction site, such as workers' residences, canteen, offices,

buildings, and maintenance plant. Staff are to be assigned for collecting waste and transferring them to the collection site.

- Contractor shall contact Koh Klang SAO to collect waste and disposed off at approved disposal site.



Figure 4.1-4 Example of Waste Segregation Bins

Wastewater from construction site

- The discharge of wastewater into the environment necessitates two essential steps: first, thorough treatment, and second, adherence to pertinent Water Quality (WQ) standards. The outcomes of these processes must be meticulously documented.
- Provide 1 set of mobile toilet equipped with onsite septic-anaerobic tank (4 toilets/tank) at both side of construction areas (Koh Khlang and Koh Lanta Noi) and corrodinate with Koh Khlang and Koh Lanta Noi SAOs to collect wastewater for further treatment each day.



Figure 4.1-5 Example of Mobile Toilets

Wastewater from concrete mixing plant

- Wastewater from the concrete mixing plant shall be processed through two coagulation pits with acid (Sulfuric acid (H2SO4)/Hydrochloric acid (HCl/ CO2) added to neutralize the pH level to 5-7. The 1st pit (4.0 x 4.0 x 1.5 m) is for residue concrete in concrete truck and the 2nd pit (4.0 x 4.0 x 1.5 m) is for the overflow from the 1st pit.
- Constractor shall construct water collection pond (6.5 m x 6.5 m x 1.5 m) and sedimentation pond (54 cu.m.) for final sedimentation before water will be reused e.g. for vehicle washing, and/or other activities as much as possible before discharge out to the public drain. Once the pit is full, the sludge should be disposed in a landfill.



Figure 4.1-6 Example of Water Storage or Sedimentation Pond

b) Operation Phase

<u>Contractor's Responsibilities (Contractor to built these facilities during Construction</u> <u>Phase)</u>

- Construct toilet facilities at bridge parking space in Koh Khlang Sub-district.
- Provide 240-liter waste bin with a lid and a steel mesh cage to prevent monkeys from digging through garbage at parking space near bridge view points entrance (on both left and right side). Each set should comprise separated bin for 4 categories of waste: biodegradable waste, hazardous waste, general waste and recyclable waste.
- Clearly label waste bins with signs or symbols of waste type.
- Install signs encouraging entrepreneurs and tourists to refrain from using plastic and foam containers.

DRR's Responsibilities

- Coordinate with Koh Klang Subdistrict Administrative Organization to operate and maintain toliet facilities.
- Coordinate with Koh Klang sub-district Administrative Organization to collect wastes and dispose at Krabi Municipality's Waste-to-Energy Plant. The suggested waste collection frequency is 1 2 trips/day (during 08.00 16.00) for low tourism season and 3 4 trips/day (07.00 17.00) for long holidays and high tourism season (November March).

4) Implementation Period

- **Construction Phase**: Continuously throughout the construction period
- Operation Phase: Through out project operation phase
- 5) Responsible Agencies
 - Construction Phase: Contractor
 - **Operation Phase:** Contractor and DRR
- 6) Budget
- Construction Phase: 2,845,749 THB (Table 4.1-1)
- Operation Phase: 605,000 THB (Table 4.1-2)
- 7) Evaluation

The inspection committee and the project supervisor of the Department of Rural Roads are to inspect the operation of the construction contractor to be aligned with the determined action plan.

4.2. Action Plan for Prevention and Mitigation of Impacts on Marine Water Quality

1) Objectives

The objectives are to prevent and reduce the impacts from the diffusion of sediments and construction debris during the construction in the sea (Khlong Chong Lad) as well as to ensure the implementation of the project development causes the least possible impacts on the marine water quality and marine ecology.

2) Implementation Area

- Connecting roads (Km 0+000 – Km 0+500) and Km 2+000 – 2+527)

- Construction site of the temporary jetty on the Koh Klang Subdistrict side extending from the bank along the bridge construction line to the sea for 50 meters and the temporary jetty on the Koh Lanta Noi Subdistrict side extending from the bank along the bridge construction line to the sea for 200 meters.

- Construction site of the bridge pier structures in the sea (Khlong Chong Lad), Foundation of the Extradosed Bridge, Foundation of the Balanced Cantilever Bridge, Bridge Pier P17-P18 and P19-P32 (**Figure 4.2-1**).

3) Implementation Methods

Construction Phase

Sediment control at connecting roads

Construct a temporary drainage channel and install a Temporary Silt Fence with a height of 1 m. above the ground at the construction site near 2 water sources, namely Koh Klang sub-district (km.0+000-km.0+500) and Koh Lanta Noi sub-district (Km. 2+000-Km. 2+527) to prevent leaching from rain water into water sources. (Figure 4.2-2 and 4.2-4)

Prevention of concrete mixture spill into the sea

- Examine the strength of the formwork and bracing before pouring concrete and caulking with rebar plugging out to prevent lime water from flowing out while pouring concrete.
- Use waterproof steel formwork. Inspect the formwork before pouring concrete and caulk existing holes to prevent cement leakage from the formwork. (See example in Figure 4.2-5).
- Prevent leakage of polymers into the sea during underwater foundation pile casting by installing an extended casing on top of the foundation pile steel casing. (Figure 4.2-6).



Figure 4.2-1 Locations of Koh Lanta Bridge Piers









TEMPORARY SILT FENCE

Figure 4.2-2 Example of Temporary Silt Fence



Figure 4.2-3 Location of Temporary Silt Fence on Koh Khang District Side



Figure 4.2-4 Location of Temporary Silt Fence on Koh Lanta Noi District Side



Figure 4.2-5 Example of Extended Casing



Figure 4.2-6 Example of waterproof steel formwork



Figure 4.2-7 Example of Safety Nets

Prevention of fall at sea (materials/objects and staff/workers)

- Workplace management
 - Limit working from height as necessary.
 - Install net fences and equipment to prevent material from falling into the sea throughout the construction period (Figure 4.2-7).
 - Provide warning sign/barricade or close opening on floor where it could cause trip /fall hazards.
- o Falling objects
 - Store small objects and scraps in secure/safe container to prevent falling.
 - Store scraps of materials and construction equipment orderly, not obstructing the walkway and constantly clean staff.
 - Keep working areas clean.
 - Use equipment appropriate to type of work.
 - Secure equipment used to prevent falling hazard.
 - Move equipment/materials properly.
- Trip/Slip hazards
 - Keep materials and equipment in order, regularly cleaned and not obstruct alk ways.

- Make sure that electrical wire, flexible hose are not obstruct walk way.
- Stair case should be free from obstruction.
- Provide guardrails and safety net in the areas with falling risks.
- Working space should be free from standing water, oil strain, floor should be smooth to prevent trip and slip hazrds.
- Fall hazards from movement
 - Provide guardsrail or rope surround structure.
 - Provide temporary walkways with safety fence.
 - Provide safety nets attached with secure structure underneath working place.
 - Provide scaffolding and equipment required in a workplan.
 - Make sure PPEs are used at all time.
 - Donot allow working at height without safety harness.
 - Provide training for staff involve working at height.
 - Provide health inspection for staff/workers.

Prevention of sediment distribution

- Use steel piles and vibratory piling method for installation of temporary jetties to reduce sediment disturbance.
- Construct a temporary jetty at Koh Khlang side by extension from the existing jetty around 50 m into the sea. Contractor shall install silt curtains made from flexible materials, anchored to the sea floor around construction areas (Figure 4.2-8) before start construction of temporary jetty and bridge pier F2 Type 2 No.1 (located closest to the shoreline). Remove silt curtian when piling of temporaty jetty and bridge pier are completed then continue to the next pier F1 type 1.
- Construct a 200 m-long temporary jetty at Koh Lanta Noi side along bridge alignment. Construction of temporary jetty should be carried out section by section in totally three sections, covering bridge pier F3 Type 3 No. 1-4 (Figure 4.2-9). Install silt curtains made from flexible materials, anchored to the sea floor around construction areas before construction at each section start and remove it after competion of piling and underwater foundation works and move to the next section until complete in all 3 sections. Construction platform will be used as jetty for construction of bridge pier F3 Type 3 No. 5-13.
- Construction of bridge piers F1 type 1 (P16, P17), F2 type 2 (P18) and F3 type 3 (P19-P32) will be carried out from construction barge hence construction platform will not be required. Contrtactor shall install silt curtain at 5 m distance around bridge piers and anchored it to the sea floor before start of construction (Figure 4.2-10). Technical specification of silt curtain for the project is presented in Figure 4.2-11. Installation method and example of detailed design are presented in Figure 4.2-12 4.2-13.



Figure 4.2-8 Silt Curtain Installation at Temporary Jetty at Koh Khlang District Side













High Performance Silt Curtain QSC

QSC 100 T

Mechanical Properties		Test Method	Unit		Value
Physical Properties					
Tensile Strength	MD	ASTM D4595	kN/m	≥	100
Tensile Strength	CD	ASTM D4595	kN/m	≥	100
Elongation	MD	ASTM D4595	%	≤	15
Elongation	CD	ASTM D4595	%	≤	15
Mass per unit area		ASTM D5261	g/m²	≥	300
Rate of Contraction		ISO 7771	%	±	0.2
Size of Float (Diameter)			mm	≥	400
Packing (Standard exp	ort packing)		Unit		Value
Span width			m		20
Canvas depth			m		customized, <10m
Float Style					Tube Type
20ft Container (with/without floats)			span		6 / 60
40ft Container (with/without floats)			span		13 / 120

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Figure 4.2-11 Technical Specification of Silt Curtain for the Project



Figure 4.2-12 Silt Curtain Installation Method for the Project



กำสารการที่อไป

การศึกดิ์ ณักบรักษณาสน (SH Curton) ในแหล่งน้ำในช่วงก่องร้าง เป็นการป้องกันแหนร์อยู่ที่ประโยคงสู่ แหล่งน้ำในโห้ออกบอกเขตที่นที่ก่อล้าง และจะเป็นการอักให้เอะวัดคราก ชื่ออยบบมิวนี้เราต่องชีพิบน้ำ ทำให้สามารถอดการกระจายของสารรุ่นดินที่ประโยโปในแหล่งน้ำได้

NUTELNE

- มิติดารที่แต่งสร้างหมดเป็นเมตร ยามวันที่ระบุเป็นขยางสืน
 การก่อสร้างมากมักของคนต้องดำเนินการให้และผรังก่อนเป็นกิจกระบารก่อสร้าง
- โดยการสิตส์ เม่าแล้กละกอบสามารถพิดารณาวิธีการสิตส์สได้เริ่ม 2 ราไมน ดังนี้ 2.1 รามมาการสิดสีเสียรสิง : ทำการสิดสีเฉการลักระกษาระบบ 2 รูปแบบที่จน
- 1 ปนุณภาพที่สามหรือ เท่าการที่หรือการที่สามหรือเกราะบุเป็นใหญ่ สร้างของกับ สามารถให้สามหรือก็มีเหลือไปที่สองสามารถของเห็นก็ครายสม 2.2 ปนุณภาพที่หรือเราะถูกต่องระบบอาหารการการกระบบสามารถกรรม ซึ่งกำบัต้นที่กระบบสามารถกรรมการกระบบสามารถกรรม 3. รัตโทรแมนะรุณแหม่ไทระที่สุดท้ายในกับสามารถ
- กรรมวิธีการอีกทร (woven) และมีร่องสำหรับได้ทันลอย (FLOATS) สามเหนือน้ำ
- 1.2 วัตถุมันสังหมายนายมีสมมายนายมายนายมายนาย (Const) ตามหายนาย 3.3 วัตถุมันสังหมายนายมส์ 3.3 มิที่กำลังรัฐมองสิ่งที่กำหนด ณ สู่อสุด (No/co) ในน้อยกว่า 150/150 มห./m และให้รับทองมาตรฐาน ISO 10310 3.4 มีคำรุนาคร้องมีควัสดุ ไม่น้อยกว่า 0.10 มณ และได้รับรองมาตรฐาน ISO 12956
- 3.5 สามาชลใช้ร่วมกับพุ่นตระวัสดุ POLYESTER ที่มีรบาดมากกว่าหรือเท่ากับ 400 มม. ได้ การกรวจสุดบนสะการกุมสะรักษา : ในกรณีมีการทำใจกรรมการก่อสร้างบริเวณที่ม่านลักสะกลุ่มอยู่ในพื้นที่ที่มีน้ำใหลมรง
- โดยมีสมันหรือมีน้ำขึ้น-น้ำอง จะต้องทำการกรรดอบในพกวันเมืองจากขึ้นด่วมรัดอาการก่อตั้วงอาจหลดไปโดนร่านลึกตะกอน
- การราชสาน () การสาของสาของสาของการการราชสาของสาของการสาของการสาของสาของสาของสาของสาของการสาของการสาของการสาของการสาของการสาของการสาของการสาของการสาของการสาของการสาของการสาของการสาของการสาของการสาของการสาของการสาของการสาของการสาของการสาของการ 6. รูปแบบนี้เป็นรูปแบบแนะนำ พากผู้รับการประสงค์ระกัสสาของการสาของการสาของการสาของการสาของการสาของการสาของการสาข 6. รูปแบบนี้เป็นรูปแบบแนะนำ พากผู้รับการประสงค์ระกัสสาของการสาของการสาของการสาของการสาของการสาของการสาของการสาของการ ไม่พิจารณาก่อนด้ามนินการก่องกำเ
- 7. สามารถพิจารณาใช้ SHEET PLE ต้อมรอบพื้นที่ก่อสร้างเพื่อป้องกับการพู้งกระจายของสะกอบแทนม่านศึกสะกอบได้ โดยแนวนำให้ไข้ Seet Pile รูปที่กรูปขึ้อรูปหมวาดาม นอก1390 โดยระดีบรอง Sweet Pile ความรู่เหนือระดับน้ำ ประมาณ 1 นอร และมีฟักองไปในกลุ่มไระะะบน 3 นอร



Figure 4.2-13 Example of a Silt Curtain Detailed Design

4) Implementation Period

The construction contractor must implement the installation of the silt curtain throughout construction phase.

5) Responsible Agencies

Construction contractor under the supervision of the Department of Rural Roads

6) Budget

As described in Table 4.2-1 and 4.2-2.

7) Evaluation

The inspection committee and the project supervisor of the Department of Rural Roads are to inspect the operation of the construction contractor to be aligned with the determined action plan.

Table 4.2-1 Budget for Action Plan for Prevention and Mitigation of Impacts on Marine WaterQuality (Installation of Temporary Silt Fence)

Item	Quantity	Unit	Price/Unit	Total (THB)	Note	
Install Temporary Silt Fence on Koh Klang Sub-district side	30	Sq.m.	5,000	150,000	Additional budget	
Install Temporary Silt Fence on Koh Lanta Noi Sub-district side	30	Sq.m.	5,000	150,000	per environmental measures	
Total				300,000		

Table 4.2.-2 Budget for Action Plan for Prevention and Mitigation of Impacts on Marine Water Quality (Installation of Silt Curtain)

Item	Quantity	Unit	Price/ Unit (THB)	Total (THB) ^{1/}	Note
1. Installation of slit curtain around temporary jetties					
1.1 Installation of slit curtain surrounding piles around temporary jetty area on Koh Klang side	165.5	meter	2,700	446,850	Additional budget per environmental measures
1.2 Installation of slit curtain surrounding piles around temporary jetty area on Koh Lanta Noi side	198.0	meter	2,700	534,600	
2. Installation of slit curtain surrounding piles around bridge pier					
2.1 Bridge pier F1 type 1 (P16, P17) depth 7.0 meters	107.5	meter	5,200	559,000	

	ltem	Quantity	Unit	Price/ Unit (THB)	Total (THB) ^{1/}	Note
2.2	Bridge pier F2 type 2 (P18) depth 4.0 meter	100.0	meter	3,750	375,000	
2.3 meter	Bridge pier F3 type 3 (P19-P32) depth 4.0	381.6	meter	3,750	1,431,000	
	Total	952.6			3,346,450	

Note: 1/ Standard of Cost Appraisal Division, Department of Rural Roads



Figure 4-1 Detail example of temporary silt fence



Figure 4-2 Location of temporary silt fence installation on Koh Klang sub-district side


Figure 4-3 Location of temporary silt fence installation on Koh Lanta Noi sub-district side

4.3. Action Plan for Prevention and Mitigation of Impacts on Noise

1) Objectives

The objectives are to prevent and reduce the noise impacts from the construction activities and transportation on the project route during the construction phase and implementation phase for environmentally sensitive areas along the project route.

2) Implementation Area

Community areas along km 0+000 - km 0+527 of the Project route potentially affected by noise genrated during Project Construction and transportation during Project Operation Phase.

3) Implementation Methods

Preparation/Construction Phase

-During the construction of the project roads and the bridge foundation, the installation of a metal sheet (0.64 mm) fence (**Figure 4.3-1**) or materials with higher efficiency with the height of 3.0 meters shall be undertaken at the environmentally sensitive areas affected by noise that exceeded the noise level standard of 70 decibels (A) according to the National Environmental Board Notification No.15 B.E.2540 (1997). The metal sheet will be installed in two areas including Ban Hua Hin (Ban Tha Rua) and Thung Toh Yum Cemetery. The temporary installations of noise barriers are shown in **Figure 4.3-2** and **Figure 4.3-3**.

-After the completion of the road construction, proceed to install clear acrylic type soundproof barrier (15mm) at the bridge rail of the project to prevent the noise impact towards Thung Toh Yum Cemetery where religious ceremonies are performed on a regular basis. (Figure 4.3-4 and Figure 4.3-5).

- Install No Horn traffic signs at the bridge railing before approaching Thung Toh Yum Cemetery to minimize impact from noise during religious ceremony.

Operation Phase

- Conduct checkup and maintenance of the traffic surface to be in good conditions in order to minimize impact between wheels of vehicles and traffic surface.

- Check the conditions of the acrylic glass noise barrier at the bridge railing (Km 0+260 – Km 0+375) and maintain the noise barrier in good conditions.

- Coordinate with local police in Krabi Province to strictly enforce laws on vehicles causing loud noises and to control the speed of vehicles using the project route according to the law.

- In case of complaints about noise impact, sound measurements shall be performed at the affected location. DRR to coordinate with the complainant and take immediate actions to solve the problem.

4) Implementation Timeline

(1) Construction Phase

Continuously throughout the construction phase of the project development

(2) Operation Phase

Throughout the operation phase

5) Responsible Agencies

(1) Construction Phase

Construction contractor under the supervision of the Department of Rural Roads

(2) Operation Phase

Department of Rural Roads

6) Budget

Totally of 2,753,995 THB (1,517,925 THB for Construction Phase and 1,236,070 THB for Operation Phase) as presented in **Table 4.3-1**).

7) Evaluation

The inspection committee and the project supervisor of the Department of Rural Roads are to inspect the operation of the construction contractor to be aligned with the determined action plan.

Table 4.3-1 Budg	et for Action Plan	o prevent and m	itigate noise impacts
Table 4.3-1 Duug	Set for Action Flam	o prevent and m	inigate noise impacts

Item	Height (m.)	Lenght Area Price/Unit (m.) (sq.m.) (THB)		Note		
Construction phase: Tempor	ary noise b	arrier metal s	heet type depth	n 0.64 mm		
Moo 8 Ban Hua Hin (Ban Tha Rua) 3.0		100	300	2,735	820,500	
Thung Toh Yum Cemetery	3.0	85	255	2,735	697,425	
Total (1)		285	855		1,517,925	environmental measures
Implementation phase: Temporary noi Thung Toh Yum Cemetery 2.0 Total(2) Cotal(2)		se barrier acry	lic type depth 1	5 mm		
		85	170	7,271	1,236,070	
					1,236,070	
Grand Total (1)+(2)				2,753,995		



Figure 4.3-1 Detail of temporary soundproofing wall of metal sheet type



Figure 4.3-2 Location of temporary soundproofing wall of metal sheet type installation at Moo 8 Ban Hua Hin (Ban Tha Rua) during construction phase



Figure 4.3-3 Location of temporary soundproofing wall of metal sheet type installation at Thung Toh Yum Cemetery during construction phase







Figure 4.3-5 Location of acrylic glass noise barriers installation at Thung Toh Yum Cemetery during Project Operation phase

4.4. Action Plan for Mangrove Replantation

1) Objectives

The objective is to replant mangrove forests affected by the Project construction in accordance with the regulations of the Department of Marine and Coastal Resources on Reforestation and Maintenance of Mangrove Forest, B.E.2564 (2021).

2) Implementation Area

Mangrove replantation areas in the Project or nearby areas to be identified by the DMCR as locations suitable for mangrove replantation.

3) Implementation Methods

(1) Construction Phase

- DRR to allocate budget for the DMCR for replantation of mangrove forests of not less than 20 times of the affected areas (1x20 = 20 rai). Competent officer/s of DMCR will be responsible for a survey, selection of replantation areas and mangrove species.
- DRR to also allocate budget for the DMCR for 5 years (Year 2-6) maintenance of the replantation plots. DMCR to select situable replantation areas to offset the affected mangrove forest areas.
- Mangrove replanting should occur within Krabi province, and preferably in close proximity to the project site.
- -
- Mangrove replantation shall follow DMCR Order on Replantation and maintenance of mangrove forests for conservation or environmental preservation B.E. 2556 (2013), Article 6

 "Government agencies utilizing the area of mangrove forests must allocate a budget for the Department of Marine and Coastal Resources as an expense for the mangrove replantation not less than 20 times of the utilized area of mangrove forests, which shall be accounted as part of the project development. The budgt establishment shall follow the standards set by the Bureau of the Budget, as well as the conditions and criteria determined by the National Environmental Board".
- Mangrove replantation shall follow *DMCR Order on Mangrove Plantation and Maintenance B.E. 2564 (2021),* as follows:

a) Survey and Identification of Mangrove Replantation Areas

Criteria for Identification of Mangrove Replantation Areas

- Designated area for the mangrove reforestation and maintenance must be in the mangrove forests area according to the cabinet resolution or areas that were influenced by the tides which are considered forests according to the Forest Law, National Reserved Forests Law or Conserved Mangrove Forests according to the laws on promotion and management of marine and coastal resources only.
- Designated area for the mangrove reforestation is the area influenced by sea water that has the ecological system of degraded mangrove forest that can be restored.

- -Conduct a detailed survey of the area. Generate a map and determine implementation plans. Prepare survey report and map using form Por Bor.1. The survey report shall cover the followings information:
 - Replantation area which clearly specify the name of the village, Subdistrict, District, Province, and whether the areas are located within the National Reserved Forests, Mangrove Forests conservation area, or Mangrove Forests according to the Cabinet Resolution.
 - Boundary of replantation areas indicating immediately adjacent areas, area size, maps scaled at 1:50,000 and 1:40,000, along with photographs and clear details on the coordinates.
 - The topography indicating physical features on an area–plain or lowlands, types of soil, inclines, elevation above sea levels, and rise and fall of sea levels.
 - Climate showing details of temperatures, precipitations, and relative humidity.
 - Biological characteristics that specify conditions of mangrove forests area, plant species, undergrowth plants, reproduction of the trees, aquatic and terrestrial animal species.
 - Possible threats to the planted trees including threats from human, animals, insects, diseases, plants, natural disasters, and other available reasons as well as recommndations to address the threats identified.
 - Socio-economic data including population, village, living conditions, income, primary and secondary occupations, and transportation mode.
 - Conditions of land use in the area specifying utilization of the area, permission to use the area, status, management and maintenance under the Department of Marine and Coastal Resources or other government agencies in the formerpresent area (if any).
 - Other details that should be specified such as government agencies, private organizations, factories, located in the areas that may cause impacts towards magrove replantation.
 - Specify the dates starting the field survey and completing the survey.
 - From the surveyor's point of view, specify whether and how the land conditions are suitable for the planting and maintenance of mangrove forests. Specify if there are any obstacles in planting and maintaining the mangrove forest. Include other opinions regarding the planting and maintenance of the mangrove forests in the area such as the species to be replanted, the appropriate methods for planting and maintenance, labor sources, and seed sources.

b) Selection of plants

- In case the conditions of the area are suitable for various types of plants, select at least three plant species and mixed-planting according to the conditions and suitability of the area; the local plants should be considered priority.
- In case the conditions of the area are only suitable for one type of plant, the most suitable species of plant for the land condition must be selected.
- The determined plant species for the planting and maintenance of mangrove forests are stated in **Table 4.4-1.** Other plant species not listed in this table must be approved by the Director-General of the Department of Marine and Coastal Resources.

Scienti	fic name of mangrove plants
1.	Rhizophora apiculata Blume.
2.	Rhizophora mucronata Lam.
3.	Vitex rotundifolia L.f.
4.	Dolichandrone spathacea (L.f.) K.Schum.
5.	Nypa fruticans Wurmb.
6.	Barringtonia asiatica (L.) Kurz
7.	Barringtonia racemosa (L.) Spreng.
8.	Aglaia cucullata (Roxb.) Pellegrin.
9.	Xylocarpus rumphii (Kostel.) Mabb.
10.	Xylocarpus granatum J. Koenig
11.	Xylocarpus moluccensis (Lam.) M. Roem.
12.	Excoecaria agallocha. L.
13.	Cerbera manghas L.
14.	Cerbera odollam Gaertn.
15.	Pandanus odorifer (Forssk.) Kuntze
16.	Bruguiera cylindrica (L.) Blume.
17.	Bruguiera parviflora (Roxb.) Wight & AmexGrift.
18.	Pemphis acidula J.R. & G.Forst.
19.	Hibiscus tilliaceus L.
20.	Ceriops decandra (Griff.) W. Theob.
21.	Ceriops tagal (Perr.) C.B.Rob.
22.	Lumnitzera racemosa Willd.
23.	Lumnitzera littorea (Jack) Voigt.
24.	Bruguiera hainesii C.G.Rogers.
25.	Bruguiera sexangula (Lour.) Poir.
26.	Bruguiera gymnorrhiza (L.) Savigny.
27.	Thespesia spp.
28.	Rapanea porteriana (Wall. & A. DC.) Mez.
29.	Scaevola taccada (Gaertn.) Roxb.
30.	kandelia candel (L.) Druce.
31.	Ardisia elliptica Thunb.
32.	Sonneratia caseolaris (L.) Engl.
33.	Sonneratia alba Sm.
34.	Sonneratia ovata Backer
35.	Sonneratia griffithii Kurz.
36.	Casuarina equisetifalia J. R. & C. Forst
37.	Shirakiopsis indica (Willd.) Esser
38.	Calophyllum inophyllum L.
39.	Melaleuca spp.
40.	Avicennia lanata Ridl.
41.	Avicennia alba Blume
42.	Avicennia officinalis L.
43.	Avicennia marina (Forsk.) Vierh.
44.	Heritiera littoralis Aiton
45.	Heritiera fomes BuchHam.
46.	Cordia subcordata Lam.
47.	Millettia pirnata (L.) Pierre
48.	Intsia bijuga (Colebr.) Kuntze

Table 4.4-1 Plant species for mangrove replantation

Source: DMCR Order on Mangrove Plantation and Maintenance B.E. 2564 (2021).

c) Seedling Production

- There should be sufficient numbers of seedlings produced for the replantation. New mangrove plantation for typically requires 710 seedlings per rai (1,600 sq.m.).

Whereas the maintenace plantation or rehabilitation would requires 300 seedlings per rai. At least additional 20% of seedling should be prepared for maintenance.

d) Area Preparation

- Eliminate weeds and prepare the land to be appropriate for mangrove plantation.
- Use planting row markers of no less than one meter. The material used for planting row markers must be strong and durable; as well as painted with red color on the top part no less than 15 cm.
- For new plantaion, place the 710 row markers/rai (1.5 x 1.5 m interval).
- For maintenance plantation or rehabilitation, place 300 row markers/rai.

e) Planting

- Seedlings of the age of no less than 3 months must be used for planting.

f) Cadastral Surveying and Boundary Marking

- The area to plant and maintain the mangrove forests must be surveyed and marked for boundary as follows:
 - Cadastral Surveying and generating a map with a scale of 1:50,000 and 1:40,000 specifying details of the coordinates.
 - Boundary marking the planting plot using 4x4 meters reinforced concrete which is elevated for at least one meter high around the plot. The boundary mark should specify year, plot, and area as evidence for inspection.
 - Create a signage stating a brief information on the planting plot, by using a white signage, dark-colored text indicating responsible agency for planting, year of planting, and area size of reforestation areas. The signage is a size of 1.20 x 2.40 meters and will be installed in the mangrove reforestation area no less than 1.5 meters above the ground on two reinforced concrete columns. The column size should be at least 3x3 inches and the length should be according to the conditions of the areas. Overall, the signage must be firmly and safely installed. In case the reforestation area is less than 30 rai, consider signage that is suitable for the area.
- g) Mangrove Forests Maintenance plot from the age of 2-6 years must follow the following steps:
 - Maintain the clear boundary lines of replantation area.
 - Carry out weed control for the entire plots 2 times/year.
 - Examine the survival rates of the plants after the weed controlling and replanting damaged trees, if needed, immediately. Survival rate should not less than 80%.

h) Reporting

 After the completion of the magrove replantation/maintenance, prepare a Mangrove Replantation Report using form Por Bor.2, Mangrove Maintenance Report using form Por Bor.3 (for year 2-6), and Mangrove Forest Plantation Plots Survey Report for Year 2-6 Maintenance Budget Request using form Por Bor.4 along with the map with a scale of 1:50,000 and 1:40,000, indicating the coordinates and colored photographs. One copy of the reports shall be kept at the responsible agency office and submit to the DMCR in shape file and color photographs within 15 Octber of each year or within 15 days after completion of Project completion.

- In addition, after the completion of the above-mentioned report, record the report data onto the electronic program specified by the Department of Marine and Coastal Resources.
- In case that the proposed mangrove repaintation is located in special areas differed from general mangrove forests, implementation plan to improve the conditions of ecosystem to be suitable for the growth of mangrove plants including the land preparation, suitable seeds and seedlings, planting, maintenance, as well as budgets shall be submitted to the DG of DMCR for apporval before implementation. These special areas include: salt field, Forest areas connecting mangrove and beach forest, deposited muddy land, deposited land behind erosion protection, delta inside mangrove forests, coastal swamps, public land under other governmental agencies, temples, or schools, and mangrove forests along the river banks, canals, etc;

(2) Operation Phase

- Care and maintenance of trees after planting will be the responsibility of DMCR. After planting, weeds must be cleared around the base of the tree at least once a year and other pests shall be eliminated as deemed necessary.
- Count the survival rate and immediately plant trees to replace the dead ones or the dying trees after clearing, weeding or other pest control. Survival rate should not less than 80%.
- -The DG of DMCR is to appoint no less than three committee members to monitor implementation of mangrove replantation. The committee members must consist of at least one government officer.

4) Implementation Timline

(1) Construction Phase

Starting from the first year of the construction phase.

(2) Implementation Phase

Continuously maintenance for 5 consecutive years (Year 2-6)

5) Responsible Agencies

(1) Construction Phase

The Department of Rural Roads to set up the budget for the Department of Marine and Coastal Resources to implement.

(2) Implementation Phase

The Department of Rural Roads to set up the budget for the Department of Marine and Coastal Resources to implement.

6) Budget

The Bureau of the Budget–the Unit Price Rate (B.E.2564) (2021) determined the cost of mangrove forest planting as follows:

- Cost of new mangrove forest Planting (Age 1 year) 6,580 Baht/rai
- Cost of supplementary/maintenance plantation and rehabilitation 3,670 Baht/rai
- Cost of mangrove seeds preparation 2,860 Baht/rai
- Maintenance cost of new mangrove forest plantation plots (Age 2-6 years) 1,190
 Baht/rai
- Maintenance cost of supplementary plantation and rehabilitation 690 Baht/rai
- Maintenance cost of mangrove seedling preparation 820 Baht/rai

Therefore, the total cost for the implementation of reforestation, 20 times (1.2x 20 = 24 rai) of the Project affected mangrove forest is 698,640 THB (**Table 4.4-2**)

7) Evaluation

The inspection committee and the project supervisor of the Department of Rural Roads are to hire a third party to inspect the operation of the Department of Marine and Coastal Resources to be aligned with the determined action plan.

Table 4.4-2 Budget for the im	plementation of mangrove r	eforestation and maintenance
Table 4.4-2 Duuget für the ini	plementation of mangiover	erorestation and maintenance

		Year						
Activities	Cons	truction pl	nase	Or	Total (THB)			
	1	2	3	4	5	6	ζ,	
Cost of Mangrove Replantation 24 Rai (Age 1 year)	157,920	-	-	-	-	-	157,920	
Cost of Supplementary/maintenance Plantation and rehabilitation	88,080	-	-	-	-	-	88,080	
Cost of mangrove seeds preparation	68,640	-	-	-	-	-	68,640	
Maintenance cost of Mangrove Replantation (Age 2-6 years)	-	28,560	28,560	28,560	285,60	28,560	142,800	
Maintenance cost of supplementary plantation and rehabilitation	-	16,560	16,560	16,560	16,560	16,560	82,800	
Maintenance cost of mangrove seedling preparation	-	19,680	19,680	19,680	19,680	19,680	98,400	
Preparation of reports	10,000	10,000	10,000	10,000	10,000	10,000	60,000	
Total	324,640	74,800	74,800	74,800	74,800	74,800	698,640	

4.5. Action Plan for Forest Replantation (National Reserved Forest)

1) Objective

The objective is to replant forest in a National Reserved Forest areas affected by the Project.

2) Implementation Area

Reforestation will be implemented in the degraded forest areas or areas where the Royal Forest Department considers to be appropriated.

3) Implementation Methods

(1) Construction Phase

- The Department of Rural Roads must set a budget for the Royal Forest Department to implement the reforestation three times (4x3 = 12 rai) of the lost forest. The reforestation will be undertaken within Krabi Province, and ideally in the National Reserved Forest near the project development. There shall also be the maintenance of planted seedlings, replanting to replace dead plants, and preventing wildfires that may occur.
- The Department of Rural Roads to coordinate with the Royal Forest Department in supporting the expenses for the reforestation in the first year of implementation phase and maintenance phase (Age 2-10 years) for 9 years. The Royal Forest Department will consider the suitable areas for the reforestation due to the lost forest from the project development.

(2) Implementation Phase

- DRR will provide budget for the Royal Forest Department for care and maintenance (and replanting) of trees during implementation phase as discused earlier. Efforts should be made to ensure that trees are properly maintained with sufficient watering, weed control and fertilization. Regular fertilization with 15-30-15 fertilizer every 2-3 weeks for the 1st three months period should be applied to accelerate growth and the expansion of the roots. In case of dead plants, the repair or replanting to replace dead trees must be undertaken immediately.
- Evaluate the survival rate. Survival rate should not less than 80%.

4) Implementation Timeline

(1) Construction Phase

Starting from the first year of the construction phase.

(2) Implementation Phase

Continuously maintain every year (2-10 years of age) for 9 years.

5) Responsible Agencies

(1) Construction Phase

The Department of Rural Roads is to set up the budget for the Royal Forest Department to implement.

(2) Implementation Phase

The Department of Rural Roads is to set up the budget for the Royal Forest Department to implement.

6) Budget

The Bureau of the Budget–the Unit Price Rate (B.E.2564) (2021) determined the cost of forest replantation and maintenance of the original area per rai as follows:

- Cost of Forest Replantation (Age 1-3 years) 4,020 baht/rai
- Cost of Firebreaks Construction (Age 1-3 years)
 5,320 baht/km (approx.
 1,064 baht/rai*) (*Firebreaks must be at least 8 meters wide according to the terrain and the amount of fuel)
- Cost of Maintenance of the original area (Age 2-6 years) 1,060 baht/rai/year
- Cost of Maintenance of the original area (Age 7-10 years) 510 baht/rai/year

Therefore, the total cost of forest replantation (4x3 times = 12 rai) is 274,624 baht shown in **Table 4.5-1.**

7) Evaluation

The inspection committee and the project supervisor of the Department of Rural Roads are to hire a third party to inspect the operation of the Royal Forest Department to be aligned with the determined action plan.

	Operation year										
Activity	Construction phase				Implementation phase						Total (THB)
	1	2	3	4	5	6	7	8	9	10	ζ,
Cost of Reforestation 12 Rai (Age 1-3 years)	48,240	-	-	-	-	-	-	-	-	-	48,240
Cost of Firebreaks Construction (Age 1-3 years)	12,768	12,768	12,768	-	-	-	-	-	-	-	38,304
Cost of Maintenance of the original area (Age 2-6 years)	-	12,720	12,720	12,720	12,720	12,720	-	-	-	-	63,600
Cost of Maintenance of the original area (Age 7-10 years)	-	-	-	-	-	-	6,120	6,120	6,120	6,120	24,480

Table 4.5-1 Budget for forest replantation and maintenance

Preparation of reports	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	100,000
Total	71,008	35,488	35,488	22,720	22,720	22,720	16,120	16,120	16,120	16,120	274,624

4.6. Action Plan for Prevention and Mitigation of Impacts on Transportation, Accidents, and Safety

1) Objectives

The objectives are to prevent and minimize the impacts on land and water transportation and risks of accidents in the project area of influence.

2) Implementation Area

(1) Construction Phase

- Along the project route km 0+000 km 2+527
- Construction sites of the connection and the bridge approach structures in both Koh Klang Subdistrict and Koh Lanta Noi Subdistrict.
- The waterways between Koh Klang and Koh Lanta Noi where the bridge constructions are implemented.

(2) Implementation Phase: -

3) Implementation Methods

Land Transportation

- The construction contractor is determined to prepare the traffic management plan before undertaking the project construction by organizing the barriers, traffic cones, road markings, and construction zone warning signs. Traffic lights shall be installed at least 500 meters before the construction zones especially on the crossroads/connections throughout the construction period **(Figure 4.6-1 - Figure 4.6-2)** as follows:

- At a distance of 1 kilometer before the construction zone, install the construction zone warning signs to warn the road users of the construction zones ahead, allowing them to be more careful for the next 500 meters before construction zones. In case there are constructions on the road and reduction of lanes, warning signs are also necessary to warn road users of lane reduction and construction zone.

- At a distance of 150 meters before the construction zone, in case there are constructions on the road and reduction of lanes, warning signs for the construction zone, lane reductions, and speed limits must be put up to warn the road users.

- At a distance of 100 and 50 meters before the construction zone, install the speed limit, navigation, and beware of construction worker warning signs to warn the road users. The navigation signs, along with the warning flashing lights are to be installed at every 3-meter throughout the construction zones. The traffic cones must be placed every 1-2 meters along the lines of reduction of traffic lanes.

- At a distance of 20 meters before the construction zone, install end of construction zone signs and cones, as well as the speed limit signs to warn the road users. Concrete barriers or

barriers must be put up to surround the construction zones, along with the warning signs or flashing lights that are clearly visible to the road users within the distance of no less than 500 meters in normal visibility. Start installing on the edge of the road shoulder every 50-60 cm not more than 30 meters apart along the construction zones.

- Traffic arrangements during the bridge construction must proceed with the construction of a road diversion. Arrange barriers, traffic cones, road markings, and navigation signs indicating a road diversion one kilometer before the diversion point. Furthermore, install the construction zones warning signs and flashing lights that are clearly visible during both daytime and nighttime before the construction zones no less than 500 meters throughout the construction period.



Figure 4.6-1 Example of warning signs during the construction period





Figure 4.6-2 Traffic management during the construction period





Figure 4.6-2 Traffic management during the construction period (Continued)

Water Transportation

- Provide the fishing wharf for 20 fishing boats beside Ban Hua Hin Pier, as well as 20 mooring cleats to secure boats to, (approximately 60 meters long) shown in **Figure 4.6-3.**

- Construct a temporary fence on the bridge by installing an orange HDPE plastic fence, 1.2 meters high and 1,360 meters long. Install 300 fence posts (1.5 meters high) along with LED flashing lights; with regular maintenance and repairs throughout the construction period.

- Install two sets of flashing buoys in the sea on the navigation paths. The flashing buoy uses a solar panel system and requires maintenance and repairs throughout the construction period.

- Install concrete safety barriers around the construction areas on land, at the starting point of the project from km 0+150 - km 0+500 on Koh Klang Subdistrict side and km 2+050 - km 2+200 on Koh Lanta Noi Subdistrict. The total distance is 1,000 meters. Along with the transportation cost during the construction phase.

- After the completion of the bridge construction, install the reflective strips indicating bridge piers positions using fenders around the bridge piers of the Extradosed Bridge and electric lighting to make the piers visible and prevent the risks of ships colliding with the piers (**Figure 4.6-4**).



Figure 4.6-3 Prepartion of temporary moorings at Ban Hua Hin Pier



Figure 4.6-4 Installation of reflective tapes (fenders) to mark the column positions around the extradosed bridge structure

- 4) Implementation Timeline
 - (1) Construction Phase

Continuously throughout the construction phase

(2) Implementation Phase

5) Responsible Agencies

(1) Construction Phase

Construction contractor under the supervision of the Department of Rural Roads

(2) Implementation Phase

-

6) Budget

Land Transportation

- Total budget for action paln to prevent and mitigate impacts on land transportation is 1,609,853 THB which is included in the project safety management budget.

Water Transportation

- Total budget for action pain to prevent and mitigate impacts on water transportation is 3,400,000 THB which is included in the project safety management budget as shown in **Table 4.6-1.**
- 7) Evaluation

The Department of Rural Roads, Ministry of Transport, as a project owner is to supervise and evaluate the performance of responsible agencies to be strictly aligned with the determined action plan.

No.	Detail	Cost (THB)
1	Cost of 20 mooring cleats for fishing boats including construction cost	50,000
2	Construction cost of fence on temporary jetty - Install an orange HDPE plastic fence, 1.2 meters high and 1,360 meters long - Install 300 fence posts (1.5 meters high) along with LED flashing lights - Regular maintenance and repairment cost throughout the construction period	500,000 300,000 200.000
3	Installation cost of flashing buoys in the sea on the navigation paths - 2 sets of flashing buoy using a solar panel system - Regular maintenance and repairment cost throughout the construction period	100,000 50,000
4	Installation cost of concrete safety barrier around the construction areas on land - Concrete safety barriers around the construction areas on Koh Klang Subdistrict side and on Koh Lanta Noi Subdistrict total total distance 1,000 meters - Transportation cost during the construction phase	2,000,000 200,000
	รวม	3,400,000

Table 4.6-1 Budget for the implementation of transportation and safety management

4.7. Action Plan for Prevention and Mitigation of Impacts on Dolphins

1) Objective

In accordance with the MMO Plan, to be developed by the Contractor prior to construction, the objective is to observe and monitor dolphins that may enter in the project construction areas and surrounding areas. Although the project areas are not a habitat for dolphins, some have occasionally traveled to the project area for food and even shelters during the monsoon seasons in the inner area of Koh Lanta Noi where the waves are calmer.

2) Implementation Area

On the north and south of the Koh Lanta Bridge construction sites, as well as areas along the bridge. Details are shown in **Figure 4.7-1**.

3) Implementation Methods

Construction Phase

Contractor shall follow the following measures to prevent impacts on bottlenose dolphin and the Indo-Pacific humpbacked dolphin:

- Establish dolphins observation zone (bridge route and two roles of 500 m strips along both sides of brdige route) (Figure 4.7-1). Conduct boat survey in the observation zone and stop to observe dolphins at every 500 m.
- The observer shall use a binoccular to survey on the water surface onboard the ship.
- Contractor shall also construct elevated platforms at least 5 meters above the water line on each end of the bridge construction site and position observers searching with hand-held binoculars on elevated platforms.
- Establish communication procedures between the observers and piling crew/construction team, including a formal chain of communication between the observers and the person who can stop the piling operation.
- The observation zone should be monitored visually by observers for an agreed period prior to the commencement of piling.
- Piling should not be commenced if dolphins are detected within the observation zone.
- If a dolphin is found entering the observation area, the observer shall immediately notify the construction team by phone to suspend construction activities temporarily.
- Continue the observation and note-taking until dolphins leave the surveillance zone.
- If there is a pause in the piling operations for a period of greater than 10 minutes, then the pre-piling search should be repeated before piling recommences.
- A 20 km/hour speed limit should be established for boats under normal conditions and 10 km/hour when dolphins are detected in the area.
- Appoint the construction supervisor to monitor and be on alert for dolphins along the construction sites of the Koh Lanta Bridge Project on every operating day; through visual inspection in the construction areas. If the dolphins are observed entering the surveillance areas, the construction supervisor is to immediately notify the construction sites via calls to stop any construction activities causing impacts towards sea surface or vibrations underwater.

Operation Phase

- Conduct boat survey in the observation zone as indicated in **Figure 4.7-1** and stop to observe dolphins at every 500 m.
- The observer shall use a binoccular to survey on the water surface onboard the ship.

4) Implementation Timeline

(1) Construction Phase

Continuously throughout the construction phase of the project and inspected by the construction supervisor.

(2) Operation Phase

2 times/year when the sea is calm (December) and during monsoon season (September) in the 1^{st} , 2^{nd} , 3^{rd} , 5^{th} , 10^{th} , 15^{th} , and 20^{th} year.

5) Responsible Agencies

(1) Construction Phase

A third party under the direction of either the contractor or PMU will serve as MMO.

(2) Operation Phase

The Department of Rural Roads is to hire a third party to implement.



Figure 4.7-1 Surveillance areas for dolphins at the construction area of the bridge

6) Budget

(1) Construction Phase

- The estimated cost of the surveillance action plan is 115,000 THB/year or 345,000 THB for 3 years Construction period as shown in **Table 4.7-1.**

(2) Operation Phase

- The estimated cost of the surveillance action plan is 95,000 THB/year or 665,000 THB as shown in **Table 4.7-2.**

7) Evaluation

The inspection committee and the project supervisor of the Department of Rural Roads are to inspect the operation of the construction contractor and third-party monitoring firm to be aligned with the determined action plan.

	Table 4.7-1 Estimated	budget of the su	rveillance action	plan during	construction phas
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No.	Detail	Days	Times/year	Price/Unit (THB)	Total* (THB)
1	Cost for the dolphin's surveillance				
	Construction phase				
	- Rent of patrol vessel with fuel	5	2	4,000	40,000
	- Per diem for 3 officers	5	2	1,500	15,000
	- Operating cost and equipment	5	2	20,000	40,000
	 Cost of surveillance equipment of construction supervision officers 	-	-	20,000	20,000
	Total				115,000 THB/Year or
					345,000 THB / 3 Years

Table 4.7-2 Estimated budget of the surveillance action plan during operation phase

No.	Detail	Days	Times/year	Price/Unit (THB)	Total* (THB)
1	Cost for the dolphin's surveillance				
	Operation phase				
	- Rent of patrol vessel with fuel	5	2	4,000	40,000
	- Per diem for 3 officers	5	2	1,500	15,000
	- Operating cost and equipment	5	2	20,000	40,000
	Total				95,000 THB/Year or 665,000 THB / 7
					Years

4.8. Stakeholder Engagement Plan (SEP)

In addition to social mitigation measures and monitoring program summarized in **Table 3.1**, the project has developed the Stakehodlers Engagement Plan. The project's stakeholders and engagement activiteis shall be consistent with this SEP, the details of which are presented in **Table 4.8-1 to 4.8 – 6**.

(Consultation issue	Proposed methodology	Frequency	Place	Place Stakeholder recipients	
	a. Pre-construction	n phase				
1.	Updated on detailed design including universal design principles	Pre- construction consultation	Once (At least 15 days before the construction)	Krabi	All stakeholder groups	DRR
2.	Construction plan and schedule	Pre- construction consultation	Once (At least 15 days before the construction)	Krabi	All stakeholder groups	DRR
3.	Project level Grievance Redress Mechanisms (GRM)	Pre- construction consultation	Once	Krabi	All stakeholder groups	DRR
4.	Additional environmental Studies: CIA and CHA	Individual and/or group meetings	As needed	Krabi	Relevant stakeholder groups (to be listed)	DRR
5.	Temporary construction of workers camp	Pre- construction consultation	Once at pre- construction consultation, and additional individual and group meetings (if required)	Krabi	 (a) Inform all stakeholders at the pre- construction consultation (b) Communities surrounding workers camp 	DRR
6.	Expected disturbances when the construction starts and mitigation	Pre-construction consultation	Once at pre- construction consultation	Krabi	Nearby communities (within 500 m of project site), tourism and hotel operators, commuting public	DRR
7.	Economic displacements of ferry operator (Songserm Trans Service Co., Ltd.) and ferry workers	individual meetings through Working Group	as needed (in progress)	Koh Lanta District Office	Working Group	DRR, Krabi Provincial Administrative Organization (for Lanta Island bridge)

Table 4.8-1: The Project Consultation Strategies

Consultation issue		Proposed methodology	Frequency	Place	Stakeholder recipients	Party Responsible
8.	Economic displacements of shop operators around the project's u-turn point	Individual meetings Focus groups	As needed	At business site	4 shop renters	DRR, Krabi PAO
9.	Economic displacements of shops along DOH's ROW	Individual meetings Focus groups	As needed	At business site	5 shop operators	DRR, Krabi PAO, Koh Klang TAO
10.	Noise impact and noise barrier	- individual meetings	As needed (Confirmation of agreements at least 1 month before construction)	House number 19, Moo 8, Koh Klang Sub- district, Koh Lanta District Krabi Province	Mr. Sumrit Saekow	Krabi PIU, Contractor
11.	Mooring point relocation of fisher folks	Group meetings	As needed (confirmation of agreement at least 1 month before construction)	Moo 8, Ban Hua Hin, Koh Klang Sub- district, Koh Lanta District Krabi Province	A group of local fishing boats / Hua Tong boats, 20 boats, 3 ferries and 2 speed boats	DRR and Contractor
12.	Disturbances of cemetery	Individual meetings (engage through religious leaders and/or mosque committees)	As needed	Koh Lanta	Users of Muslim cemetery	DRR and contractor
13.	Relocation of utility facilities	Individual meeting	As needed	Krabi	Utility agencies	DRR
14.	Issues of concerns for government agencies such as legal, administrative, and coordination.	Individual and group meetings	as needed	Bangkok, Krabi	Relevant government agencies	DRR
15.	Issues of concerns for Interest Groups such as economic, environmental and	Pre- construction consultation	Once	Krabi	Interest groups such as environmental and social NGOs/CSOs	DRR

Consultation issue	Proposed methodology	Frequency	Place	Stakeholder recipients	Party Responsible
social impacts of the construction.					
 Issue of specific concerns of Urak Lawoi Group (such as project-related employment opportunities, grievances) 	Meeting with Urak Lawoi community leaders	Once	Lanta	Urak Lawoi community	DRR
b.Construction phase					
1. Project implementation plan in construction phase	- Survey interviews with affected households. -Public consultation	once (mid- construction phase consultation)	Krabi	Communities within 500 m from the project site	DRR
2. Issues of concerns for government agencies such as legal, administrative, and coordination.	-Individual and group meetings (as needed)		Bangkok, Krabi,	Relevant government agencies	DRR
 Concerning issues of any construction disturbances for communities living near the project area such as dust, noise, vibration, safety. 	-Public consultation -Individual and group meetings - Coordinate with community leaders	Once (public consultation) As needed (individual and group meetings)	Krabi	Communities living near the project area in Krabi	DRR (Krabi PIU) and contractor
4. Road safety and travel inconveniences	- group meeting (coordinate with village heads, hotel operators, schools, hospitals)	As needed	Krabi and Lanta	Commuting public and nearby communities	DRR (Krabi PIU) and contractors
 Issue of concerns relating to mooring point relocation of fisher folks 	Group meetings	As needed	Moo 8, Ban Hua Hin, Koh Klang Sub- district, Koh Lanta District Krabi Province	A group of local fishing boats / Hua Tong boats, 20 boats, 3 ferries and 2 speed boats	DRR (Krabi PIU) and Contractor

Consultation issue		Proposed methodology	Frequency	Place	Stakeholder recipients	Party Responsible
6.	Issue of concerns relating to disturbances of cemetery	Individual meetings (engage through religious leaders and/or mosque committees)	As needed	Koh Lanta	Users of Muslim cemetery	DRR (Krabi PIU) and contractor
7.	Issue of concerns relating to conservation of natural resources	-Public consultation -group meeting	once (mid- construction phase consultation)	Krabi	A group of agencies responsible for or involved in project implementation	DRR (Krabi PIU)
	environment		As needed (individual and group meetings)		Conservation CSOs, NGOs, interested in environmental conservation and Irrawaddy dolphin conservation	

Table 4.8-2: The Project Information Dissimination Strategies

Information to be circulated	Proposed methods	Frequency	Place	Stakeholder addressees	Party Responsible			
Pre-Construction Phase	Pre-Construction Phase							
1. Updated on detailed design including universal design principles	 Public consultations Pamphlet Website 	Once At least 15 days before the construction	Pre- consultation consultation in Krabi	All groups	DRR-PMU			
2. Construction plan and schedule	 Public consultation Website Publicity sign Official letter to relevant organizations and stakeholders in sensitive areas 	Once At least 15 days before the construction	Pre- construction consultation in Krabi	All groups Ensuring communication to: - People living in a distance of 500 from the project location	DRR-PMU			

Information to be circulated	Proposed methods	Frequency	Place	Stakeholder addressees	Party Responsible
				- 103 sensitive area groups, 4 mosques, 26 schools, 21 child development centers, 9 sub- district health promotion hospitals, 2 district hospitals, a temple and a monastery	
3. Additional environmental Studies: CIA and CHA	 Website Share with relevant agencies (to be listed) 	Once		Relevant agencies (e.g. CIA-tourism association)	DRR-PMU
4. Project level Grievance Redress Mechanisms (GRM)	 Public consultation Publicity sign Pamphlet Website Radio and other media 	Once	Pre- construction consultation in Krabi Publicity sign (at project sites – in the construction plan publicity sign)	All stakeholder groups	DRR-PMU and Lanta PIU
5. Workers' camp establishment	Public consultationWebsiteBanner	Once	Pre- construction consultation in Krabi Banner at the site	Communities surrounding designated worker's camp	DRR
6. Cement plant establishment	 Public consultation Website Banner	Once	Banner at the cement plant		DRR
Construction Phase					
1. Construction progress update	Website	As needed		All stakeholder groups	Contractor (construction supervisor consultant)

In	formation to be circulated	Proposed methods	Frequency	Place	Stakeholder addressees	Party Responsible
2.	Amendments in construction timeline	Amend on the banner Website	As needed		All stakeholder groups	DRR
3.	Road safety and travel inconveniences information	 Public signs Local radios (for nearby communities) inform village heads (for PWD and critically ill patients) inform through community health volunteers and districts/subdistricts hospitals Share information to nearby schools and religious places 	As needed	Krabi and Lanta	Commuting public and nearby communities	DRR and contractor
Pos	st-Construction Phase	e				
1.	Post construction survey result	Website	once		All stakeholder groups	DRR

Table 4.8-3: Project's Plan for the Public Participation Meeting

Project Stakeholders	Invitation	Timeframe	Venue
1. General Public	Yes		Koh Lanta District Office
2. Ferry operator and workers	Yes	1st Meeting: Pre-Construction Stage (Around first 3 months at the beginning of Contract)	
3. Concessionaires/ small businesses of Krabi PAO owned areas	Yes		
4. Economic displacements of shops along Department of Highway's Right of Way	Yes	2nd Meeting: Construction Stage (Around middle of Contract)	
5. Fisherfolk (mooring station)	Yes		
6. Communities beside workers' camp	Yes	3rd Meeting: Pre-Construction Stage (Around last 3 months before end of Contract)	
7. NGOs/PWD assns	Yes		
8. Government agencies - envi mitigation and utility providers	Yes		

Project Stakeholders	Invitation	Timeframe	Venue
9. Urak Lawoi community	Yes		
10. Noise impact and noise barrier Muslim Cemetary and Mr. Sumrit Saekow	Yes		
11 Others (see ESMP) Business facility, tour operator and sensitive receivers	Yes		

Table 4.8-4: Project's Plan for the Individual Meeting or Focus Group Meeting

Project Stakeholders	Invitation	Timeframe	Venue
1. Ferry operator and workers	Yes		
2. Concessionaires/ small businesses	Yes	Refore 1 st Public Participation Meeting	
3. Economic displacements of shops along DOH's ROW	Yes	and/or before start the construction in that particular area (as needed)	At stakeholders' sites or nearby
4. Fisherfolk (mooring station)	Yes		
5. Other stakeholders (as needed)	Yes		

103 | Page

Table 4.8-5: Pro	ject's Information	Disclosure Plan
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Mooting	(Info to Disclose	Poriods	Location	
weeting		Perious	Koh Klang	Koh Lanta
	1. Updated on detailed design including universal design principles		>	~
	2. Construction Plan & Timeline	1st PR: Pre-Construction Stage (Around first 3 months at the beginning of Contract)		
	3. Project-level Grievance Redress Mechanisms (GRM)			
	4. Additional environmental Studies: CIA and CHA	2nd PR: Construction Stage (Around middle of Contract)		
Public Consultations	5. Road and Traffic Safety Measures			
	6. Expected disturbances when the construction starts and mitigation	3rd PR: Pre-Construction Stage (Around last 3 months before end of Contract)		
	7. Workers' Camp Establishment			
	8. Cement plant establishment			
	9. Estimate costs and sources of expenses for project implementation.			
	10. Construction Progress			
Table 4.8-6: Project's Public Information and Grievance Redress Plans

		Location		
Public Information and Grievance Redress Channel	Timeframe	Koh Khlang District	Koh Lanta Noi District	
1. Project Information Board		~	<	
2. Grievance Box and Information Board at PIU and local provincal offices	At the beginning of Contract	~	~	

5. MONITORING PROGRAMS

This chapter described in more detail the requirements for monitoring of some key environmental and social monitoring parameters in Table 3.1, column "Monitoring Program/Responsibility/Cost", including to provide detailed cost estimate and required methodology. These monitoring program will be carried out by a third-party that will be hired by DRR. The third-party firm shall hold a license from the ONEP to conduct EIA compliance monitoring. This monitoring program is not replaced the daily/weekly supervision and monitoring that need to be carried out by Contractor and Supervision Consultant during project construction to supervise and monitor Contractor implementation of all mitigation measures included in Chapter 3.

5.1. Monitoring Plan for Impact on Fresh Water Quality

1) Objectives

- To monitor the quality of water in water clarifiers/anaerobic filters from activities in construction site offices and construction worker camps before being released to water sources or areas in the vicinity.
- To use the monitoring results to improve mitigation plans for wastewater quality to be more appropriate and effective.

2) Implementation area

- During construction phase
 - Water clarifiers/anaerobic filters used for wastewater collection from construction site offices and construction worker camps.
- During implementation phase
 - o -None

3) Implementation method

- Collect samples of wastewater and analyze the quality of wastewater according to the Standard Method for Examination of Water and Wastewater as specified by APHA, AWWA and WPCF. The index for analysis is shown in **Table 5.1-1**.
- Develop a report to present the monitoring results of fresh water quality along with recommendations.

4) Timeline and frequency of monitoring

- During construction phase
 - Quarterly covering rainy season and dry season throughout the construction period
- During implementation phase
 - o None

Table 5.1-1 Index of surface water quality and analysis method

Index	Unit	Analysis method
1) pH	-	Electrometric Method (pH Meter)
2) Suspended solid (SS)	mg/l	Total Suspended Solids Dried at 103- 105 °C
 Value of organic matters in the form of BOD 	mg/l	Azide Modification Method
4) Total Phosphorus	mg/l	Ascorbic Method
5) Total Nitrogen	mg/l	Cadmium Reduction Method
6) Fat, Oil & Grease	mg/l	Partition-Gravimetric Method

Note: Methods for analyzing surface water quality according to the Notification of the National Environment Board No. 8 (B.E. 2537) issued under the Enhancement and Conservation of the National Environmental Quality Act, B.E. 2535 regarding the determination of water quality standards in surface water sources and Standard Methods for the Examination of Water and Wastewater 1084 APHA, AWWA and WEF (1998)

7) Responsible agencies

- During construction phase the Department of Rural Roads hires a third party for the implementation.
- During implementation phase

8) Budget

- During construction phase: Total budget of 40,000/year
 - Analysis fee 10,000 Baht/station
 - Amount 1 station/time
 - Frequency of analysis 4 times/year
- During implementation phase
 - o None

9) Evaluation

The third party shall conduct the monitoring of environmental quality and the effectiveness of impact minimization through the monitoring of fresh water quality. The results from the monitoring of wastewater quality shall not be higher than the standard value according to the notification of the Ministry of Natural Resources and Environment on Standards for Quality Control of Wastewater Disposal from Domestic Wastewater Treatment Systems (B.E. 2553). The third party shall develop a report and summary of results to be presented to the World Bank 2 times/year and to ONEP 1 time/year.

5.2. Monitoring Plan for Impact on Marine Water Quality

1) Objectives

- To monitor the quality of seawater in the project route area. It is expected that seawater quality would be affected by the project implementation.
- To use the monitoring results to improve mitigation plans for seawater quality to be more appropriate and effective.

2) Implementation area

- During construction phase
 - Collect seawater samples from three stations (Figure 5.2-1) including:
 - Station 1: at the coast of Ban Hua Hin, Koh Klang Sub-district
 - Station 2: at the coast of Koh Pling
 - Station 3: at the coast of Ban Thung Toh Yum, Koh Lanta Noi Sub-district
- During implementation phase
 - o None

3) Implementation method

• -Collect samples of seawater and analyze the quality of seawater according to the notification of the National Environmental Board on Control of Seawater Quality as

published in the Royal Gazette, No. 134, Special Section 288 Ngor, dated 23 November 2017. The index for analysis is shown in **Table 5.2-1**.

 -Develop a report to present the monitoring results of seawater quality along with recommendations.

Table 5.2-1 Marine water quality monitoring index

Marine water quality index	Unit	Period of sample collection
1. Floating object	-	Rainy season, Dry season
2. Smell	-	Rainy season, Dry season
3. Oil and grease	-	Rainy season, Dry season
4. Temperature	PC	Rainy season, Dry season
5. pH	-	Rainy season, Dry season
6. Transparency	cm	Rainy season, Dry season
7. Suspended Solids	-	Rainy season, Dry season
8. Dissolved oxygen (DO)	mg/l	Rainy season, Dry season
9. Salinity	ppt	Rainy season, Dry season
10. Lead (Pb)	2/1	Rainy season, Dry season
11. Total Mercury	?/I	Rainy season, Dry season
12. Arsenic (As)	P/I	Rainy season, Dry season
13. Total Coliform Bacteria	MPN/100 ml	Rainy season, Dry season
14. Fecal Coliform Bacteria	CFU/100 ml	Rainy season, Dry season

Note: Analysis method of seawater quality according to the notification of the National Environmental Board on Control of Seawater Quality as published in the Royal Gazette, No. 134, Special Section 288 Ngor, dated 23 November 2017

In addition to the above mentioned index of marine water quality, oil spill incident shall be monitored and reported starting from observing of oil sheen on the water surface to other oil spill incident of greater quantities.

4) Timeline and frequency of monitoring

- During construction phase
 - Quaterly covering rainy season and dry season throughout the construction period, especially at construction areas close to the water sources.
- During implementation phase: None

5) Responsible agencies

- During construction phase
 - The Department of Rural Roads hires a third party for the implementation.
- During implementation phase
 - o -None

6) Budget

- During construction phase: Total budget of 72,000/year
 - o Analysis and sampling fee 6,000 Baht/station
 - Amount 3 stations/time
 - Frequency of analysis 4 times/year
- During implementation phase
 - o None

7) Evaluation

The third party shall conduct the monitoring of environmental quality and the effectiveness of impact minimization through the monitoring of marine water quality camparing standard value of marine water quality. The third party shall develop a report and summary of results to be presented to the World Bank 2 times/year and to ONEP 1 time/year.



Figure 5.2-1 Stations monitoring the quality of marine water in the project route area

5.3. Monitoring Plan for Impact on Air Quality

1) Objective

To monitor the impact of air quality from project activities in community areas and environmentally sensitive areas along the project route.

2) Implementation area

- During construction phase
 - Monitor the air quality at two stations (Figure 5.3-1) including:
 - Station 1: Moo 8, Ban Hua Hin (Ban Tha Rua)
 - Station 2: Thung Toh Yum Cemetery
- During implementation phase
 - o None

3) Implementation method

- Monitor the air quality from environmentally sensitive areas along the project route using the measurement and analysis methods according to the regulations specified in the notification of the National Environmental Board No. 24 (B.E. 2547) on Air Quality Control in Atmospheric Conditions as published in the Royal Gazette, No. 121, Special Section No. 104, dated 22 September 2004, and other relevant standards. The monitoring shall take place over five consecutive days, covering weekdays and weekends as shown in Table 5.3-1.
- Develop a report to present the monitoring results of air quality along with recommendations.



Figure 5.3-1 Location of air quality monitoring stations

-				
Index		Sample collection method	Analysis method	Period of measurement
1.	TSP	High Volume Air Sampler	Gravimetric Method	24 hours
2.	PM10	High Volume PM-10 Air Sampler	Gravimetric Method	24 hours
3.	NO2	Impinger Absorption Gas Analyzer	Chemiluminescense Method	1 hour
4.	СО	Gas Analyzer	Non-Dispersive Infrared	1 hour
5.	Wind Speed & Wind Direct	Wind Speed & Wind Direction Sensor	Wind Speed Analysis	24 hours

Table 5.3-1 Air quality monitoring index and analysis method

4) Timeline and frequency of monitoring

- During construction phase
 - Twice a year during five consecutive days, covering rainy season and dry season throughout the construction period
- During implementation phase
 - o None

5) Responsible agencies

- During construction phase
 - The Department of Rural Roads hires a third party for the implementation.
 - During implementation phase
 - o None

6) Budget

- During construction phase: Total budget of 250,000/year
 - Analysis fee 62,500 Baht/station
 - Amount 2 stations/time
 - Frequency of analysis 2 times/year
- During implementation phase
 - o None

7) Evaluation

The third party shall conduct the monitoring of environmental quality and the effectiveness of impact minimization through the monitoring of air quality comparing with standard value of ambient air quality. The third party shall develop a report and summary of results to be presented to the World Bank 2 times/year and to ONEP 1 time/year.

5.4. Monitoring Plan for Impact on Noise

1) Objective

To monitor the sound impact from project activities to cause the least possible effects on communities and environmentally sensitive areas.

2) Implementation area

- During construction phase
 - Monitor the sound levels at two stations (Figure 5.4-1) including:
 - Station 1: Moo 8, Ban Hua Hin (Ban Tha Rua)
 - Station 2: Thung Toh Yum Cemetery
- During implementation phase
 - \circ $\;$ Monitor the sound levels at two stations including:
 - Station 1: Moo 8, Ban Hua Hin (Ban Tha Rua)

• Station 2: Thung Toh Yum Cemetery

3) Implementation method

- Monitor the sound levels according to the methods in the notification of the National Environmental Board No. 15 (B.E. 2540) on Standards of Sound Levels in General Circumstances published in the Royal Gazette, dated 3 April 1997, and the notification of the Pollution Control Department on Sound Levels Measurements published in the Royal Gazette, dated 25 November 1997. The measurements shall take place over five consecutive days, covering weekdays and weekends. The index for monitoring is shown in **Table 5.4-1**.
- -Develop a report to present the monitoring results along with recommendations.

Index	Sampling method	Analysis method	Period of measurement
1) Leq 1 hr			1 hour
2) Lmax	Integrated Sound	Integrated Sound	24 hours
3) Leq 24 hr	integrated Sound	integrated Sound	24 hours
4) Ldn	Level Meter	Level Meter	24 hours

Table 5.4-1 Index of sound level and analysis method

4) Timeline and frequency of monitoring

- During construction phase
 - Quarterly during five consecutive days (three working days and two public holidays), covering rainy season and dry season throughout the construction period
- During implementation phase
 - Twice a year during five consecutive days, covering rainy season and dry season in the 1st, 2nd, 3rd, 5th, 10th, 15th, and 20th year of the project implementation.

5) Responsible agencies

- During construction phase
 - The Department of Rural Roads hires a third party for the implementation.
 - During implementation phase
 - The Department of Rural Roads hires a third party for the implementation.

6) Budget

- During construction phase: Total budget of 24,000/year
 - Analysis fee 3,000 Baht/station
 - Amount 2 stations/time
 - Frequency of analysis 4 times/year
- During implementation phase: Total budget of 12,000/year
 - Analysis fee 3,000 Baht/station
 - Amount 2 stations/time
 - Frequency of analysis 2 times/year

7) Evaluation

The third party shall conduct the monitoring of environmental quality and the effectiveness of impact minimization through the measurements of sound levels. The results from the monitoring of sound levels shall not be higher than the standard sound levels. The third party shall develop a report and summary of results to be presented to the ONEP and the World Bankat least once a year.



Figure 5.4-1 Stations monitoring the sound levels in the project route area

5.5. Monitoring Plan for Impact on Vibration

1) Objective

To monitor the vibration impact from project activities to cause the least possible effects on communities and environmentally sensitive areas.

2) Implementation area

- During construction phase
 - Monitor the vibration levels at two stations (Figure 5.5-1) including:
 - Station 1: Moo 8, Ban Hua Hin (Ban Tha Rua)
 - Station 2: Thung Toh Yum Cemetery
- During implementation phase
 - o None

3) Implementation method

- Monitor the vibration levels and the frequency (Hertz) of vibration and record events causing high vibration levels that could cause effects, using a vibration meter that only responds to the vertical axis of the speed at the position of measurement. Both the vertical axis and horizontal axis are measured. The measuring device shall be placed at the ground level or at the lowest level of a building according to the regulations specified in the standard of DIN 4150. The vibration measurements are calculated as PPV. The methods for analysis are shown in **Table 5.1.5-1**.
- Develop a report to present the monitoring results along with recommendations.

Table 5.5-1 Index of vibration levels and analysis method

Index	Period of sample collection	Sampling method	Analysis method	Standard of analysis method
 PPV Frequency (Hz) 	24 hours 24 hours	Vibration Meter	Ground Vibration Method	DIN 4150

Note: Compared against the Standard on Vibration Level to Prevent Impact to Buildings from the Notification of the National Environmental Board No. 37, B.E. 2553, the standard of German system No. 4150 (DIN 4150) and the British system standard No. 5228

4) Timeline and frequency of monitoring

- During construction phase
 - Quarterly during five consecutive days (three working days and two public holidays), covering rainy season and dry season throughout the construction period
- During implementation phase
 - o None

5) Responsible agencies

- During construction phase
 - The Department of Rural Roads hires a third party for the implementation.
- During implementation phase
 - o None

6) Budget

- During construction phase: Total budget of 144,000/year
 - Analysis fee 18,000 Baht/station
 - Amount 2 stations/time
 - Frequency of analysis 4 times/year
- During implementation phase:
 - o None



Figure 5.5-1 Stations monitoring the vibration levels in the project route area

7) Evaluation

The third party shall conduct the monitoring of environmental quality and the effectiveness of impact minimization through the measurements of vibration levels. The results from the monitoring of vibration levels should not exceed the Standard on Vibration Level to Prevent Impact to Buildings from the Notification of the National Environmental Board No. 37, B.E. 2553, the standard of German system No. 4150 and the British system standard No. 5228. The third party shall develop a report and summary of results to be presented to the World Bank 2 times/year and to ONEP 1 time/year.

5.6. Monitoring Plan for Impact on Marine Aquatic Ecology

1) Objective

To monitor the impact from project activities to cause the least possible effects on aquatic ecology.

2) Implementation area

- During construction phase: Three stations (Figure 5.6-1) including:
 - \circ $\;$ Station 1: at the coast of Ban Hua Hin, Koh Klang Sub-district
 - Station 2: at the coast of Koh Pling
 - Station 3: at the coast of Ban Thung Toh Yum, Koh Lanta Noi Sub-district
 - During implementation phase
 - o None

3) Implementation method

- Conduct a samples of phytoplankton, zooplankton, benthos, fish and maine aquatic plant species. The sampling and analysis method is shown in **Table 5.6-1.**
- Develop a report to present the monitoring results along with recommendations.

4) Timeline

During construction phase Quarterly, covering rainy season and dry season throughout the construction period, especially during construction activities at sea.

•	017		
Index of aquatic ecology	Unit	Sampling method	Analysis method
1. Phytoplankton	cell/cm ³	Juday Plankton Trap	Sedwide-Rafter Counting Cell
2. Zooplankton	cell/cm ³	Juday Plankton Trap	Sedwide-Rafter Counting Cell
3. Benthos	cell/cm ²	Ekman Dredge	Sedwide-Rafter Counting Cell
4. Fish species	Туре	Random sampling	Sum of Species
5. Aquatic plant species	Туре	Random sampling	Sum of Species

Table 5.6-1 Index of aquatic ecology, sampling, and analysis method

Note: - Plankton analysis method according to Standard Methods for the Examination of

water and Wastewater 21* Edition, 2005 defined by APHA-AWWA-WEF

-Benthos analysis method according to Standard of Holme and McIntyrc

-Phytoplankton and Zooplankton samples are preserved using 4% concentration of formalin

-Benthos samples are preserved using 7% concentration of formalin



Figure 5.6-1 Stations monitoring aquatic ecology in project route area

5) Responsible agencies

During construction phase The Department of Rural Roads hires a third party for the implementation.

6) Budget

- During construction phase: Total budget of 234,000/year
 - Analysis fee 19,500 Baht/station
 - Amount 3 stations/time
 - Frequency of analysis 4 times/year

7) Evaluation

The third party shall conduct the monitoring of environmental quality and the effectiveness of impact minimization through the surveys on aquatic ecology. The third party shall develop a report and summary of results to be presented to the ONEP and the World Bankat least once a year.

5.7. Monitoring Plan for Impact on Flora (Nation Reseved Forest)

1) Objective

To monitor the impact from project activities on National Reserved Forest. (Monitoring of mangorve replantation is covered in *Section 4.4 Action Plan for Mangrove Replantation*.

2) Implementation area

- During construction phase
 - Construction area from milestone 1+958 to milestone 2+527. The total distance is approximately 0.282 kilometers.
- During implementation phase
 - In the areas where there are replanting of trees in the Project ROW and Project forest replantation areas.

3) Implementation method

- During construction phase
 - Count the number and species of trees that are cut down and removed from the construction area.
- During implementation phase
 - Verify the number and growth conditions of trees that were planted.
 - Count the number of dead trees.
 - Verify the size of the area of tree replantation.

4) Timeline

- During construction phase
 - Monitor tree felling in the construction area every time there is the cutting of trees and timber extraction.
- During implementation phase
 - Once a year in the 1st, 3rd, 5th, 10th, 15th, and 20th year of project implementation.

5) Responsible agencies

- During construction phase
 - The Department of Rural Roads hires a third party for the implementation under the supervision of the Department of Rural Roads or the Forest

Industry Organization.

- During implementation phase
 - The Department of Rural Roads hires a third party for the implementation.

6) Budget

- During construction phase: Total budget of 10,000/year
 - Analysis fee 10,000 Baht/station
 - Frequency of analysis 1 time/year
- During implementation phase: Total budget of 10,000/year
 - Analysis fee 10,000 Baht/station
 - Frequency of analysis 1 time/year

7) Evaluation

The third party shall conduct the monitoring of the removal of trees (restricted wood) and develop a report and summary of results to be presented to the World Bank 2 times/year and to ONEP 1 time/year.

5.8. Monitoring Plan for Impact on Fauna

1) Objective

- To monitor wildlife species and wildlife ecology within 500 m from the Project route.
- To study ecological functions of wildlife species including birds.
- To conduct and survey and record number of wildlife and birds injury and mortality related to impacts from the Project.

2) Implementation area

Area along the project route from milestone 0+000 to milestone 2+527 within a 500-meter radius from the project.

3) Implementation Method

Monitor the follwing index:

- Diversity
- Distribution & abundance
- Status
- Habitat and foraging site ecology, areas usage
- Records of animal injuries & deaths (animal species, number, incident location, cause of injuries & death, etc.)

4) Timeline

- During construction phase
 - 2 times/Year covering the rainy season and dry season throughout the construction
- During implementation phase
 - 2 time/year in Year 1, 2, 3, 5, 10, 15, and 20 of implementation period.

5) Responsible Agencies

- During construction phase
 - The Department of Rural Roads hires a third party for the implementation.

- During implementation phase
 - The Department of Rural Roads hires a third party for the implementation.

6) Budget

- During construction phase: Total budget of 300,000/year
 - Analysis fee 150,000 Baht/station
 - Frequency of analysis 2 times/year
- During implementation phase: Total budget of 300,000/year
 - -Analysis fee 150,000 Baht/station
 - -Frequency of analysis 2 times/year

7) Evaluation

The third party shall conduct the monitoring of fauna species, especially protected wildlife species in the project area. The third party shall develop a report and summary of results to be presented to the World Bank 2 times/year and to ONEP 1 time/year.

5.9. Monitoring Plan for Impact on Rare Species

1) Objective

- To observe marine mamals that may enter the project construction area and the vicinity and could be affected by project activities.
- To monitor the impact from activities of the project during the construction phase and implementation phase on rare species.
- To monitor protected wildlife species that enter the areas along the project route to forage, inhabit or take refuge.

2) Implementation area

Area along the project route from milestone 0+000 to milestone 2+527 within a 500-meter radius from the project route, especially the northern and southern side of the construction area of Koh Lanta Bridge and the project route.

3) Implementation method

Construction phase: Dolphins

- During construction activities, the contractor shall implement the monitoring plan for impact on bottlenose dolphins and Indo-Pacific humpbacked dolphins as follows:
 - Establish dolphins observation zone (bridge route and two roles of 500 m strips along both sides of brdige route). Conduct boat survey in the observation zone and stop to observe dolphins at every 500 m.
 - The observer shall use a binoccular to survey on the water surface onboard the ship.
 - Contractor shall also construct elevated platforms at least 5 meters above the water line on each end of the bridge construction site and position observers searching with hand-held binoculars on elevated platforms.
 - Establish communication procedures between the observers and piling crew/construction team, including a formal chain of communication between the observers and the person who can stop the piling operation.

- The observation zone should be monitored visually by observers for an agreed period prior to the commencement of piling.
- Piling should not be commenced if dolphins are detected within the observation zone.
- If a dolphin is found entering the observation area, the observer shall immediately notify the construction team by phone to suspend construction activities temporarily.
- Continue the observation and note-taking until dolphins leave the surveillance zone.
- If there is a pause in the piling operations for a period of greater than 10 minutes, then the pre-piling search should be repeated before piling recommences.

Construction phase: Rare Terrestrial Animals

Conduct a field survey in the project area to monitor the following:

- Species diversity
- Relative abundance
- Status of Wildlife
- Habitat and foraging site ecology, areas usage
- Records of animal injuries & deaths (animal species, number, incident location, cause of injuries & death, etc.)

4) Timeline

- During construction phase
 - For terrestrial animals: 2 times/Year covering the rainy season and dry season throughout the construction
 - For dolphin observation: Throughout bridge foundation construction period especially rainy season (Jun Dec)

• - During implementation phase

2 time/year in Year 1, 2, 3, 5, 10, 15, and 20 of implementation period.

5) Responsible agencies

- During construction phase
 - The Department of Rural Roads hires a third party for the implementation.
 - $\circ~$ For dolphin: Contractor to implement dolphin observation measures in mitigation section .
- During implementation phase
 - The Department of Rural Roads hires a third party for the implementation.

6) Budget

- During construction phase: Total budget of 690,000/year
 - Analysis fee 690,000 Baht/station
 - Frequency of analysis 2 times/year
- During implementation phase: Total budget of 190,000/year
 - -Analysis fee 95,000 Baht/station
 - o -Frequency of analysis 2 times/year

7) Evaluation

The third party shall conduct the monitoring of rare species in the project area. The third party shall develop a report and summary of results to be presented to the World Bank 2 times/year and to ONEP 1 time/year.

5.10. Monitoring Plan for Impact on Transportation, Accidents and Safety

1) Objective

- To monitor impact caused by transportation activities of the project during the construction phase and the implementation phase in order to cause the least possible impact to local residents and road users.
- To monitor the impact from accidents and safety for the local population and road users of the project route.

2) Implementation area

- During construction phase
 - Two main routes used for the project transportation activities are as follows:
 - Highway no. 4206
 - Local highway no. KB. 5035
- During implementation phase
 - Highway no. 4206
 - Local highway no. KB. 5035
 - Project route

3) Implementation method

- During construction phase
 - Monitor the number of vehicles used for the transportation of construction materials and equipment that enter-exit from the project area for each activity.
 - Survey the conditions, damage, degradation of project route as well as routes used for the transportation of construction materials and equipment into the project area.
 - Compile statistics on accidents, time of accidents and cause of accidents on project route and conduct a survey on transportation.
- During implementation phase
 - Conduct a survey on the number of cars using the project route whether and how it increases or decreases in order to assess traffic flow of the route.
 - \circ $\;$ Survey the conditions, damage and degradation of project route.
 - Compile statistics on accidents, time of accidents and cause of accidents on project route

4) Timeline

- During construction phase
 - Once a year throughout the construction period
- During implementation phase
 - Once a year, in the 1st, 2nd, 3rd, 5th, 10th, 15th, and 20th year of project implementation.

5) Responsible agencies

- During construction phase
 - The Department of Rural Roads hires a third party for the implementation.
- During implementation phase
- The Department of Rural Roads hires a third party for the implementation.

6) Budget

- During construction phase: Total budget of 60,000/year
 - Analysis fee 30,000 Baht/time
 - Frequency of analysis 2 times/year
- During implementation phase: Total budget of 30,000/year
 - Analysis fee 30,000 Baht/time
 - Frequency of analysis 1 time/year

7) Evaluation

The third party shall conduct the monitoring and compilation of data and statistics on the causes, characteristics, and severity of accidents from land and water transportation. The third party shall develop a report and summary of results to be presented to the World Bank 2 times/year and to ONEP 1 time/year.

5.11. Monitoring Plan for Impact on Water Drainage and Flood Control

1) Objective

To monitor the water drainage and flood control in areas that the project route cut through. To propose recommendations to address issues in case of impact in order to minimize as much impact on water drainage as possible.

2) Implementation area

- During construction phase
 - Project area from the beginning point at milestone 0+000 in Koh Klang Sub-district to the end point at milestone 2+527 in Koh Lanta Noi Subdistrict, Krabi Province.
- During implementation phase
 - o -None

3) Implementation method

• Throughout the construction phase

- Monitor water logging on both sides of the project route and areas in the vicinity.
- Conduct a survey on the effectiveness of spillways along the project route. Examine the conditions of sediment collection and weed near pipelines and drains.
- During implementation phase
 - o None

4) Timeline

- During construction phase
 - Twice a year throughout the construction period. When there is heavy rain, the monitoring shall be carried out within 24 hours.
- During implementation phase
 - o None

5) Responsible agencies

- During construction phase
 - The Department of Rural Roads hires a third party for the implementation.
- During implementation phase
 - o None

6) Budget

- During construction phase: Total budget of 40,000/year
 - Analysis fee 20,000 Baht/time
 - Frequency of analysis 2 times/year
- During implementation phase

o None

7) Evaluation

The third party shall conduct the monitoring of water logging on both sides of the project route and areas in the vicinity and examine the effectiveness of spillways along the project route. The third party shall develop a report and summary of results to be presented to the World Bank 2 times/year and to ONEP 1 time/year.

5.12. Monitoring Plan for Impact on Socio-Economic

1) Objective

- To monitor impact on economy and society to the local population during the construction phase and implementation phase and to seek the opinion of the local population.
- To monitor the impact on public health to the local population and to seek the opinion of the local population.
- To monitor the impact on occupational health to construction workers and to seek the opinion of the local population.

2) Implementation area

- During construction phase and Implementation Phase
 - Project study areas in Koh Khlang District and Koh Lanta Noi District.

• Target groups include households, community leaders, business owners, and environmentally sensitive areas.

3) Implementation method

- During construction phase and Implementation Phase
 - Target groups
 - Households
 - Community leaders
 - Business owners
 - Environmentally sensitive areas
 - Monitoring index
 - Socio-economic and cultural data and changes due to the project construction and implementation.
 - Suggestions and feedback for the project
 - Study method: Conduct the study through interviews using a questionnaire. Upon the completion of surveys, all data shall be verified and organized in different groups from the survey. The data shall be coded and analyzed using SPSS for Windows used for social sciences research. The analysis of data shall be done using descriptive statistics including amount and percentage. The analysis and description of data shall be done according to groups.

4) Timeline

- During construction phase
 - Once a year throughout the construction period
- During implementation phase
 - Once a year in the 1st, 2nd, 3rd, 5th, 10th, 15th and 20th year of project implementation

5) Responsible agencies

- During construction phase
 - \circ The Department of Rural Roads hires a third party for the implementation.
- During implementation phase
 - \circ The Department of Rural Roads hires a third party for the implementation.

6) Budget

- During construction phase: Total budget of 250,000/year
 - Survey and analysis fee 1,000 Baht/sample
 - Amount 250 samples

- Frequency of analysis 1 time/year
- During implementation phase: Total budget of 250,000/year
 - Survey and analysis fee
 1,000 Baht/sample
 - Amount 250 samples

Frequency of analysis 1 time/year

7) Evaluation

The third party shall conduct the monitoring of impact and issues that the local population is facing and seek the opinion and suggestions of the local population. The third party shall develop a report and summary of results to be presented to the World Bank 2 times/year and to ONEP 1 time/year.

5.13. Monitoring Plan for Impact on Public Health, and Occupational Health and Safety

1) Objective

- To monitor impact on public health in nearby communities.
- To monitor the impact on construction workers health and safety.

2) Implementation area

- During construction phase and Implementation Phase
 - 500 m areas along the Project route and project areas.
- During Implementation Phase: None

3) Implementation method

- During construction phase
 - Target groups include households, and construction workers.
 - Monitoring index: health conditions of targeted households and construction workers and public health service in nearby communities
 - Study method:Collect information on public health and OHS from health facilities within Project study areas. Conduct the study through interviews using a questionnaire together with socio-economic monitoring survey. Upon the completion of surveys, all data shall be verified and organized in different groups from the survey. The data shall be coded and analyzed using SPSS for Windows used for social sciences research. The analysis of data shall be done using descriptive statistics including amount and percentage. The analysis and description of data shall be done according to groups.

4) Timeline

- During construction phase
 - Once a year throughout the construction period
- During implementation phase: None

5) Responsible agencies

- During construction phase
 - $\circ\,$ The Department of Rural Roads hires a third party for the implementation.
- During implementation phase: None

6) Budget: included in socio-economic monitoring

7) Evaluation

The third party shall conduct the monitoring of impact and issues that the local population is facing and seek the opinion and suggestions of the local population. The third party shall develop a report and summary of results to be presented to the World Bank 2 times/year and to ONEP 1 time/year.

Additional health risks monitoing proposed in the Project Health Impact Assessment are described in **Table 5.13-1 and 5.13-2.**

Component	Health Impacts	Sensitive Receptors	Monitoring Index	Frequency	Monitoring Location/Group	Responsible Agency	Budget
1. Air Quality	Impact on Physical Health When humans breathe pollution into the body, such as smoke, gases, dust, and toxic substances, it has an effect and becomes the cause of diseases such as respiratory system ailments, lung cancer, cardiovascular disease, and heart disease, and heart disease. This pollution also leads to numbness in the lungs, the beginning of coughing up blood, and long-term consequences that may eventually result in death.	Construction Workers	 Inspection use of breathing protective equipment in workers and crews who expose to air pollutants in the workplace. Complain and suggestion made by workers related to the workplace air quality Record of sickness related to the worker's respiratory system. 	Twice /year for 3 consecutive days during the dry season (April) and the rainy season (November) throughout the 3- year construction period.	Construction worker groups, potentailly exposed to air pollutants in workplace environment	Department of Rural Roadsor the employed 3rd party	Included in the overall monitoring budget
	mental nearth impact						

Table 5.13-1 : Health Risk Monitoring of the Project – Construction Phase

Component	Health Impacts	Sensitive Receptors	Monitoring Index	Frequency	Monitoring Location/Group	Responsible Agency	Budget
	Additionally, it has an impact on mental health, causing feelings of annoyance, frustration, and anxiety when exposed to dust.						
		Residents in the vicinity – 500 m radius of the construction location	 Ambient air quality monitoring – following the environmental monitoring program Complain and suggestion made by workers related to the workplace air quality Record of sickness related to the community's respiratory system. 	Twice /year for 3 consecutive days during the dry season (April) and the rainy season (November) throughout the 3- year construction period.	Ambient air quality Monitoring: 1) Station 1: Moo 8, Ban Hua Hin (Ban Tha Rua) 2) Station 2: Thung Toh Yum Cemetery	Department of Rural Roads or the employed 3rd party	Included in the overall monitoring budget
2. Noise	Impact on Physical Health: Excessive noise can have detrimental effects on physical health. It can lead to a decrease in auditory capacity, causing temporary or	Construction Workers	 Inspection use of noise protective equipment in workers and crews working in elevated noise workplace environment Complain and suggestion made by workers related to the workplace noise level 	Quarterly for 3 consecutive days throughout the 3 - year construction period.	Construction worker groups, potentailly exposed to elevated noise in workplace environment.	Department of Rural Roads or the employed 3rd party	Included in the overall monitoring budget

Component	Health Impacts	Sensitive Receptors	Monitoring Index	Frequency	Monitoring Location/Group	Responsible Agency	Budget
	permanent hearing loss depending on the intensity, frequency, and duration of exposure. Impact on Mental Health: The constant annoyance caused by excessive noise can disrupt sleep patterns, resulting in increased stress levels and affecting both physical and mental well-being. It can lead to feelings of anxiety and may even pose a risk to overall mental health.		 The occurrence of illness and stress within the worker group that are associated with hearing problems 				
		Residents in the vicinity – 500 m radius of the construction location	 Ambient noise – following the environmental monitoring program Complain and suggestion made by community related to the noise impact 	Quarterly for 3 consecutive days throughout the 3-year construction period.	1) Station 1: Moo 8, Ban Hua Hin (Ban Tha Rua) 2) Station 2: Thung Toh Yum Cemetery	 Department of Rural Roads or the employed 3rd party 	 Included in the environmental monitoring budget

Component	Health Impacts	Sensitive Receptors	Monitoring Index	Frequency	Monitoring Location/Group	Responsible Agency	Budget
			 The occurrence of illness and stress within the community that are associated with hearing problems 				
3. Vibration	Physical Health Impact The impact on physical health can include various effects when exposed to prolonged vibrations. For instance, it can lead to abnormal posture, dizziness, nausea, loss of appetite, blurred vision, and muscle fatigue accompanied by muscle pain. Mental Health Impact Furthermore, the psychological impact can result in feelings of	Construction Workers	 Complain and suggestion made by workers related to the workplace vibration. The occurrence of illness and stress within the construction workers that are associated with workplace vibration problems. 	Quarterly throughout the construction period.	Construction worker groups, potentially exposed to vibration in workplace environment.	 Department of Rural Roads or the employed 3rd party 	 Included in the environmental monitoring budget

Component	Health Impacts	Sensitive Receptors	Monitoring Index	Frequency	Monitoring Location/Group	Responsible Agency	Budget
	for those experiencing the vibrations.						
		Residents in the vicinity – 500 m radius of the construction location	 Vibration – following the environmental monitoring program Complain and suggestion made by the communities related to the workplace vibration. The pre and post survey on the residential building, household and structure that might be impacted by the activities with elevated vibration. The occurrence of illness and stress within the residential communities that are associated with workplace vibration problems. 	Quarterly for 3 consecutive days throughout the 3-year construction period. Before and after the construction for the residential structural survey for damage, which is potentially caused by the construction vibration.	1) Station 1: Moo 8, Ban Hua Hin (Ban Tha Rua) 2) Station 2: Thung Toh Yum Cemetery	 Department of Rural Roads or the employed 3rd party 	 Included in the environmental monitoring budget
4. Water Quality	Physical health impact Direct discharge of wastewater and various pollutants into water sources can cause water pollution.	Construction workers	 Surface water quality – following the environmental monitoring program. The occurrence of illnesses and stress within the worker group that are associated with 	Quartery throughout the 3- year construction period	1) Water clarifiers/anaerobic filters used for wastewater collection from construction site offices and	 Department of Rural Roads or the employed 3rd party 	 Included in environmental monitoring budget.

Component	Health Impacts	Sensitive Receptors	Monitoring Index	Frequency	Monitoring Location/Group	Responsible Agency	Budget
	Water contaminated with pathogens can lead to diseases such as gastrointestinal infections, liver diseases, dermatological conditions, including bacterial infections, viruses, parasites, and fungi. These pathogens can enter the body through direct consumption, skin contact, or respiratory systems.		water pollution and water borne deceases.		construction worker camps. 2) Discharge from the concerte plant		
	Mental health impact						
	Stress, anxiety, and a sense of insecurity regarding water usage for consumption and daily activities.						
		Residents in the vicinity – 500 m radius of the	 Surface water quality – following the environmental monitoring program. 	 Quartery during the dry throughout the 3-year 	 Nearest surface water body of the community which receives 	 Department of Rural Roads or the 	 Included in environmental monitoring budget.

135 | Page

Component	Health Impacts	Sensitive Receptors	Monitoring Index	Frequency	Monitoring Location/Group	Responsible Agency	Budget
		construction location	The occurrence of illnesses and stress within the affected residential areas that are associated with water pollution and water borne deceases.	construction period	the discharge from the construction worker camp and office and also the concrete plant.	employed 3rd party	
5. Occupational health (Work-related accidents and illnesses and unsuitable and unsafe working conditions and environment)	The impacts on physical health: Construction activities of the project require a daily workforce of 150 people and continuous work for a long period, which may pose risks of accidents during construction or work execution. Particularly, tasks related to the use of large machinery, sharp tools, electrical equipment, cutting and welding work, such as drilling, can lead to injuries,	Construction workers	 Incident and accident statistic of the following events: Near-miss First aid case Medical treatment case Lost time accident Fatality Fire (minor and major) Spill Availability and read to use condition of fire extinguishing equipmen and system Safety inspection of the construction site, worke camp and material storage for example fue 	Every month Every month	 Construction site Construction office Worker camp Material storage and warehouses 	 Department of Rural Roads or the employed 3rd party 	 Included in the overall monitoring budget
	or even fatalities						

Component	Health Impacts	Sensitive Receptors	Monitoring Index	Frequency	Monitoring Location/Group	Responsible Agency	Budget
	among construction workers. The impacts on mental health: Work-related stress and anxiety may arise from the nature of the work. Social impacts can occur. The burden on		Emergency response exercise covering all emergency situations				
	This can have an impact on healthcare services provided to the local population in the area, putting additional strain on healthcare facilities.						
6. The problem arising from	The physical health impacts:	Residents within a 500- meter radius of	Numbers of the locally employed workers	 Monthly basis throughout the 	Construction workers	 Department of Rural Roads or the 	 Not included in the overall monitoring budget – pre-

137 | Page

Component	Health Impacts	Sensitive Receptors	Monitoring Index	Frequency	Monitoring Location/Group	Responsible Agency	Budget
the influx of migrant workers.	 If healthcare facilities and medical personnel are insufficient to handle illnesses, it can have consequences when construction workers experience illnesses or severe accidents during work. In case there are no healthcare services or experienced medical personnel with necessary medical equipment within the project area, it can result in the loss of lives. 	the construction sites.	 Numbers of the non- locally employed workers Pre-employment physical health examination Random substance abuse check in construction workers and project's construction personnel Complain received from the surrounding communities and other local regarding the construction worker mis-conduct. Number of reported cases of conflict between the local and the construction workforce. Sickness and illness cases of construction workforces 	construction phase.	Other project's construction personnels	employed 3rd party	employment health examination

Component	Health Impacts	Sensitive Receptors	Monitoring Index	Frequency	Monitoring Location/Group	Responsible Agency	Budget
	The mental health impacts:						
	Stress and anxiety can arise due to delayed medical treatment.						
	Social Impacts:						
	It leads to social issues such as drug addiction problems, criminal activities, and theft problems.						
	It creates competition for the use of community healthcare services.						
7. Problems regarding adequacy of personnel and medical and healthcare facilities.	 Impacts on physical health: Insufficient hospitals and medical personnel to accommodate 	Residents within a 500- meter radius of the construction sites.	 Baseline level of services of the local medical health care facility, to be used by the project during the construction phase. 	 Monthly basis throughout the construction phase. 	 Construction workers Other project's construction personnels 	 Department of Rural Roads or the employed 3rd party 	 Included in the overall monitoring budget

139 | Page

Component	Health Impacts	Sensitive Receptors		Monitoring Index	Frequency	Monitoring Location/Group	Responsible Agency	Budget
	 patients' needs can result in adverse consequences. In the case of construction workers, injuries or severe accidents that occur during work can have a negative impact on their physical health. Lack of healthcare facilities or experienced medical personnel in the project area, including essential medical equipment, can lead to loss of life. 		•	Numbers of cases of injury, illness and sickness, referred for the medical services at the local medical healthcare facility.				
	Impacts on mental health: The delay in receiving							
	medical treatment can							
Component	Health Impacts	Sensitive Receptors	Monitoring Index	Frequency	Monitoring Location/Group	Responsible Agency	Budget	
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	cause stress and anxiety. Social impacts: It has an impact on the local population in the project area due to the increased burden on healthcare organizations in the							
	area, affecting the provision of services to the community in the project area as well as existing services.							
8.Traffic accident	Physical health impacts: Injuries or fatalities of individuals commuting due to the use of transportation routes within the project area.	Residents within a 500- meter radius of the construction sites.	 Statistics of accidents from construction or operation Accident statistics from the local traffic Road damage case 	2 times/year throughout the 3- year construction period	along the project route	Department of Rural Roads or the employed 3rd party	Included in the environmental monitoring budget	

Component	Health Impacts	Sensitive Receptors	Monitoring Index	Frequency	Monitoring Location/Group	Responsible Agency	Budget
	Mental health impacts: Increased anxiety or stress during travel.						
9. Waste management	Impact on Physical Health: It serves as a breeding ground for insects or various animals that act as carriers of diseases to humans, such as flies, mosquitoes, and rats. It becomes a source of various diseases. Impact on Mental Health: It can cause psychological distress or create annoyance	Construction workers	 Types and quantity of waste generated from construction activities and other ancillary units for example construction office, worker camp, concrete plan, complaint handling centers Records of waste transportation and disposal Inspection of waste segregation and storage 	Monthly basis throughout the construction phase	 Construction sites Worker camp Construction offices Compliant handling centers Concrete plant 	Department of Rural Roads or the employed 3rd party	Included in the overall monitoring budget

Component	Health Impacts	Sensitive Receptors	Monitoring Index	Frequency	Monitoring Location/Group	Responsible Agency	Budget
	due to unpleasant odors.						
		Residents within a 500- meter radius of the construction sites.					
10. Water supply	Impact on Physical Health: Water scarcity leads to physical weakness and affects the overall well-being of individuals. Impact on Mental Health: The scarcity of water for consumption and daily needs can cause stress and anviety	Construction workers	 Quantity of water supply used by the construction project Case of water supply disruption in the nearby communities and the root cause. 	 Monthly basis throughout the construction periods 	 Construction site Worker camp Construction offices Compliant handling centers Concrete plant 	 Department of Rural Roads or the employed 3rd party 	 Included in the overall monitoring budget.

Component	Health Impacts	Sensitive Receptors	Monitoring Index	Frequency	Monitoring Location/Group	Responsible Agency	Budget
		Residents within a 500- meter radius of the construction sites.					
11. Communicable diseases from workers	Dengue hemorrhagic fever and mosquito vectors - Impacts on physical health Dengue fever is considered endemic in Thailand. It is widely and rapidly spreading, especially in the event of project construction. It can be spread and transmitted from human to human by mosquitoes as a carrier of the disease. - Impacts on mental health	Construction workers	 Dengue Hermorrhagic Fever Numbers of cases of construction workers and personal infected by the Dengue Fever COVID-19 Pandemic Numbers of COVID- 19 cased in the construction worker and project's personnel Numbers of COVID- 19 screening conducted Number of vaccines received by the construction workers and other project's personnel 	Monthly basis throughout the construction periods	 Construction site Worker camp Construction offices Compliant handling centers Concrete plant 	Department of Rural Roads or the employed 3rd party	 Included in the overall monitoring budget. Note: the expenses for the COVID-19 vaccine is subsidized by the Government.

Component	Health Impacts	Sensitive Receptors	Monitoring Index	Frequency	Monitoring Location/Group	Responsible Agency	Budget
	Dengue fever is considered endemic in Thailand. It is widely and rapidly spreading, especially in the event of project construction. It can be spread and transmitted from human to human by mosquitoes as a disease carrier. As a result, workers are worried about its outbreak.	Residents within a 500- meter radius of the construction sites.	 Collection the record of the community's COVID-19 cases from the local health care facility located in the project's construction area. 	Monthly basis throughout the construction phase.	Residents within a 500-meter radius of the construction sites.	Department of Rural Roads or the employed 3rd party	Included in the overall monitoring budget.

Table 5.13-2: Health Risk Monitoring of the Project – Operation Phase

Env Components	Health Impacts	Sensitive Receptors	Monitoring Index	Frequency	Monitoring Location/Group	Responsible Agency	Budget
1. Air Quality	Impact on Physical Health Air pollutants such as dust, particulate matter, carbon monoxide (CO), and nitrogen dioxide (NO2) emitted from vehicles can directly affect	Residents in the vicinity – 500 m radius of the bridge	 Following the air quality monitoring in the environmental monitoring program Number of compliant made regarding the 	Twice /year for 3 consecutive days during dry season (April) and rainy season (November) in years 1, 2, 3, 5,	 Ban Laem Community - Road reservation Laem Chong Thanon Temple Wat Ao Bua 	Department of Rural Roads or the employed 3rd party	Included in the environmental monitoring budget

Env Components	Health Impacts	Sensitive Receptors	Monitoring Index	Frequency	Monitoring Location/Group	Responsible Agency	Budget
	human health. When the human body inhales a significant amount of pollutants, it can result in the inability of red blood cells to efficiently transport oxygen from the lungs to the body, impacting normal bodily functions. Impact on Mental Health		impact of air pollution from the road traffic	10, 12 and 15	School Ban Rai Health Promoting Hospital		
	Air pollutants, such as dust, particulate matter, carbon monoxide (CO), and nitrogen dioxide (NO2) emitted from vehicles, can also lead to disturbances in daily life and cause feelings of anxiety, stress, psychological distress, or irritation.						
2. Noise	Impact on physical health: Prolonged exposure to continuous loud noise can lead to a decrease in hearing ability.	Residents in the vicinity – 500 m radius of the construction location	 Following the noise monitoring in the environmental monitoring program Number of compliant made regarding the impact of noise 	Twice /year for 3 consecutive days during dry season (April) and rainy season (November) in years 1, 2, 3, 5, 10, 12 and 15	 Ban Laem Community - Road reservation Laem Chong Thanon Temple 	Department of Rural Roads or the employed 3rd party	Included in the environmental monitoring budget

Env Components	Health Impacts	Sensitive Receptors	Monitoring Index	Frequency	Monitoring Location/Group	Responsible Agency	Budget
	Impact on mental health: It can cause annoyance and irritability for individuals exposed to disturbing noises.		from the road traffic		 Wat Ao Bua School Ban Rai Health Promoting Hospital 		
3. Vibration	Impact on physical health. None Impact on mental health. Vibrations caused by large trucks can lead to annoyance and have an impact on mental well-being.	Residents within a 500-meter radius of the construction sites.	 Following the vibration monitoring in the environmental monitoring program Number of compliant made regarding the impact of the vibration from the road traffic 	Twice /year for 3 consecutive days during dry season (April) and rainy season (November) in years 1, 2, 3, 5, 10, 12 and 15	 Ban Laem Community - Road reservation Laem Chong Thanon Temple Wat Ao Bua School Ban Rai Health Promoting Hospital 	Department of Rural Roads or the employed 3rd party	Included in the environmental monitoring budget
4. Traffic accident	Impact on physical health: There may be injuries, fatalities, and property loss in the event of accidents, which can pose risks to physical health.	Residents within a 500-meter radius of the construction sites.	 Statistics of accidents from construction or operation Accident statistics from the local traffic Road damage case 	2 times/year in years 1, 2, 3, 5, 10, 12 and 15	along the project route	Department of Rural Roads or the employed 3rd party	Included in the environmental monitoring budget

Env Components	Health Impacts	Sensitive Receptors	Monitoring Index	Frequency	Monitoring Location/Group	Responsible Agency	Budget
	Impact on mental health: Anxiety and stress can arise from experiencing loss of life and property in the event of accidents.						

6. **REPORTING**

6.1. Contractor Report

The selected Contractor shall check the implementation of environmental mitigation measures on a weekly basis and shall report the weekly checks on the implementation of environmental mitigation measures to the PISC on monthly basis. The Monthly Progress Report shall include reference to all environmental and social mitigation activities carried out by the Contractor with any complaints made in the relevant month The monthly report shall contain the checklists and a summary of the mitigation measures implementation and contractor monitoring program, if any, as well as minutes of consultation with communities and Project Affected People, any complaints received during the relevant period, reference to complaints resolution; or complaints referred into the Grievance Redress Mechanism (GRM), ensuring respect to confidentiality for gender and other discrimination- based complaints. All the information above will be in compliance with the endorsed ESIA, SLIP, ESMP and Environmental License requirements, if any. These will be used as bases in the preparation of Compliance Monitoring Reports.

6.2. Construction Supervision Consultant (CSC) Report

The Project Construction Supervision Consultant (CSC) shall assist the PMU, PIU and check/investigate the implementation of environmental and social mitigation measures by the Contractor on a weekly basis. Subsequently, the CSC shall report their investigation result of environmental and social mitigation measures implementation (done by Contractor) to the PMU, PIU on a monthly basis.

The CSC's Monthly Progress Report to PMU, PIU shall contain a summary of the implementation of environmental and social mitigation measures for Koh Lanta Bridge Project as well off-site installations (if any).

6.3. PMU Report

The PMU, with support from 3rd Party Environmental and Social Monitoring firm, will submit to the World Bank progress of the implementation of the Project environmental and social mitigation measures and monitoring plan as required by the Project ESMP, LMP, SEP and other document in the Supplemental Lender Information Package (SLIP) every six months. These reports will incorporate the main items raised in Contractor's monthly reports and the CSC monthly report, as well as all other items required by DRR and the World Bank.

PMU will submit to the Office of Natural Resources and Planning (ONEP) a report on the implementation of Environmental Impact Assessment (EIA) Mitigation Measures and Monitoring Plan on annually basis.

All reports mentioned above will contain sufficient detail on (i) internal monitoring and inspections; (ii) incidents, accidents and emergency reporting; (iii) performance in the implementation of mitigation measures; (iv) training given and received by the supervision staff and workers; and (v) any complaints made in the relevant month and reference to complaints resolution; or complaints referred to the Grievance Redress Mechanism (GRM), ensuring respect to confidentiality for gender and other discrimination- based complaints. **Table 6.3-1** presents the types of Contractor and CSC reports that required to be submitted.

Table6.3-1 Reporting Requirement and Schedule

Responsiblity	Report	Reporting Objective	Frequency of Submission	Submit to
Contractor: Health, Safety & Environmental Manager supported by Environmental and Safety Officer	Daily Environmental & Social Compliance Checklist	Checklist of environmental and social compliance during construction.	Weekly	CSC
	Accidents and Incidents Report	Notification of accident or incident events.	Within 24 hours of the accident/ incident	CSC, PIU PMU
	Non-Compliance Report	Detail the cause, nature, and effect of any environmental and social non- compliant act performed (including gender- based violence noncompliant acts)	Within one week of the event	CSC
	Monthly Compliance Report	The detailed account of mitigation measures implemented during the month reported to the CSC (including those aimed at dealing with gender-based violence noncompliant acts).	Report on compliance and non-compliance measures on a monthly basis	CSC
		Checklist of environmental and social compliance during construction.		

Responsiblity	Report	Reporting Objective	Frequency of Submission	Submit to
CSC: assigned Environmental Engineer/Specialist	Weekly Compliance Checklist	Checklist of environmental and social compliance during construction.	Weekly	Internal
	Monthly Compliance Report	Monthly report of compliance within 10 days from receiving the report from the Contractor.	Monthly	PMU PIU
	ESMP updates, including any changes	For approval prior to implementation.	As required, prior to implementation	PMU PIU
	Key changes in the project activities that may trigger conditons in the Environmental licenase.	Ensure compliance with the ESMP updates.	As required, prior to implementation	PMU PIU

7. Cost Estimate

The cost of environmental and social management and mitigation measures has been included in the contract to ensure that the mitigation and monitoring requirements are correctly implemented and funded.

In the construction phase, the mitigation measures' costs will be included in the construction contract and be covered by the Contractor. The Contract requires the Contractor to take all necessary measures and precautions to ensure that the execution of the works and all associated operations are carried out in conformity with statutory and regulatory environmental and social requirements of Thailand and the World Bank policies.

The Contractor must refer to the Environmental and Social Management Plan (ESMP) which is included in the Contract Bidding Document and shall comply with the Contract Specifications of which involve the Environmental Safeguard. The DRR reserves the right to withhold payments and/or stop construction in the event of serious or repeated violations of the conditions stipulated in the Environmental and Social Management Plan and Contract Specifications.

The Environmental and Social Management Plan (ESMP) forms part of the Contract and shall be considered alongside the specifications. Therefore, the descriptions in the ESMP are mandatory in nature and also contractually binding. The ESMP will also equally apply to sub- contractors including nominated sub-contractors (if any).

The main Contractor will responsible for the compliance with the requirements of the ESMP and for compliance by sub-contractors, including nominated sub-contractors. The mitigation measures implemented during the construction phase is, therefore, the responsibility of the Contractor. The PMU will monitor the implementation of all the mitigationmeasures.

The descriptions and clauses detailed in the ESMP are an integral component of the specifications for relevant items of work unless separate items are included in the Bill of Quantities. Thus, separate payments will be not be made in respect of compliance with the ESMP.

In case the Contractor or its sub-contractor fails to implement the ESMP, recommendations after informing in writing, the CSC will take whatever actions it is deemed necessary to ensure that the ESMP is properly implemented and/or to rectify the damages caused by such negligence. However, any cost thus incurred will be recovered from the Contractor's payments.

The costs for training involved preparation of training material and imparting of training are covered in the PMU costs. Furthermore, the costs for training proposed to include the costs incurred towards the site visits, travel to the training program by the participants, printing of training materials and other logistic arrangements.

The Environmental and Social Consultants will be financed through the PISC fee paid for by the loan, the first three yearssalary of the ESC will be also financed out of the loan, after which time the DRR – PMU will cover the cost of the salary as with other full-timestaff.

The budget estimate for the environmental and social management costs for the Project is presented in **Table 7-1.**

Table 7-1 Summary of Estimated Cost for ESMP Implementation

No	Ref No	Description	No of Unit	Unit	Unit rate (THB)	Subtotal (THB)	Cost Assingment
1	ITEM 1.7(1)	Occupational Health and Safety				1,720,000.00	contractor
1.1		Safety equipment, sign, banner, board, security				1,720,000.00	
		guard, safety campaign, first aid kits, safety campain,					
		vehicle, substance abuse examination, etc.					
1.2		Contractor health surviellance program				-	included in the overall
							budget
1.3		Communicable disease/COVID-19 prevention				-	included in the overall
2		Deed Maintenance and Traffic Immed Mitigation				2 700 000 00	budget
2	11 EIVI 1.5(1)	(Additional)				2,700,000.00	contractor
2.1		Road diversion, temporary access, road surface	4,000.00	sq.m.	500.00	2,000,000.00	
		maintenance.		-			
2.3		traffic sign and electricity cost	1.00	set	700,000.00	700,000.00	
-							
3		Environmental Mitigation Costs				17,790,983.00	
3.1		Water Quality Mitigation for Construction Office and				2,845,749.00	contractor
		worker Camp					
3.1.1		Installation of Septic Tank				719,249.00	
3.1.2		Toilet - 10 cu.m.	1.00	tank	228,333.00	228,333.00	
3.1.3		Canteen - 10 cu.m.	2.00	tank	228,333.00	456,666.00	
3.1.4		maintenance shop - 1.5 cu.m.	1.00	unit	34,250.00	34,250.00	
3.1.5		Installation of grease trap	1.00	unit		66,500.00	
3.1.6		canteen - 0.5 cu.m.	4.00	unit	13,300.00	53,200.00	
3.1.7		maintenance shop - 0.5 cu.m.	1.00	unit	13,300.00	13,300.00	
3.1.8		Concrete pavement				700,000.00	
3.1.9		fuel storage tank - 140 sq.m.	1.00	unit	100,000.00	100,000.00	
3.1.10		equipment maintenance yard - 140 sp.m.	1.00	unit	100,000.00	100,000.00	
3.1.11		car wash area - 240 sq.m.	1.00	unit	500,000.00	500,000.00	
3.1.12		Install mobile toilet - 4 unit/set and 2 set every 200 m	2.00	set	100,000.00	200,000.00	
3.1.13		Waste management	1.00	unit		60,000.00	
3.1.14		waste seggreation bin - 240 liter for 4 set	4.00	set	15,000.00	60,000.00	
3.1.15		Wastewater management from concrete plant				1,100,000.00	

No	Ref No	Description	No of Unit	Unit	Unit rate (THB)	Subtotal (THB)	Cost Assingment
3.1.16		sedimenation pond 4x4x1.5 m	1.00	unit	300,000.00	300,000.00	
3.1.17		chemical treatment pond 4x4x1.5 m	1.00	unit	300,000.00	300,000.00	
3.1.18		retention pond 5x6x1.5 m	1.00		500,000.00	500,000.00	
3.2		Surface Water Quality Mitigation - Implementation				605,000.00	contractor
3.2.1		mobile toilet for tourist	1.00	set	500,000.00	500,000.00	
3.2.2		Waste bins with net cover - provent monkey scavenging	1.00	set	25,000.00	25,000.00	
3.2.3		waste seggregation sign	1.00	piece	30,000.00	30,000.00	
3.2.4		environmental campaign sign	1.00	piece	50,000.00	50,000.00	
3.3		Seawater Quality Mitigation - Construction				300,000.00	contractor
3.3.1		Installation of temporary silt fence - Koh Klang side	30.00	sq.m.	5,000.00	150,000.00	
3.3.2		Installation of temporary silt fence - Koh Klang side	30.00	sq.m.	5,000.00	150,000.00	
3.4		Installation of Silt Certain around the pile construction area				3,346,450.00	contractor
3.4.1		Around the temporary jetty -1	165.50	m.	2,700.00	446,850.00	
3.4.2		Around the temporary jetty -2	198.00	m.	2,700.00	534,600.00	
3.4.3		Around the brige pile construction area				-	
3.4.4		F1 type 1 (P16,17) about 7 meter depth	107.50	m.	5,200.00	559,000.00	
3.4.5		F2 type 2 (P18) about 4 meter depth	100.00	m.	3,750.00	375,000.00	
3.4.6		F3 type 3 (P19-32) about 4 meter depth	381.60	m.	3,750.00	1,431,000.00	
3.5		Noise Mitigation Measures - Construction				1,517,925.00	contractor
3.5.1		Noise Barrier - Ban Hua Hin	300.00	sq.m.	2,735.00	820,500.00	
3.5.2		Noise Barrier - Thung Toh Yum	255.00	sq.m.	2,735.00	697,425.00	
3.6		Noise Mitigation Measures - Operation				1,236,070.00	contractor
3.6.1		Noise Barrier - Thung Toh Yum	170.00	sq.m.	7,271.00	1,236,070.00	
3.7		Mangrove Replantation and Maintenance				698,640.00	DRR Saving/Fiscal budget balance - support DMCR
3.7.1		Mangrove replantation - 24 rai	1.00	unit	157,920.00	157,920.00	
3.7.2		Replanting and forest area improvement	1.00	unit	88,080.00	88,080.00	
3.7.3		Mangrove tree seeding production	1.00	unit	68,640.00	68,640.00	

No	Ref No	Description	No of Unit	Unit	Unit rate (THB)	Subtotal (THB)	Cost Assingment
3.7.4		Mangrove maintenance (age 2-6 years old)	1.00	unit (4 years)	142,800.00	142,800.00	
3.7.5		Replanting and forest area improvement	1.00	unit (4	82.800.00	82.800.00	
				years)	,	,	
3.7.6		Maintenance for the tree seeding production	1.00	unit (4	98,400.00	98,400.00	
				years)			
3.7.7		Reporting	1.00	Unit (5	60,000.00	60,000.00	
				years)			
3.8		Forest Replantation (National Reserved Forest)				274,624.00	DRR Saving/Fiscal budget balance - support RFD
3.8.1		Forest Replantation 12 rai (1-3 years)	1.00	unit	48,240.00	48,240.00	
3.8.2		Fire barrier (1-3 years)	1.00	unit	38,304.00	38,304.00	
3.8.3		Maintenance of the forest (2-6 year)	1.00	unit	63,600.00	63,600.00	
3.8.4		Maintenance of the forest (7-10 year)	1.00	unit	24,480.00	24,480.00	
3.8.5		Reporting	1.00	unit	100,000.00	100,000.00	
3.9		Land and Water Transport Safety Measures				3,400,000.00	contractor
3.9.1		Installation of temporary moring pile - 20@	1.00	unit	50,000.00	50,000.00	
3.9.2		Construction of fence for temporary jetty	1.00	unit	1,000,000.00	1,000,000.00	
3.9.3		Installation of flashing bouys along the navigation channel and maintenance	1.00	unit	150,000.00	150,000.00	
3.9.4		Construction of concrete safety barrier - 1000 meter and mobilization cost	1,000.00	unit	2,200.00	2,200,000.00	
3.10		Dolphin Monitoring - Construction				115,000.00 THB/Year	contractor
3.10.1		fuel cost for survey boat	10.00	trip/year	4,000.00	40,000.00	
3.10.2		Allowance for 3 crews	10.00	trip/year	1,500.00	15,000.00	
3.10.3		Equipment and operating cost	10.00	trip/year	4,000.00	40,000.00	
3.10.4		Survey equipment cost	1.00	unit	20,000.00	20,000.00	

No	Ref No	Description	No of Unit	Unit	Unit rate (THB)	Subtotal (THB)	Cost Assingment
3.11		Dolphin Monitoring - Operation				95,000.00 THB/Year	DRR
3.11.1		fuel cost for survey boat	10.00	trip/year	4,000.00	40,000.00	
3.11.2		Allowance for 3 crews	10.00	trip/year	1,500.00	15,000.00	
3.11.3		Equipment and operating cost	10.00	trip/year	4,000.00	40,000.00	
3.12		Activities under Project Stakeholder Engagement Plan				1,006,525.00	contractor
3.12.1		Pre-construction information dissemination: - Pamphlet, website, and other media	-	Unit	-	82,000.00	
3.12.2		 Project Information Board 	-	Unit	-	40,000.00	
3.12.3		 Grievance Box and information Board at PIU and local provincial office 	3.00	unit	10,000.00	30,000.00	
3.12.4		Construction stage information dissemination: - Pamphlet, website, and other media	-	Unit	-	352,000	
3.12.5		End construction stage information dissemination and household survey: - Pamphlet, website, and other media	-	Unit	-	107,000	
3.12.6		Public consultations: pre-construction, construction and after construction	3.00	meeting	130,175.00	390,525.00	
3.12.7		Joint meetings with other government agencies, small group meetings/focus groups, individual meetings	5.00	meeting	5,000.00	25,000.00	
3.12.8		Public consultation - preconstruction/construction	2.00	meeting	52,000.00	104,000.00	
3.12.9		Public consultation - operation	1.00	meeting	77,000.00	77,000.00	
4		Environmental Monitoring - Construction				5,367,000	DRR to set up the budget to directly hire the licensed third-party consultant.
4.1		Surface water quality	3.00	year	40,000.00	120,000.00	
4.1		Seawater quality	3.00	year	72,000.00	216,000.00	
4.1		Air quality	3.00	year	500,000.00	1,500,000.00	
4.1		Noise	3.00	year	24,000.00	72,000.00	
4.1		vibration	3.00	year	144,000.00	432,000.00	
4.1		Aquatic ecology	3.00	year	234,000.00	702,000.00	

No	Ref No	Description	No of Unit	Unit	Unit rate (THB)	Subtotal (THB)	Cost Assingment
4.1		Flora	3.00	year	10,000.00	30,000.00	
4.1		Fanua	3.00	year	300,000.00	900,000.00	
4.1		Rear species	3.00	year	115,000.00	345,000.00	
4.1		Transportation and safety	3.00	year	60,000.00	180,000.00	
4.1		Drainage and flood protection	3.00	year	40,000.00	120,000.00	
4.1		Socio-economic	3.00	year	250,000.00	750,000.00	
4.1		Public Health	3.00	year	-	-	
5		Environmental Monitoring - operation				4,879,000.00	DRR to set up the budget to directly hire the licensed third-party consultant.
5.1		Surface water quality	7	year		-	
5.1		Seawater quality	7	year		-	
5.1		Air quality	7	year		-	
5.1		Noise	7	year	24,000.00	168,000.00	
5.1		vibration	7	year		-	
5.1		Aquatic ecology	7	year		-	
5.1		Flora	7	year	10,000.00	70,000.00	
5.1		Fanua	7	year	300,000.00	2,100,000.00	
5.1		Rear species	7	year	95,000.00	665,000.00	
5.1		Transportation and safety	7	year	300,000.00	210,000.00	
5.1		Drainage and flood protection	7	year			
5.1		Socio-economic	7	year	250,000.00	1,750,000.00	
5.1		Public Health	7	year		-	
6		Contractor Self-Monitoring Program					contractor
6.10		Contractor-self monitorig program - estimated	1.00	unit	1,000,000.00	1,000,000.00	
					Total	33,119,983	
					Only Contractor	23,421,719	

8. ESMP Integration to Bid Document

This ESMP will be included as part of the bid document. The Bidder shall prepare and submit with its Technical proposal its ESHS Management Strategies and Implementation Plans (MSIP) to implement the ESMP and EIA for the Project and the Bank's ESF including the mitigation measures of all risks identified in such Reports. The key environmental risks that the Bidder shall address and detail the mitigation measures in its MSIP-C, include, among other risks and requirements set forth in the ESMP, the following:

- (a) Fresh water quality management plan;
- (b) Marine water quality management plan including: Construction and piling method of temporary jetties and temporary platform using barge to minimize silt plumes; Method statement showing how to install, maintain and monitor silt plumes curtains;
- (c) Dolphin monitoring and protection plan: underwater noise management, dolphin observation, work stoppage when dolphins present, etc.);
- (d) Air quality management plan;
- (e) Noise and vibration management plan;
- (f) Waste management plan;
- (g) Traffic management plan;
- (h) Occupational Health and Safety and Emergency Response Plan;
- (i) Site Rehabilitation Plan for construction office, worker camp and cement mixing plant;
- (j) Worker Accommodation Management Plan

Similarly, the social risks that the Bidder shall address and detail the mitigation measures in its MSIP-C, include, among other risks and requirements set forth in the ESMP, the following:

- (a) A system how to manage, control and solve the problem of workers in the worker's camp with outside community.
- (b) A solution how to organize the work plan allowing fishermen crossing the construction zone during construction.
- (c) Labor management procedures: how SEA/SH will be reported and monitored.
- (d) Training of Personnel and subcontractors on SEA/SH and social sustainability

The ESMP will serve as a guidance document. The Contractor's MSIPs will collectively form the Contractor-ESMP which shall be approved by the PMU prior to its implementation at the project site by the contractor.

9. Review of the ESMP

The Contractor will be responsible for the civil works and fully respond to all contract conditions including those covering environmental mitigation, social disruption and awareness, and monitoring. The Contractor will therefore responsible for implementing all Health, Safety, Environmental and Social actions included in the ESMP and relevant clauses in the bidding documents and contract during the preconstruction and construction period. The PMU/PIU will supervise and advise the Contractor in this regard through the CSC.

The selected Contractor will prepare the Construction's ESMP (CESMP) during the pre- construction phase, based on the site-specific construction methodologies proposed to use and following requirements in this ESMP and C-MISP. The PMU and PIU with support from CSC will review and approve the CESMP before the commencement of construction.

In the event that mitigation measures are insufficient to control impact to acceptable levels, the CESMP will be updated and amended to ensure that there is acceptable control of environmental impacts. The ESMP may be updated, as needed, with clearance from the World Bank.

ANNEX 1 CHANCE FIND PROCEDURES

(Lanta Bridge Project)

A. Brief Description of Cultural Heritage Sites in the Project

According to the geographical database of the Fine Arts Department, reveals that there are 72 historical sites in Krabi Province. This information is referenced in the Royal Thai Gazette No.135, special section 165 D, dated 12 July 2018.

The project submitted a letter requesting a review of archaeological and historical sites, which was undertaken by the 12th Regional Office of Fine Arts in Nakhon Si Thammarat. The review, referred to in letter 0422/14 dated 5 January 2021, encompassed a 1 km radius around the project area. The findings of the review indicated that no archaeological or historical sites were present within this 1 km radius of the project study area.

B. Policy Framework

a. Definition of Cultural Heritage in Thai context

The Cultural Heritage Promotion and Preservation Act B.E. 2559 defines the meaning of 'cultural heritage' as follows:

'Cultural heritage' refers to knowledge, expressions, behaviors, or cultural skills that are manifested through individuals, tools, or objects that individuals, groups, or communities collectively acknowledge, feel ownership of, and inherit from one generation to another. It may undergo changes to adapt to their environmental conditions. In this context, 'community' refers to a group or multiple groups of people who possess knowledge, engage in behaviors, pass down, or participate in that cultural heritage."

However, in terms of antiquity" or "ancient artifacts' in accordance with the Archaeological Sites, Antiques, Fine Arts, and National Museums Act B.E.2504 (1961) refers to ancient objects or sites that are of historical, artistic, scientific, or archaeological value, regardless of whether they are human-made structures, natural sites, gardens, human remains, or animal remains. It encompasses their age, physical characteristics, or historical significance as evidence of human civilization, cultural history, archaeological science, or traditional customs.

b. Government Agency in Charge

The Fine Arts Department is a government agency responsible for creating, preserving, conserving, promoting, and disseminating the art, archaeology, and culture of the nation. It covers various fields such as fine arts, museums, antiquities, literature, history,

traditional customs, rituals, the National Library, the National Archives, as well as dance, music, theater, architecture, and craftsmanship, to ensure their enduring presence.

C. National Policy and Regulations on Cultural Heritage

The Archaeological Sites, Antiques, Art Objects, and National Museums Act of 2504 B.E. (1961), after being amended and supplemented, consists of a total of 60 articles. It comprises 40 original articles and an additional 20 articles. These articles are divided into nine sections as the following:

- The first section, consisting of Articles 1 to 6, is the preliminary provisions of the law.
- The second section, comprising Articles 7 to 13, is Section 1: Archeological Sites.
- The third section, containing Articles 14 to 24, is Section 2: Antiques and Art Objects.
- The fourth section, encompassing Articles 25 to 27, is Section 3: National Museums.
- The fifth section, consisting of Articles 28 to 30, is Section 4: Archaeological Funds.
- The sixth section, from Article 30 to the end, is Section 4: Temporary Use and Revocation of Licenses.
- The seventh section, comprising Articles 31 to 39, is Section 5: Penalties.
- The eighth section, Article 40, is a specific provision.
- The ninth section is the schedule of fees (at the end of the Royal Decree).

Key provisions of the law include the important provisions regarding archeological sites and antiquities that are valued to be studied. These provisions consist of Article 4, which defines the terms "archeological sites," "antiquities," and "art objects." Article 7 addresses the registration of archeological sites, while Article 7(2) prohibits the construction of buildings within archeological site's areas without permission by the Fine Art Department. Article 10 prohibits unauthorized repairs or excavations of archeological sites, and Article 14 addresses the registration of antiquities or art objects. Finally, Article 15 prohibits unauthorized alterations to antiquities or art objects.

In this context, "archeological sites" refer to immovable property that, due to its age or characteristics, serves as evidence of its historical significance in terms of art, history, or archaeology, this includes places that are archaeological sites, historical sites, and historical parks. "Antiquities" refer to ancient property, whether it be artifacts or naturally occurring objects or any part thereof, whether it be human remains, animal remains, or parts thereof, which are of value in terms of art, history, or archaeology based on their age, characteristics, or historical significance. "Art objects" refer to objects made with intricate craftsmanship and high artistic value.

The relevant regulatory requirements in pertaining to Chance Find Procedure, include but not limited to the following:

Article 10: Prohibited to repair, modify, change, demolish, add to, deface, move, or excavate an archeological site or any part thereof, or to construct buildings within the area of an archeological sites, unless authorized by the Director-General or granted written permission

by the Director-General. If such permission is granted, it must be subject to any specified conditions, which must be adhered to.

Article 18: Ancient artifacts and art objects that are the property of the land cannot be transferred unless authorized by the Director-General, except when granted by the authority of the law. However, if similar ancient artifacts and art objects exist in excess of the required amount, the Director-General may permit their transfer through sale or exchange for the benefit of the National Museum or as a reward or compensation for the excavator, as specified in the regulations announced by the Director-General in the Royal Gazette."

Article 31: Whoever possesses, conceals, buries, or discards ancient artifacts or art objects through actions that cannot be claimed by anyone as ownership, and appropriates or claims those ancient artifacts or art objects as their own or someone else's property, shall be liable to imprisonment for a term not exceeding seven years, or a fine not exceeding seven hundred thousand baht, or both imprisonment and fine.

In addition, there are additional regulations outlined in Announcement No. 189 of the Revolutionary Council that impose further requirements for excavating archaeological sites, handling antiques, and dealing with art objects. These regulations include:

Section 1: It is prohibited for anyone to excavate or search for ancient artifacts or art objects within the designated area as defined in the Archaeological Sites, Antiques, Art Objects, and National Museums Act of 1961, unless authorized by the Director-General of the Fine Arts Department or a person delegated by the Director-General. Anyone who violates this provision shall be subject to imprisonment for not exceeding one year, or a fine not exceeding two thousand baht, or both imprisonment and fine.

Section 2: It is prohibited for anyone to sell, transfer, or move ancient artifacts or art objects obtained from excavations within the designated area as specified in Section 1, unless authorized by written permission from the Director-General of the Fine Arts Department or a person delegated by the Director-General. Once the Director-General of the Fine Arts Department grants permission for the sale, transfer, or movement of such artifacts or objects, they are exempted from control according to the announcement of this Revolutionary Council. Anyone who violates this provision shall be subject to imprisonment for not exceeding one year, or a fine not exceeding two thousand baht, or both imprisonment and fine."

Section 3: Those who possess, on the day of the announcement of this Revolutionary Council, ancient artifacts or art objects obtained from excavations within the designated area as stated in Section 1 shall report the quantity, descriptions, and storage locations of such artifacts or objects to the Director-General of the Fine Arts Department for collection within thirty days from the date of this Revolutionary Council's announcement. This provision applies to the owners in Bangkok Metropolitan area or the district chief in other provinces. Those who comply with this reporting requirement shall be exempted from penalties as stipulated in the Ancient Monuments Act, Antiquities Act, National Museum Act of 1961, Section 31, and the Criminal Code, Sections 355 and 357, for offenses committed prior to the reporting.

Section 4: When the Director-General of the Fine Arts Department deems that any ancient artifacts or art objects, as specified in Section 3, have artistic, historical, or archaeological value worthy of preservation as national heritage, the Director-General may issue a written order for the owners to deliver such artifacts or objects to the Fine Arts Department at the designated location within the specified time. In this case, the provisions of Section 24 of the Ancient Monuments Act, Antiquities Act, National Museum Act of 1961 shall not apply. If anyone fails to deliver the ancient artifacts or art objects according to the order of the Director-General of the Fine Arts Department, they shall be subject to imprisonment for not exceeding six months, or a fine not exceeding one thousand baht, or both imprisonment and fine.

Section 5: The Director-General of the Fine Arts Department or the authorized officials delegated by the Director-General have the authority to conduct inspections at suspected locations that may contain ancient artifacts or art objects, without prior notification of the quantity, descriptions, and storage locations as specified in Section 3 or without delivery as ordered by the Director-General of the Fine Arts Department as specified in Section 4. They also have the authority to seize or impound such ancient artifacts or art objects. Anyone who obstructs the Director-General of the Fine Arts Department or the authorized officials delegated by the Director-General from carrying out their duties as specified in Section 4 shall be subject to imprisonment for not exceeding one month, or a fine not exceeding five hundred baht, or both imprisonment and fine.

D. Chance Find Procedures for Lanta Bridge Project

a. Notification

If any ancient sites, antiques, or art artifacts are discovered during the excavation of piers in the water, all construction operations must immediately cease. The Fine Arts Office No. 12 in Nakhon Si Thammarat should be promptly notified by calling their contact number 075-356458. Alternatively, the police in the area, such as the Ko Lanta Provincial Police Station, can be informed by calling their contact number 075-668192, to come and inspect the findings. The person who discovers or collects the artifacts will be eligible to win no more than one-third of the property's value, according to government regulations and the Fine Arts Office No. 12 will then continue to explore the archaeology through an archaeological Survey. The project's activities could not be proceeded until the archaeological survey is completed.

Pre-Construction and Construction Phases

During the pre-construction and construction phase, in the event of chance find, the following notification steps must be followed:

1. If any archaeological evidence is encountered during the construction phase, the contractor is required to inform the Department of Rural Road, the Underwater

Archaeological Survey Unit 12 and the local police department for further necessary assessment.

2. In the event of discovering any ancient artifacts such as pottery, metal parts, or ship remnants during the pre-construction and construction of the bridge, all construction activities must be stopped. The contractor shall promptly notify the Department of Rural Road, the Underwater Archaeological Survey Unit 12 and the local police department for inspection, and a detailed map indicating the location of the chance find should be submitted.

2. If any underwater archaeology is uncovered, the contractor shall notify the Department of Rural Roads, the Underwater Archaeological Survey Unit 12 to allow for exploration and continuation of the project.

Operation Phase (Bridge Maintenance)

During the operation of the bridge, maintenance activities will cover the initial road section connected to the bridge, its right of way, and the bridge itself. In the event of a chance find, the following notification steps must be followed:

- 1. If any archaeological evidence is encountered during the operation phase, the Rural Roads Department is required to inform the Underwater Archaeological Survey Unit 12 for further necessary assessment.
- 2. If any traces of antiquities such as pottery, metal parts, ancient ship parts, etc., are discovered during the maintenance of the bridge, all maintenance and related activities must be halted immediately. The maintenance contractor shall notify the Department of Rural Road, the Underwater Archaeological Survey Unit 12 and local police department for inspection, and a detailed map indicating the chance find location should be also submitted.
- 3. If any underwater archaeological findings are discovered, the maintenance contractor shall notify the Department of Rural Roads, the Underwater Archaeological Survey Unit 12 and the local police department to facilitate the exploration and assessment process until it is completed prior to resuming the project's activities.

The procedure for the Notification Steps of Chance Find of Lanta Bridge Project is illustrated in Figure 1 below:



Figure 1: Notification Steps of the Chance Find Procedure of Lanta Bridge Project

b. Fencing-Off/Disturbance Avoidance Procedures

When a chance find is discovered, the immediate area will be secured to prevent unauthorized access and potential damage to the artifacts or site. Fencing may be used to enclose the discovery area and prevent accidental or intentional disturbance allowing only authorized personnel such as archaeologists, researchers, or relevant authorities to enter the area. This helps ensure proper investigation, documentation, and protection of the discovered cultural heritage.

c. Assessment of Found Objects or Sites

The Fine Art Department and the Underwater Archaeological Survey Unit are responsible for assessing the discovered objects or sites in the Lanta Bridge Project. According to Thai

regulations, the assessment of these objects and items should be completed within an unspecified timeframe before proceeding with other project activities.

d. Other Actions Consistent with National Laws and ESS2

As confirmed by the Fine Art Department, there are no significant archaeological sites or items within a 1 km radius of the project site. Therefore, there are no further actions required to comply with relevant national laws and ESS2 requirements.

e. Training of project personnel and project workers

The Chance Find Procedure will be included in the orientation program for the construction employees and workers, provided by the construction contractor or the assigned third party to ensure their awareness and understanding of the relevant regulatory requirements, as well as the procedures and steps to follow in the event of discovering any archaeological sites or items at the project site.