Ministry of Fisheries and Aquatic Resource, Sri Lankan Government.

Asian Development Bank (ADB).

Environmental Impact Assessment Report

January 2020

Main Report

Northern Province Sustainable Fisheries Development Project- Point Pedro Fisheries Harbor Development Project

Submitted to:

Coast Conservation and Costal Resources Management Department, 4th Floor, New Secretariat Building, Maligawatte, Colombo.

Prepared by:

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CURRENCY EQUIVALENTS
(AS OF 01 March 2017)

Currency Unit		Sri Lanka Rupee
1 US$	=	157.88 LKR
0.0063 US$	=	1 LKR

ABBREVIATIONS

ADB	Asian Development Bank
AIA	Archaeological Impact Assessment
CBO	Community Based Organizations
CCA	Coastal Conservation Act
CCCRMD	Coastal Conservation and Coastal Resources Management Department
CCS	Climate Change Secretariat
CCRF	Code of Conduct for Responsible Fisheries
CEA	Central Environmental Authority
CECB	Central Engineering Consultancy Bureau
CEMP	Contractor Environmental Management Plan
DoA	Department of Archaeology
DC	Development Consent
DDT	Detail Design Team
DFAR	Department of Fisheries and Aquatic Resources
DMC	Disaster Management Center
DS	District Secretariat
DSC	Design & Supervision Consultant
DWC	Department of Wildlife Conservation
EA	Executing Agency
EEZ	Exclusive Economic Zone
EHSG	Environmental. Health and Safety Guidelines – World Bank
EICC	East Indian Coastal Current
EMP	Environmental Management Plan
EMMP	Environmental Management and Monitoring Plan
EnA	Environmental Assessment
EPL	Environmental Protection Licensing
FD	Forest Department
FMA	Fisheries Management Areas
GoSL	Government of Sri Lanka
GRM	Grievance Redress Mechanism
GSMB	Geological Survey and Mines Bureau
ha	hectares
IA	Implementing Agency
IEE	Initial Environmental Examination
IES	International Environment Specialist
IMUL	Inboard Multiday Boats
INDC	Intended Nationally Determined Contributions
NPISEA	Northern Province Integrated Strategic Environmental Assessment
IUU	Illegal, Unreported and Unregulated
LST	Long shore Sediment Transport
M	Meters
MDM	Ministry of Disaster Management

MEPA	Marine Environment Protection Authority
MFAR	Ministry of Fisheries and Aquatic Resources
MHWL	Mean High Water Line
NMC	North Monsoon Current
MLWL	Mean Low Water Line
MEWL	Ministry of Environment and Wildlife
MoA	Ministry of Agriculture
MD	Ministry of Defense
MoL	Ministry of Lands
MSL	Mean Sea level (MSL).
NBSAP	National Biodiversity Strategic Action Plan
NDC	Nationally Determined Contributions
NEA	National Environmental Act
NES	National Environment Specialist
NGO	Non-Governmental Organizations
NMC	North Monsoon Current
NPC	Northern Provincial Council
NPoA	National Plan of Action
NPSFDP	Northern Province Sustainable Fisheries Development Project
NWSDB	National Water Supply and Drainage Board
PAA	Project Approving Agencies
PDA	Project Development Assistance
PIU	Project Implementation Unit
PMU	Project Management Unit
PPFHDP	Point Pedro Fisheries Harbor Development Project
PPTA	Project Preparatory Technical Assistance
PRDA	Provincial Road Development Authority
DRD-NP	Department of Road Development -Northern Province
PS	Pradeshiya Sabha
RDA	Road Development Authority
REA	Rapid Environmental Assessment
SC	Supervision Consultants (SC)
SD	Sri Lanka Dome
SEOs	Strategic Environmental Objectives
SAMP	Special Area Management Plans
SMA	Special Management Areas
SMC	South Monsoon Current
SPS	Safeguard Policy Statement
WICC	West Indian Coastal Current 888888

WEIGHTS AND MEASURES

Ha	-	Hectare
Kg	-	kilogram
Km	-	Kilometer
M	-	Meter

GLOSSARY

Adaptation	The process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate and its effects (IPCC, 2014).
Anchorage (fishery)	A location/development that includes Marine Structures or Dredging to provide shelter for Fiber Reinforced Plastic Boats with Outboard Engines OFRP boats and Traditional Crafts (TCs) with or without OBEs (i.e. Mechanized or Non-Mechanized)
Aquatic Resources	Living aquatic organisms include any seaweed, phytoplankton or other aquatic flora and non-living substances found in an aquatic medium (Government of Sri Lanka, 2016).
Biological diversity	Variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems. (UN, 1992b).
Climate	Climate in a narrow sense is usually defined as the average weather, or more rigorously, as the statistical description in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands or millions of years. The classical period for averaging these variables is 30 years, as defined by the World Meteorological Organization. The relevant quantities are most often surface variables, such as temperature, precipitation and wind. Climate in a wider sense is the state, including a statistical description, of the climate system. {WGI, II, III}, (IPCC, 2014).
Climate change	Change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcing, such as modulations of the solar cycles, volcanic eruptions and persistent anthropogenic changes in the composition of the atmosphere or in land use. Note that the United Nations Framework Convention on Climate Change (UNFCCC), in its Article 1, defines climate change as: 'a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods'. The UNFCCC thus makes a distinction between climate change attributable to human activities altering the atmospheric composition and climate variability attributable to natural causes. See also Detection and Attribution. {WGI, II, III}, (IPCC, 2014).
Coastal access	The right of the public, to approach, enter or use an approach to enter into, or to go along a coastal margin in a physical and visual sense and also includes access along the shoreline, usually a strip of plan parallel to the waters edge or path or trail which connects the nearest public roadway with a shoreline destination along a reasonable direct route or access to the shoreline from a public road to the Mean High Water Level (Government of Sri Lanka, 2011).
Coastal zone	The area lying within a limit of three hundred meters landwards of

	the Mean High Water line and a limit of two kilometers seawards of the Mean Low Water Line and in the case of rivers, streams, lagoons, or any other body of water connected to the sea either permanently or periodically, the landward boundary shall extend to a limit of two kilometers measured perpendicular to the straight base line drawn between the natural entrance points thereof and shall include the waters of such rivers, streams and lagoons or any other body of water so connected to the sea, and shall also include the area lying within a further extended limit of one hundred meters inland from the zero Mean Sea Level along the periphery;" (Government of Sri Lanka, 2011).
Critical habitat	A subset of both natural and modified habitat that deserves particular attention. Critical habitat includes areas with high biodiversity value, including habitat required for the survival of critically endangered or endangered species; areas having special significance for endemic or restricted-range species; sites that are critical for the survival of migratory species; areas supporting globally significant concentrations or numbers of individuals of congregatory species; areas with unique assemblages of species or that are associated with key evolutionary processes or provide key ecosystem services; and areas having biodiversity of significant social, economic, or cultural importance to local communities (ADB, 2009).
Fish	Any water dwelling aquatic or marine animal, alive or not, and includes their eggs, spawn, spat and juvenile stages, and any of their parts, and includes all organisms belonging to sedentary species (Government of Sri Lanka, 2016).
Fishery landing site	A location/development that includes only Shore Facilities to provide shelter for OFRP Boats and Traditional Crafts (TCs) with or without OBEs (i.e. Mechanized or Non-Mechanized) (UoM, 2016a).
Impacts	Effects on natural and human systems. In this report, the term impacts are used primarily to refer to the effects on natural and human systems of extreme weather and climate events and of climate change. Impacts generally refer to effects on lives, livelihoods, health, ecosystems, economies, societies, cultures, services and infrastructure due to the interaction of climate changes or hazardous climate events occurring within a specific time period and the vulnerability of an exposed society or system. Impacts are also referred to as consequences and outcomes. The impacts of climate change on geophysical systems, including floods, droughts and sea-level rise, are a subset of impacts called physical impacts (IPCC, 2014).
Physical cultural resources	Defined as movable or immovable objects, sites, structures, groups of structures, and natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance. Physical cultural resources may be located in urban or rural settings and may be above or below ground or under water. Their cultural interest may be at the local, provincial, national, or international level (ADB, 2009).
Precautionary principle	Noting also that where there is a threat of significant reduction or loss of biological diversity, lack of full scientific certainty should not be used as a reason for postponing measures to avoid or minimize such a threat (UN, 1992b).

Project Area/s	Is defined for this report as the physical area (marine, coastal and land) of the project that is directly impacted by the projects scope of works. It includes associated areas that are directly impacted, such as quarry sites.
Project Area of Influence	Is defined for this report as the physical area (marine, coastal and land) that surrounds the Project Area that maybe impacted by the projects scope of works. This as defined under Sri Lankan regulations (Sir Lankan Coast Conservation and Coastal Zone Management Act, 2011, ADB 2015 & 2016a) is limited to an area extending up to 500m periphery from the boundary of the harbor, and 02 km on either sides on coastal belt and one km toward sea from the boundary of the project site.
Resilience	The capacity of social, economic and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity and structure, while also maintaining the capacity for adaptation, learning and transformation {WGII, III}. (IPCC, 2014).
Risk	The potential for consequences where something of value is at stake and where the outcome is uncertain, recognizing the diversity of values. Risk is often represented as probability or likelihood of occurrence of hazardous events or trends multiplied by the impacts, if these events or trends occur. (IPCC, 2014).
Vulnerability	The propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements including sensitivity or susceptibility to harm and lack of capacity to cope and adapt (IPCC, 2014). The Government of Sri Lanka (GoSL, 2015) specific “Vulnerability refers to the degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change”.

NOTES

This Initial Environmental Examination (IEE/EIA) is a document of the borrower. The views expressed herein do not necessarily represent those of ADB's Board of Directors, Management, or staff, and may be preliminary in nature.

In preparing any country program or strategy, financing any project, or by making any designation of or reference to a particular territory or geographic area in this document, the association does not intend to make any judgments as to the legal or other status of any territory or area.

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EXECUTIVE SUMMARY

Background.

1. The Asian Development Bank (ADB) is assisting the Government of Sri Lanka (GoSL) to upgrade and improve the infrastructure and services required for the development of fisheries infrastructure facilities in the Northern Province under the Northern Province Sustainable Fisheries Development Project (NPSFDP). The NPSFDP Project Development Assistant (PDA) Loan has been developed from a previous due diligence Project Preparatory Technical Assistance (PPTA) completed in March 2017, which was designed to revive the fisheries sector in the four-conflict affected coastal districts of the Northern Province and included four interrelated project outputs. Eight Initial Environmental Examination (IEE) have been prepared for this project this document is the assessment for the proposed Point Pedro Harbor construction.

2. This report is the Environmental Assessment (EnA) (equivalent ADB IEE and Environmental Impact Assessment – EIA – GoSL) for the design, construction and operation of the Point Pedro development project located in Jaffa District, Northern Province. The Environmental Assessment is intended to meet the requirements of the ADB for Category B projects as described in the Safeguard Policy Statement 2009 (SPS) as well as being in general compliance with the requirements of environmental assessment under the Country Safeguard System (CSS) of the GoSL.

3. The objectives of the EnA are to: (i) describe the existing environmental conditions; (ii) identify potential environmental impacts; (iii) evaluate and determine the significance of the impacts; (iv) develop an Environmental Management Plan (EMP) detailing mitigation measures, monitoring activities, reporting requirements, institutional responsibilities to address adverse environmental impacts; and (v) carry-out public consultations to document any issues/concerns and to ensure that such concerns are addressed in the project design for the preconstruction (design), construction and operational phases of the project. The ENV is based on field inspection, including marine and terrestrial ecological surveys, discussions with key government agencies, information gathered during stakeholder consultations and data compiled from secondary sources.

4. This EnA is submitted to ADB by the borrower and the final report will be disclosed to the public by the government's executing agency and uploaded to ADB's website.

Categorization.

5. The project is classified as Category B in accordance with the ADB SPS, because the project's potential adverse environmental impacts are site-specific, few if any of them are irreversible, and mitigation measures can be designed readily to ensure potential impacts are avoided or minimized to acceptable levels. The EnA was carried out initially under the PPTA and later updated after finalizing the detailed designs from February through to May 2018 and the results of this assessment and the Environmental Management Plan (EMP) are reported herein.

Project Description and Scope

6. The purpose of this project is to develop an all-weather fisheries harbor that will directly result in improved operational services and protection for fishing and transport vessel access increasing efficiency of their operations and business, health and safety to all users and assist in the sustainable development of the economy and improve lives of the citizens in this part of the nation. The NPSFDP involves the following marine based components:

- **Breakwaters:** Two breakwater structures are to be constructed out of quarry rock. The main breakwater position along the eastern boundary of the site has a total

length of 886 m. The second smaller breakwater, located along the site's western boundary has a total length of 425 m. It is estimated that a total of 327,500 m^3 rock is required to construct the breakwaters.

- **Harbor basin:** The size of the harbor basin is 17.8 Ha. The construction of the harbor includes dredging of 1.6 ha to remove approximately 18,000 m^3 of sea bed.
- **Berthing facilities:** Three jetties are to be constructed. These jetties will be attached to the eastern breakwater. The primary jetty, has a total length of 120 m and will provide facility for 12 large fishing trade vessels. The second slightly smaller jetty has a total length of 115 m and has been designed to provide facilities for the 48 IMUL boats. And the third jetty is having length of 70m and it can accommodate 32 smaller IMUL boats.
- **Land Reclamation:** The inshore intertidal reef complex within the harbor basin will be reclaimed. The total area to be filled is approximately16 Ha. It is estimated that about 117,000 m^3 of filling material is needed to reclaim the above area. About 18,000m^3 basin dredged materials will be utilised and the balance will be brought from outside.
- **Quay wall:** Three quay walls will be constructed for use of large fishing trade vessels, medium size IMUL boats, smaller local fishing boats and OFRP. The large quay has a total wall length of 270 m based on a -5m MSL water depth to accommodate the parking capacity of 8 boats whilst the second quay wall has a total length of 324m to accommodate the medium size IMUL boats at a -3.5 m MSL water depth with a capacity to park 35 boats. The third quay wall will be constructed at -1.5m MSL water depth and having the length of 60m. It has the capacity to accommodate 24 OFRP boats. In addition to these, a 70m quay wall will be constructed to fuel supply.
- **Slip way:** A mechanical slip way (45 m x 10 m) will be constructed on the western side of the wharf and will have a slope of 1: 12 (8.3%) with the capability of handling vessels up to 75 m.

7. Land based infrastructure included;

- **Net Mending Hall:** A single story net mending hall will be constructed with a floor area of approximately 960 m^2.
- **Community Hall and Canteen:** A tow story Community Hall and Canteen building will be constructed with a total floor area of 650 m^2. The canteen will be provided facilities such as kitchen, space to accommodate 6 staff, and the seating capacity of 75 to 100. The upper floor consists of a society office and community hall with a capacity of 125 seats. Bathrooms and toilets are included in the building and will utilize a septic system.
- **Bachelor Quarters:** A single storey building with a total floor area of 450 m^2 will be constructed to accommodate 8 senior officers and 10 junior officers.
- **Harbor Manager Quarters:** A two storied building with a ground floor area of 225 m^2 and upper floor with floor area 156 m^2 will be constructed.
- **Surveillance Building:** A two storey building with a total floor area of 1,600 m^2 will be constructed to provide accommodation for the marine police, coast guard and offshore (high sea) fisheries staff. The ground floor is offices for the above staff.
- **Auction Hall:** A fish auction hall with a floor area of 1,200 m^2 with a 16-number lorry base for loading and unloading and 28 inbuilt concrete auction tops structure.

- **Parking Areas:** Two parking areas will be constructed. The public parking area has a total floor area of 3,750 m^2 to park 30 vehicles and the auction hall parking area will accommodate 90 bicycles, 50 motor cycles, 51 tractors, 6 trucks and 21 other vehicles.
- **Public toilets:** The total area for the public toilet is 180 m^2. Five toilets, three washing basins and four urinals are provided for males and five toilets and four washing basins are provided for females. One disable toilet for male and female is provided. All facilities will utilize an appropriate size septic system.
- **Wastewater treatment facility:** The treatment facility will treat 61.8 m^3/day of waste-water/day.
- **Security facilities:** Two security blocks will be constructed, one at the entrance and another one will be considered during the construction stage to be located at a strategic location. The total floor area of each security block is 50 m2 and includes a bathroom with septic system.
- **Weigh bridge and control room:** A purposely built weigh bridge will be constructed with a total area of 50 m^2. Initially, a 40T weighing facility will be provided and the design could accommodate a 60T facility if necessary, in the future.
- **Fuel facility:** There will be fuel office and 3x36, 000 Litters capacity tanks with 3 x dual dispenser units catering both for small and larger boats. The floor area of the fuel office is 30 m2. The fuel facility will be located near the offloading area.
- **Off Loading Building:** Total floor area of the offloading building is 1,440 m^2. There will be three processing cool rooms, each room contains a store room, office room and hanging room.
- **Construction of Sri Lanka Custom**

  The existing custom will be demolished and a new two stories building will be constructed at the same location. Total area of the building will be 16.525 m X 26.425 m. The ground floor area will be 328m^2 and the first floor will be 216m^2.
- **Transformer and Generator facilities:** Facilities will be provided to install A 800 kVA transformer and standby generators with the capacity of 250 kVA and 350 kVA. Alternative solar power will be provided and used within the fisheries harbor with excess sold to the local electricity provider.
- Security Fence: A 1 m high rubble wall with a chain link fence above with green vegetation is proposed to surround the PPFHDP site.

8. All construction activities will be carried out according to international best practices intended to avoid and minimize adverse environmental impacts and based on the information presented herein through the Environmental Mitigation and Monitoring Plans (EMMP). These plans present the likely impacts caused by the construction and operational phases of the project and outline best practices mitigation measures to manage and lessen the impacts of these activities. These activities will be detailed in the Contractor's Environmental Management Plan (CEMP), which will be based on the EMP included in this EnA and must be approved prior to start of works.

Operations and Maintenance

9. The on-going operation and maintenance of the infrastructure upgrades has been considered during the design process. The Ceylon Fisheries Harbor Corporation (CFHC) is responsible for Operation and Maintenance (O&M) of the new infrastructure.

Environmental Impacts

10. In summary, the EnA concludes that there are no identifiable significant environmental impacts, no critically sensitive marine or terrestrial environmental habitats or species nor is the project deemed environmentally sensitive. The key findings include:

- The project is located in an area that has had a fisheries jetty and has operated as a landing site for well over a century and as such the terrestrial and shallow marine areas have been highly modified (cleared, filled, built on) and does not support any terrestrial ecological or biological (flora or fauna), endemic, endangered or significant biodiversity.
- The fisheries harbor landward site does not have any freshwater (rivers, streams), forests or agriculture.
- The project includes the coastal foreshore, intertidal reef flat and sub tidal reef systems. The coastal foreshore and intertidal reef flat areas have been highly modified (dredged, built on, rock walls) whilst the sub tidal shallow water reef areas have been impacted by fishing activities resulting in the degradation of benthic habitat and the removal of sessile benthic marine resources.
- The intertidal reef flat ecosystem associated with the project does not support any marine shallow water ecological or biological (flora or fauna) endemic, endangered or significant biodiversity. Hard coral abundance is very low and as such the proposed reclamation program and adjacent area of influence to the west and east have negligible impact on marine benthic resources.
- The subtidal reef edge and slope ecosystem associated with the project does not support any marine shallow water ecological or biological (flora or fauna) endemic, endangered or significant biodiversity. Hard-coral coverage and biodiversity in the region also shows very low levels of coverage and species diversity.
- The hard reef terminates between 6-8 meters water depth at the base of the reef slope where the substrate is exclusively dominated by surface layers of sand (between 1- 2.5 m thick), which rest on a hard-coralline base layer of rock. This area is almost devoid of sessile marine organisms and as such this area does not support any marine shallow water ecological or biological (flora or fauna) endemic, endangered or significant biodiversity.
- The proposed site includes a small area of land that is dominated by foreshore sand beach and remnant beach sand dunes that supports a low terrestrial footprint of vegetation. All vegetation located in this area is non-endemic is approximately 50 % native species and the dominate tree species is the coconut tree. A number of coconut trees may be required to be removed for the projects land-based infrastructure improvements, however a reduction in the trees to be removed is expected during the construction phases when the decision on the areas landscape, including trees is finalized.
- Two near threatened plant species (*Sesuvium portulacastrum* (Vankiruvilai) and *Trianthema decandra* (Mahasarana) were located within the Project Area, however they will not be directly impacted by the projects scope of works. These species are reported to be reasonably abundant in similar habitats within the Jaffna area. If the individual plants are to be impacted, they will be removed alive and transplanted and as such detrimental impacts will not result.
- Terrestrial fauna recorded within the Project Area was all but absent and as such there were no endemic, endangered or significant biodiversity recorded.
- The critically endangered land snail *Trachia fallaciosa* was recorded within the projects influenced area and as such will not be impacted by the projects scope of works. This species population numbers vary considerably annually, with high

numbers recorded throughout Point Pedro and the Northern Province during the wet season.

- Impacts on the terrestrial and shallow water marine ecosystems and their environments resulting from the projects construction activities are expected to be minor and manageable.
- Impacts on the environment associated with the construction of the projects two breakwaters and subtidal sand dredging and associated subsurface rock reclamation will be relatively short lived. Sedimentation resulting from these activities will have a low impact on the marine fauna and flora due to the scarcity of resources located within and adjacent to the projects area of influence, the inclusion of sedimentation mitigation measures and the constant movement of sea water throughout the area (tidal currents and oceanic waves) will reduce impacts to the environment.
- The project site does not impact any terrestrial or marine conservation and/or protected area/s, sites of cultural, customary or heritage significance nor any national or international endangered or protected species.
- Due diligence and proactive management of all pre-construction, construction and operational activities will ensure limited disturbance to the daily business activities undertaken within the fisheries harbor and surrounding business and community activities.
- Sri Lankan laws and regulations associated with labor, employment, OH&S will be complied with throughout pre-construction and construction and monitored by the Project Management Unit (PMU) based in Colombo and the Projects Implementation Unit (PIU) in Jaffna.

Environmental Benefits

11. The proposed redevelopment of the PPFHDP through the scope of works will result in the construction of a safe and fully functioning marine fisheries boat harbor for the inshore and offshore fishers utilizing the waters in the north of Sri Lanka. This development will substantially increase the safety, efficiency and economic productivity of these fishers by providing a safe and fully functional harbor that includes needed fishery land-based infrastructure amenities. It demonstrates suitable and appropriate infrastructure directly to the fishers, communities and business operators whilst ensuring the regions infrastructure is enhanced. The new infrastructure will be designed to be climate resilient and includes climate change adaptation features that contribute to the sustainability of the project. The adaptation measures will also be climate proofed by increasing the design heights of the breakwater, wharf, and foreshore fisheries harbor buildings to accommodate the projected rise in sea levels and increasing severity and frequency of waves

Environmental Management Plan

12. The PPFHDP EMP, mitigation measures, environmental monitoring and capacity development, are required to minimise the environmental impacts in the pre-construction, construction, operation and management phases of the project. The Contractor will be tasked to prepare a CEMP and the contractor will be responsible for implementing relevant aspects of the EMMP. The EMP is present as Table 7.1 of this report.

13. The EMP provides a set of mitigation, monitoring and management measures to be applied during the PPFHDP implementation to avoid, reduce, mitigate, and/or compensate for adverse environmental impacts.

14. Implementation of internationally recognized good construction environmental practices form the basis of the EMMP which covers issues such as erosion and sedimentation control, materials sourcing and spoil management, waste management, minimization of habitat disturbance, and worker and community health and safety. The

EMMP will form part of the construction contract documents and the contractor will be required to prepare a site-specific CEMP based on the contract EMP.

15. The CEMP will include sub-plans as required detailing measures to mitigate and manage impacts including site clearance, waste management (including hazardous substances removal), erosion and sediment control, materials and dredge/spoil management, health and safety.

16. The CEMP will be consistent with ADB's Safeguard Policy Statement 2009 (SPS), the laws of Sir Lanka, and international treaties ratified by nation. The contractor will submit the CEMP to PIMU for approval prior to commencement of works.

Implementation Arrangements

17. The Executive Agency (EA) for the project is the MFAR and the ministry's Project Management Unit (PMU) to be established in Colombo supported by the Project's Implementation Unit (PIU), comprised of three environmental officers and a safeguards manager to be established in Jaffna, in the Northern Province will support in the administration of the project The ministry will be supported by the Construction Supervision Consultants (SC) which includes an environmental specialist team (national full time) to assist the PMU and PIU in the supervision and contract administration of the project.

18. **Policy, Legal and Administrative Framework.** The Project shall comply with requirements of the Sri Lankan Coast Conservation Act and development consent (DC) for the project will be issued by Coast Conservation and Coastal Resources Management Department

19. The DC application shall be in accordance with the relevant Sri Lankan Regulations in keeping with the Coast Conservation Act and will also comply with the requirements of ADB's SPS 2009. Development consent (and other permits) must be obtained before any works commence.

20. **Information Disclosure, Consultation and Participation.** The stakeholder consultation process disseminated information to the general public, project affected communities and key environmental stakeholders. Information was provided on the scale and scope of the project and the expected impacts and the proposed mitigation measures through consultation with government departments, local authorities and the general public in meetings.

21. The process also gathered information on relevant concerns of the local community stakeholders of the project through a series of discussions. Key issues have been addressed and incorporated into the project design. The EnA report will be disclosed according to the provisions of ADB Public Communications Policy 2011 and requirements of the laws of Sri Lanka.

22. **Grievance Redress Mechanism (GRM).** GRM will be established to receive, evaluate and facilitate the resolution of affected people's concerns, complaints and grievances about the environmental and social performance of the project. The project's GRM is based on a multi-tiered system to allow for a sequential level approach to address the concern and provide an agreeable outcome to all parties. The approach in an ascending order includes discussions at the project/ site level (Tier 1), the divisional level (Tier 2) and National level (Tier 3).

23. The GRM is based on accepted practices in Sri Lanka and provides an accessible, time-bound and transparent mechanism for the affected persons to voice and resolve social and environmental concerns linked to the project.

24. **Conclusions and Recommendations.** The potential environmental impacts arising from design, construction, operation and maintenance of the Point Pedro Fishery Harbor Development Project (PPFDP) will be minor, localized and acceptable provided that the mitigation measures set out in the EMP are implemented properly. When completed the project will result in an improved environment associated with the fisheries harbor (significant improvements to the current land-based infrastructure and machinery), significantly improve safety and boat operational requirements and a marked improvement in the efficiencies of the local and national fishers working in the northern waters of the nation.

25. The EnA concludes that there were no identifiable significant environmental impacts and no critically important terrestrial or marine habitats. All impacts are site specific, irreversible and can be minimized through appropriate mitigation measures. Impacts arising from the project's construction phase, including the two breakwaters and reclamation of the shallow water reef flat, subsequent adjacent substrate dredging program (deepens the harbor and uses the material for project fill), associated machinery and operational phases of the project are minor, localized, and acceptable, provided that the mitigation measures set out in the outline EMP are further elaborated by the contractor, implemented and monitored properly.

26. The pre-construction, construction and operational EMP identify potential environmental impacts arising from the project. Along with a corresponding schedule and monitoring of mitigation measures ensure that potential impacts are maintained at insignificant levels. It also includes the institutional arrangements for implementing and monitoring the EMP to ensure its effectiveness.

1 INTRODUCTION

1.1 Background

27. Sri Lanka is an island state in the Indian Ocean, approximately 100 km south-east of the Indian sub-continent between latitudes 6-10° N longitudes 80-82° E. The island north to south extends approximately 440 km and is 220 km at its widest covering approximately 66,000 km^2. The nation has a narrow coastal shelf (average 22 km wide) covering 27,800 km^2, a total coastline of 1,770 km and an Exclusive Economic Zone (EEZ) of 517,000 km^2.

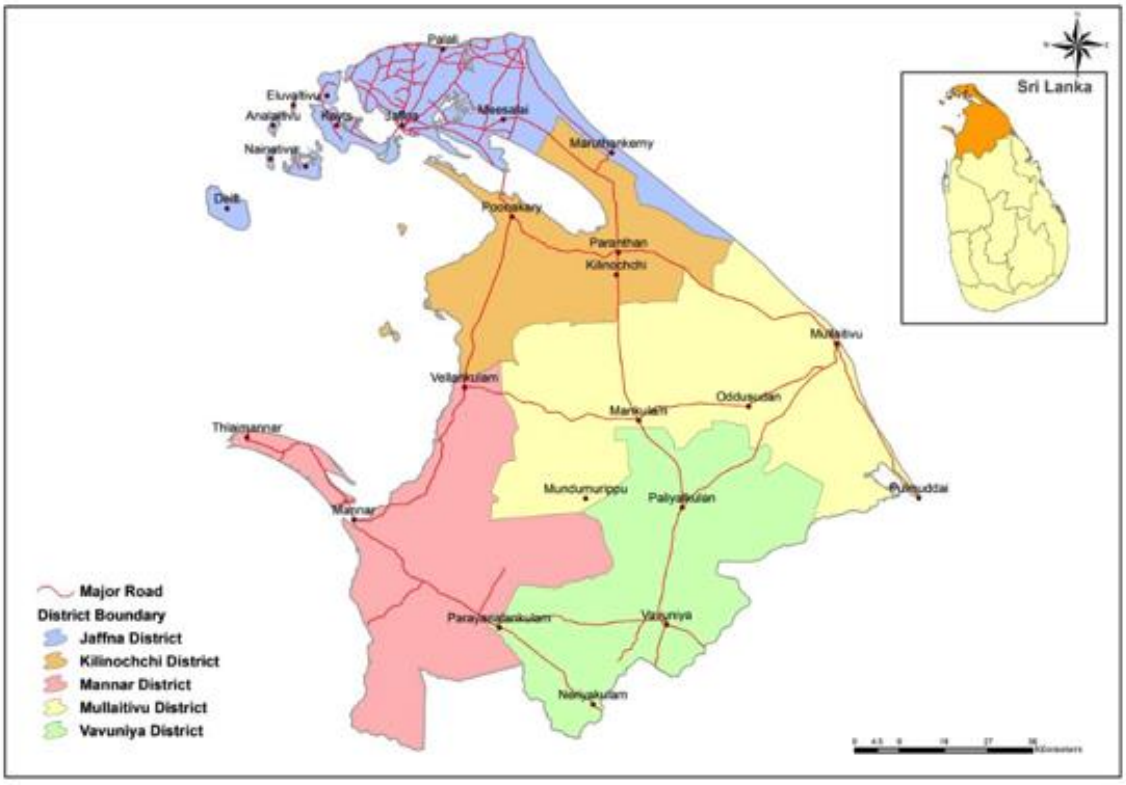
Figure 1-1: Geographical location of Sri Lanka

28. The nation is divided into 9 Provinces (**Figure 1-1**), one of which is the Northern Province, which is the location of the Point Pedro Fisheries Harbor Development Project site. The Northern Province consists of 5 districts, 4 of which are coastal; Mannar, Mullaithivu, Killinochchi, Jaffna and Vavuniya, which is landlocked (**Figure 1-2**). The northern province has a total area of 8,884 km^2 and is surrounded by the Gulf of Mannar and Palk bay to the west, Palk Strait to the north west, the Bay of Bengal to

the north and east, the North Central and North Western Provinces to the east and south, respectively (**Figure 1-2**).

29. Jaffna district is the capital of the Province and is comprised of 13 Pradeshia Sabhas, 3 Urban Councils and a Municipal Council with a population of approximately 650,720. This area was one of the worst affected by the three decades of conflict and is among the most economically disadvantaged parts of the country. Post-civil war, this area is experiencing rapid growth and population influx.

Figure 1-2: The districts of the Northern Province



Source: CEA, DMC, 2014

1.2 The Project

Main objectives of the proposed project

30. The Northern Province Sustainable Fisheries Development project is aligned with the following impacts: (i) investments in the fisheries sector promoted; and (ii) employment and livelihood opportunities in the Northern Province promoted[1]. The project will have the following outcome: Fisheries production in the Northern Province sustainably increased. The project has three key outputs: (i) Marine fisheries infrastructure constructed; (ii) Aquaculture developed; and (iii) Entrepreneurial skills, market links, and credit access for local communities; and capacities of government's staff strengthened. Under output 1: Two new harbors in Point Pedro, Jaffna District and Pesalai, Mannar District will be constructed; one anchorage in Jaffna District in Mandativu, and 23 landing sites (8 in

[1] Government of Sri Lanka. 2017. *Vision 2025: A Country Enriched*. Colombo.

Jaffna[2], 6 in Mannar[3], 6 in Mullaitivu[4], and 3 in Kilinochchi[5]) will be rehabilitated;–This EnA is for the development of the Point Pedro Fishery harbor

The objectives of the harbour development are to:

- Increase the protein intake at national level.
- Increase the national fish production for export market by constructing a modern fishery harbor including fish processing facility to conform the international standards/quality in Point Pedro to cater to small Inboard Multiday Boats (IMUL) and large scale IMULs boats.
- Increase the income of the local people by providing direct and indirect goods and services including job opportunities.
- Increase deep sea fish production and minimize the threat to near shore

Justification of the Project

31. Coastal, offshore and freshwater fishery resources of Sri Lanka provide an essential source of food security (reliable protein) and income generation (economic) benefit to the communities of the Northern Province. The past three decades of conflict in the north of the country impeded small and large-scale development of sustainable fisheries in these communities. Since the cessation of hostilities, the economic and social conditions have greatly improved resulting in the opportunities to expand fisheries related industries and the promotion of economic development. The fisheries sector provides livelihoods for more than 40,000 families in the Province. In 1983, prior to escalation of the conflict, the Northern Province, which has 40% of the nation's coastal belt, accounted for 40% of its marine fish catch. The Province's fish catch dropped considerably during the ensuing period and investment was negligible. Fishers in the Northern Province currently enjoy little fisheries infrastructure, as there are no natural fishery harbors and many anchorage sites are damaged by the conflict and extreme weather events.

32. To assist the sustainable development of fisheries activities in the Northern Province, the Government of Sri Lanka (GoSL) had requested for a loan from the Asian Development Bank (ADB) to provide financial assistance for the development of fisheries infrastructure facilities in the Northern Province under the Northern Province Sustainable Fisheries Development Project (NPSFDP). The NPSFDP loan has been developed from a previous due diligence Project Preparatory Technical Assistance (PPTA) completed in March 2017, which was designed to revive the fisheries sector in the four-conflict affected coastal districts of the Northern Province including: Jaffna, Mannar, Mullaitivu, and Killinochchi.

33. The purpose of the Project Development Assistant (PDA) loan (this consultancy assignment) is to undertake detailed engineering designs and associated environmental and social safeguards requirements of fishery infrastructure development in the Northern Province identified through the Project Preparatory Technical Assistance (PPTA) Output 1: Climate Resilient Infrastructure. The project is to include the development of two (2) harbors (Point Pedro and Pesalai), rehabilitate one (1) fishing anchorage site and twenty-three (23) fisheries landing sites within the four Northern Province districts.

34. The new harbor infrastructure development is expected to encourage new investments in offshore fishing activities, thus easing the pressure on excessive exploitation of coastal resources. The streamlining of operations at the anchorage and landing sites by

[2] Sampoladi, Chullipuram West, Aralithurai, Thuriyor, Punkuduthivu, Munai, Thalathurai, and Athikoviladi
[3] Thalimannar, Sirithoppu, Minarappadu, Wankalai, Arippu, Kodachchikuda
[4] Iranapalai, Kallappadu North, Kallappadu South, Theethakarai, Silawathai, and Kokilai
[5] Pallikuda, Valaipadu, and Nachchikuda

means of providing shore infrastructure will improve safety and security of the fishers and their vessels, fish quality which may result in increased income opportunities (separate environmental assessments have been prepared for these investments). These interventions will contribute to the sustainability of the fish resources over the long term whilst maintaining income generating opportunities to communities of the region. Sustainable development of the fisheries sector in the Northern Province will not only benefit the fishing and coastal communities residing in this region, but will also help to improve the nutritional status, food security and economic development of the nation.

35. The report is specifically written to provide the EnA of the Point Pedro Fisheries Harbor Development Project (PPFHDP). **Figure 1-3** provides a general location of the Point Pedro existing Dock facilities.

Figure 1-3: Location of the existing facilities associated with the Point Pedro Development Site.

36. Point Pedro fisheries harbor location currently consists of an old (constructed in 1875) and run-down concrete wharf supported by no water or land-based infrastructure. The wharf is located on an extensive narrow coastal fringing coral reef, which extends the length of this coastline that has been dredged to provide access to the dock. It opens directly to the sea and is exposes to the open ocean weather conditions and thus provides negligible secure and safe docking facilities (**Figure 1-4**).

Figure 1-4: Point Pedro Existing dock facility.

37. The feasibility study conducted by MARDREA in 2016, identifies that the Point Pedro area is one of the most productive fishing areas in the Jaffna District. However, the absence of adequate facilities in the area for the operation of larger fishing craft became a constraint for the operation of the larger vessels. Many of the facilities in the area, which were severely damaged during the conflict and the Indian Ocean Tsunami, have not been adequately restored to meet the needs of the fishing community in the area[6].

38. It is also evident that the benefits of fishery harbors would extend to a wider community associated with the fisheries sector that includes fish traders, transporters, handlers, exporters as well as the community as a whole with the improvement of nutritional status due to the increased level of availability of quality fish for consumption. Construction of this harbor in Jaffna, would bring about an improvement in the livelihoods and potential for employment to several in the area.

Objectives of the Environmental Assessment report

39. In compliance with the ADB environmental and social safeguard policy an environmental assessment is a prerequisite for "B" Category projects which are funded by the ADB. The ADB environmental reports are termed for this category as an Initial Environment Examination (IEE). Further, according to the Coast Conservation Act, any new developments located within the Coast Zone should obtain a development permit from the Coast Conservation and Coastal Resources Management Department (CCCRMD). Based on the magnitude of the project an Environmental Impact Assessment (EIA) is a pre-requisite for the approval by the CCCRMD. Therefore, to meet the above requirements, a combined TOR has been prepared in consultation with both agencies. This EnA report is prepared based on the TOR given by the CCCRMD and ADB for the proposed Point Pedro fisheries harbor Development Project (PPFHDP).

40. The objective of this report includes the environmental assessment of the proposed design, construction and operation of the new fisheries harbor facility for Point Pedro. The assessment is required in order that an environmental management plan (EMP) for each

[6] MFAD (2016), Feasibility Study on the Development of a Fishery Harbor in Point Pedro in Jaffna District, Ministry of Fisheries and Aquatic Development, Sri Lanka, Nov. 2016

phase of the project can be outlined to avoid, mitigate and/or manage the anticipated environmental, health and safety impacts. The EMP will be further detailed by the contractor (for pre-construction and construction impacts) and will include future operational impacts.

41. In preparing the assessment the environmental consultant has followed the terms of reference (TOR), which is attached in **ANNEX 1**. The EnA is prepared to;

- Identify and evaluate potential environmental impacts that will arise as a result of the proposed interventions;
- Recommend appropriate mitigation measures to avoid, minimize, remedy or compensate for the predicted negative impacts and;
- Produce an EMP that will give adequate project options in terms of mitigation measures, project alternatives and Monitoring Program to achieve overall environmental sustainability of the project.

Aim and scope of the Environmental Assessment study

42. The scope of this report is the environmental assessment of the design, construction and operational phases of the project and an EMP of pre-construction, construction and operational activities. The assessment is based on the site location, design and configuration of the project

43. The TOR specifies that the study area proposed for the EnA covers the Project Area (PA) site – which includes the area directly impacted by the project's scope of work, and the Project's Influencing Area (PIA) that extending up to 500 m periphery from the boundary of the PA, two km on either side of the coastal belt and one km seawards from the boundary of the project site. The initial development process undertaken for the project includes:

- The initial scoping during which the environmental consultants had consultation with Project staff and the Detail Design Team (DDT) to familiarize with the project background, proposed interventions, construction methodologies and equipment to be used, pre- construction activities,
- Establish the general baseline condition of the physical, biological and socio-economic environment on-site as well as off- site through reconnaissance visits, ecological and social surveys of the project area.
- Carrying out scoping of environmental issues that may arise as a result of project activities to the physical, biological and socio-economic environments by stakeholders and local community consultations, particularly with the beneficiaries and affected communities, and Community Based Organizations (CBO) in the area.
- Identify necessary approvals/clearances needed by the project prior to its implementation.
- Prepare a detailed Environmental Mitigation and Monitoring Plan (EMMP)
- Cost estimation for implementation of Environmental Management Plan and Environmental Monitoring Program.

Brief outline of the Methodologies and Technologies adopted in Environmental Assessment report preparation.

44. The TOR provides guidance for the preparation of the EnA report.

45. The methodology followed in preparation of this report were:

- Reviewing the existing documents
- Identifying additional information needed
- Field visits to the sites
- Conducting field tests
- Conducting stakeholder and community consultations
- Preparing the draft report

46. **Reviewing the existing documents.**

The following documents were reviewed:

- PPTA (2017). Initial Environmental Examination. Draft. 05th March 2017. ADB TA-9049 SRI. Northern Province Sustainable Fisheries Development Project (NPSFDP). Project Preparatory Technical Assistance (PPTA). FCG ANZDEC, RDC.
- PPTA (2017). Initial Environmental Examination. Final. October 2017. ADB TA-9049 SRI. Northern Province Sustainable Fisheries Development Project (NPSFDP). Project Preparatory Technical Assistance (PPTA). FCG ANZDEC, RDC.
- PPTA (2017). Environmental Assessment and Review Framework. Draft. 5 March 2017. ADB TA-9049 SRI. Northern Province Sustainable Fisheries Development Project (NPSFDP). Project Preparatory Technical Assistance (PPTA). FCG ANZDEC, RDC.
- ADB (2009). Safeguards Policy Statement. June 2009.
- University of Moratuwa (UoM) feasibility studies for Pesalai (UoM, 2016a), Point Pedro (UoM, 2016b), and for fishery anchorages and landing sites in Jaffna District (UoM, 2016d), Mullaitivu (UoM, 2016c), Kilinochchi (UoM, 2016e), and Mannar (UoM, 2016f); (iii) the PPTA technical due diligence of the UoM feasibility studies for output 1 (PPTA, 2017d);
- Published environmental assessments (IEE's and EIA's) reports and other related documents available in various source including websites referred are given as reference list to this document.

47. **Identifying additional information needed:** Based on the review of the available project documents listed above, the following information were required to prepare the EnA report.

- Report for geotechnical investigations, topographical survey, finalized design, and additional survey on coastal and marine ecological study and social assessment.
- Assessment on physical components such as water quality, ambient noise and ambient dust levels.

48. **Field visits to the site:** The consultants visited the proposed project site on several occasions individually, with other team members, ADB mission team and design engineers.

49. **Conducting necessary studies:** The baseline setting is a very important part of the EnA for the future comparison of the pollution and impact levels. Therefore, in addition to the tests and investigations conducted for the design purposes, the necessary environmental baseline assessments were also undertaken. This included;

- Geotechnical Investigation.
- Bathymetry survey.
- Terrestrial and marine ecological and biological assessment surveys.
- Sea water quality.

- Ground water quality mainly drinking water from the close by dug wells in the area.
- Ambient air quality in the area.
- Ambient noise levels in the area.

50. **Conducting stakeholder Consultations:** Detailed consultations were undertaken at all stages of the project (feasibility, project preparatory, detailed design) with the project's key stakeholders which included relevant government agencies and officers such as Chief Minister and Officers of the Northern Province, District Secretary (Jaffna), Divisional Secretary, DOF, CEA, CC & CRMD, the community organizations mainly the respective fisheries organizations, School Development Society of the Methodist Girls' High School, fisher's associations and general public.

51. **Main Beneficiaries of the project:** The PPFHDP is a nationally important project. The direct benefits will be to the fishing community operating IMUL in the country. According to the Fisheries Development Act, a fishery harbor is common property and therefore there are no geographic restrictions in the use of the harbor. The development of the PPFHDP will directly and indirectly provide jobs and increase income generation opportunities across a wide spectrum of services associated with a commercial fisheries harbor. Improved social services will also be provided including improved handling, processing, marketing and quality of fish products, health and safety aspects to the fishers, markets and retailers and to the general business and public communities.

52. The local communities within the area will directly benefit from the project by: (i) having a secure safe berthing facility for their boats. Currently these boats face major threats during the monsoonal season; (ii) direct employment opportunities during construction and the operational period; (iii) the local community also benefits by providing goods and services. Apart from these, the land value in the area will be increased due to the development of the proposed harbor.

2 INSTITUTIONAL, LEGAL AND POLICY FRAMEWORK

53. The implementation of the proposed project activities will be administered by the environmental laws and regulations of Sri Lanka and the ADB safeguard policies.

54. This chapter therefore describes Sri Lankan national laws, regulations and policies relevant to this project and the ADB SPS and as well as international agreements that are pertinent to the construction and operation of the project.

2.1 Environmental and Resource Legislation and Regulations of Sri Lankan

National Regulations and Laws

55. A number of national environmental laws and regulations are directly relevant to the proposed PPFHDP investment. The **Table 2-1** provides a summary of these key laws which are described in greater detail below (summarized from ADB, 2017).

Table 2-1 : Summary of key environmental laws associated with the PPFHDP.

Law	Project Relevance	Government Focal Point
Constitution (1987).	Fish and fisheries within territorial waters are under concurrent control.	MFAR, NPC
The National Environmental Act No 47 of 1980 and Amendment Act, No. 53 of 2000.	Environmental Approval for projects outside the coastal zone. Pollution prevention and control from land-based sources.	CEA
The Coast Conservation (Amendment) Act, No. 49 of 2011.	Development permits in the coastal zone. Coastal resources inventory and management plan.	CCCRMD
Fisheries and Aquatic Resources Act amended (2016)	Fisheries policy, monitoring, and management.	MFAR
The Fauna and Flora Protection (Amendment) Act, No. 22 of 2009.	Wildlife conservation areas and protected species.	DWC
Forest Ordinance, No. 17 of 1907 (as amended).	Conservation and management of forests, felling of trees.	FD
The Marine Pollution Prevention Act, No, 35 of 2008.	Pollution prevention and control from marine sources.	MEPA
Pradeshiya Sabha Act No. 15 of 1987.	Local authority responsibility for health and sanitation and public thoroughfares.	PS
The Ma-del (beach seine) Regulations of 1984.	Managers and licenses beach seine fishing in coastal areas.	MFAR, DS
Mines and Mineral Act No 33 of 1992**.**	Licenses the extraction of quarry material.	GSMB
Antiquities (Amendment) Act No. 24 of 1998.	Antiquities conservation.	DoA
Land Acquisition Act No. 9 of 1950.	Acquisition of lands for public purposes – includes compensation	ML, DS

	payments.	
Soil Conservation (Amendment) Act, No. 24 of 1996.	Conservation of soil resources and mitigation of soil erosion and usage.	MA

CCCRMD = Coast Conservation and Coastal Resources Management Department; **CEA** = Central Environment Authority; **DoA** = Department of Archaeology; **DWC** = Department of Wildlife Conservation; **GSMB** = Geological Survey and Mines Bureau **MEPA** = Marine Environment Protection Authority; **MFAR** = Ministry of Fisheries and Aquatic Resources; **MoL** = Ministry of Lands; **NPC** = Northern Provincial Council; **PS** = Pradeshiya Sabha; **FD** = Forest Department; **MoA** = Minister of Agriculture; **DS** = District Secretariat.

56. The protection, management and responsibility of the nation's environment is documented in the Constitution (GoSL 1978-10). Chapter VI (Directive Principles of State Policy and Fundamental Duties), Sections 27 (14) and 28 (f) declare that: "The State shall protect, preserve and improve the environment for the benefit of the community" and "it is the duty of every person in Sri Lanka to protect nature and conserve its riches".

Constitution of the Democratic Socialist Republic of Sri Lanka 1978

57. The Constitution of Sri Lanka (Government of Sri Lanka, 1987) specifies that fish and fisheries are not on the provincial council list (under the Provincial Council mandate), rather fish and fisheries resources within territorial waters are on the concurrent list (central government and province). Fish and fisheries beyond territorial waters are on the reserve list (central government).

National Environmental Act No 47 of 1980 and Amended Act, No. 53 of 2000

58. The National Environmental Act (NEA), (Government of Sri Lanka, 1980) provides the administrative arrangements "for the protection, management and enhancement of the environment, for the regulation, maintenance and control of the quality of the environment, for the prevention, abatement and control of pollution".

59. The NEA is implemented by the Central Environmental Authority (CEA), which functions under the Ministry of Environment and Wildlife Resources (MEWR) is responsible for administering the provisions of the Act. The scope of this law virtually covers all aspects necessary to safeguard the environment and natural resources in the country.

60. The Act entrusts the CEA with responsibilities regarding use of lands and the management and conservation of natural resources outside of the coastal zone. Moreover, the CEA manages the standards of wastewater discharges into coastal water bodies and fresh water bodies and monitoring for environmental degradation. Part IV B, of the Act provides the provisions for the maintenance of environmental quality and to control the environmental pollution by setting relevant standards.

61. The NEA includes two main regulatory provisions through which the environmental impacts of development projects are assessed, mitigated and managed: This includes:

i. The Environmental Impact Assessment (EIA) procedure for major development projects - regulations published in Government Gazette Extraordinary No 772/22 of 23rd June 1993 and in subsequent amendments;
ii. The Environmental Protection License (EPL) procedure for the control of pollution - regulations published in Government Gazette Extraordinary No 1533/16 of 25 January 2008.

62. The provisions for EIA are contained in Part IV C of the NEA, which requires the submission of an IEE or EIA report in respect of certain "prescribed projects". These are specified in Gazette Extraordinary No 772/22 of 23rd June 1993.

63. The PPFHDP scope of works (derived from the PPTA) has been evaluated by the CCCRMD resulting in a determination that an Environmental Impact Assessment (EIA) is required. This determination categorization represents the ADB SPS categorization of an Initial Environmental Examination (IEE) and as such one specific environmental report has been produced for the PPFHDP which ensures both processes are met.

64. The Ministry of Environment and Wildlife Resources (MEWR) is tasked with policy formulation on the environment and natural resources in Sri Lanka and as such will be the lead agency, through a number of the ministry's divisions. The Coast Conservation and Coastal Resource Management (CCCRM) division will be responsible for issuing the project Development Consent (DC) approvals. **Table 2.2** provides a summary of key Ministries and their divisions associated with the approval decisions for the PPFHDP.

Table 2-2 : Key government agencies associated with project development consent applications.

Agency	Roles Associated with the PPFHDP
MFAR	Is the project EnA and through its PMU/PIU will implement the project.
	Ceylon Fishery Harbors Corporation (CFHC): CFHC is the government agency responsible for managing fishery harbors in Sri Lanka. It is the proponent for the fishery harbors, anchorage and landing site investments under output 1 of NPSFDP. There is, currently, no permanent CFHC representation in any of the Districts of Northern Province.
	Department of Fisheries and Aquatic Resources (DFAR): DFAR has overall responsibility for implementation of the Fisheries and Aquatic Resources Act (FARA) with a particular focus on ensuring compliance with international and regional treaty obligations. At the district level, district offices of DFAR are headed by Assistant Director of Fisheries. Jaffna District has a permanent DFAR representation.
	National Aquatic Resources Research and Development Agency (NARA): NARA is "the principal national institute charged with the responsibility of carrying out and coordinating research, development and management activities on the subject of aquatic resources in Sri Lanka". NARA includes a number of research divisions relevant to NPSFDP such as "Marine Biological Resources Division"; "Socio-economic & marketing research division"; "fishing technology division"; "environmental studies division"; "institute of post-harvest technology"; "national institute of oceanography and marine science"; "national hydrographic office", "monitoring and evaluation division" and a number of regional research centers. NARA has no offices in Northern Province.
MEWR	Ministry of Environment and Wildlife Resources is responsible for the management of the environment and natural resources. The ministry includes the divisions of: Biodiversity; Environmental Pollution Control and Chemical Management, Climate Change; Natural Resource Management; Sustainable Development and Sustainable Environment.
	The Ministries Implementing Agencies include;
	➢ Central Environment Authority (CEA): The CEA is responsible for administering the provisions of the National Environmental (Amendment) Act, No. 53 of 2000 (Government of Sri Lanka, 2000). The CEA is mandated to manage the Environmental Protection Licensing (EPL) system nationally; the Initial Environmental Examination/Environment Impact Assessment (IEE/EIA) process outside the coastal zone using Project Approving Agencies (PAA) where appropriate; the environmental recommendations system

	regarding non-prescribed activities; and the scheduled waste management licensing system. CEA is also responsible for ensuring compliance with air quality, and noise, regulations. Representation of CEA at the Northern Province and Northern Province District level includes offices in all Districts.
	➢ Coast Conservation and Coastal Resource Management Department (CCCRMD): The department is mandated under the Coast Conservation (Amendment) Act, No. 49 of 2011 (Government of Sri Lanka, 2011) to conserve the "coastal zone", as defined in the Act (see glossary) including the survey of resources within the coastal zone, the production of a coastal zone and coastal resources management plan, and the issuing of "permits" for developments within the coastal zone. Unlike the CEA the CCCRMD does not have access to Project Approving Agencies (PAA) to support the development permit process within the coastal zone although it can assign responsibilities. CCCRMD can also declare "Affected Areas", "Beach Parks", "Conservation Areas", and "Special Management Areas" and develop and implement plans for these areas including "Coastal Access Plan(s)" and "Special Area Management Plans (SAMP)". CCCRMD is divided into three divisions. (i) Coastal Research and Design Division responsible for monitoring and research; (ii) Coastal Works Division responsible for shoreline management projects and maintenance of the existing coast protective structures; (iii) Planning Division responsible for the development permit system and for the formulation and implementation of Special Area Management Plans (SAMP). CCCRMD has a unit in Jaffna District Secretariat. There are CCCRMD officers in Kilinochchi and Mannar Districts that are attached to the District Secretariats.
	➢ Marine Environment Protection Authority (MEPA): MEPA is mandated under the Marine Pollution Prevention Act (Government of Sri Lanka, 2008) to effectively and efficiently administer and implement the provisions of the Act and the regulations made there under. It is responsible for addressing marine sourced pollution and not pollution from land-based sources which is the responsibility of the CEA. MEPA is responsible for the Sri Lanka National Oil Spill Contingency Plan; waste reception services and bunkering permits. Representation of MEPA at the Northern Province and Northern Province District level is one regional office in Jaffna.
	➢ Department of Wildlife Conservation (DWC) is mandated under the under the Fauna and Flora Protection (Amendment) Act, No. 22 of 2009 (Government of Sri Lanka, 2009) to identify, gazette and manage national reserves and sanctuaries, and also to ensure that fauna and flora are identified for listing in the schedules of the Act and are protected accordingly. ➢ DWC Marine Unit includes marine operation centers at a number of national parks and reserves in Northern Province including Vankalai Sanctuary, Adam's Bridge national park, Chundikulam National Park, and Kokilai Sanctuary. The Management and Technical Authority for CITES in Sri Lanka, and the national focal points for the CMS/Bonn Convention and the RAMSAR Convention is DWC. DWC protected areas and species are administered in local areas (branches) that match, but not exactly, the districts. There is a regional Assistant

	Directors office in Kilinochchi administering three of the Northern Province Districts (Jaffna, Mullaitivu and Kilinochchi) and an Assistant Directors office at Maddu (Vavuyina District) dealing with Vavuniya and Mannar District in Northern Province.
	➢ Geological Survey and Mines Bureau, established for provision of services under the Mines and Minerals act, No.33 of 1992, is the lead agency in mineral development underscores the Government's commitment to promoting mineral-based industries. The Bureau has four primary operations: geological mapping and mineral exploration, mining titles and mining regulation (core activity); client responsive activities (mineral resource surveys, laboratory services, geophysical and drilling contracts) and geo-science information. The Mines Division is presently functioning with 14 Regional Offices including Jaffna. The proposed project needs large quantity of armors and filling materials. Providing mining license and monitoring will do by the GSMB.
MD	The Ministry of Defense (MD) and the Disaster Management Centre (DMC) within the Ministry, is mandated under the Disaster Management Act No. 13 of 2005 (Government of Sri Lanka, 2005). The DMC works closely with the Climate Change Secretariat (CCS) on climate change related disaster management issues. The DMC produced a national hazards profile report (Government of Sri Lanka, 2012a) including hazard profiles for sea-level rise, storm surge, coastal erosion, drought etc. There is a disaster management unit in each District Secretariat under the MDM/DMC.
MBCRA	The Ministry Buddhasasana, Cultural and Religious Affairs (MBCRA) is responsible for cultural affairs in Sri Lanka. The ministry is responsible for the management of all cultural sites and issues associated with development activities throughout the nation.
	The Department of Archaeology (DoA) is responsible for all archaeological matters in Sri Lanka. It is not under any Ministry and is a non-ministerial government department

Coastal Conservation (Amendment) Act, No. 49 of 2011.

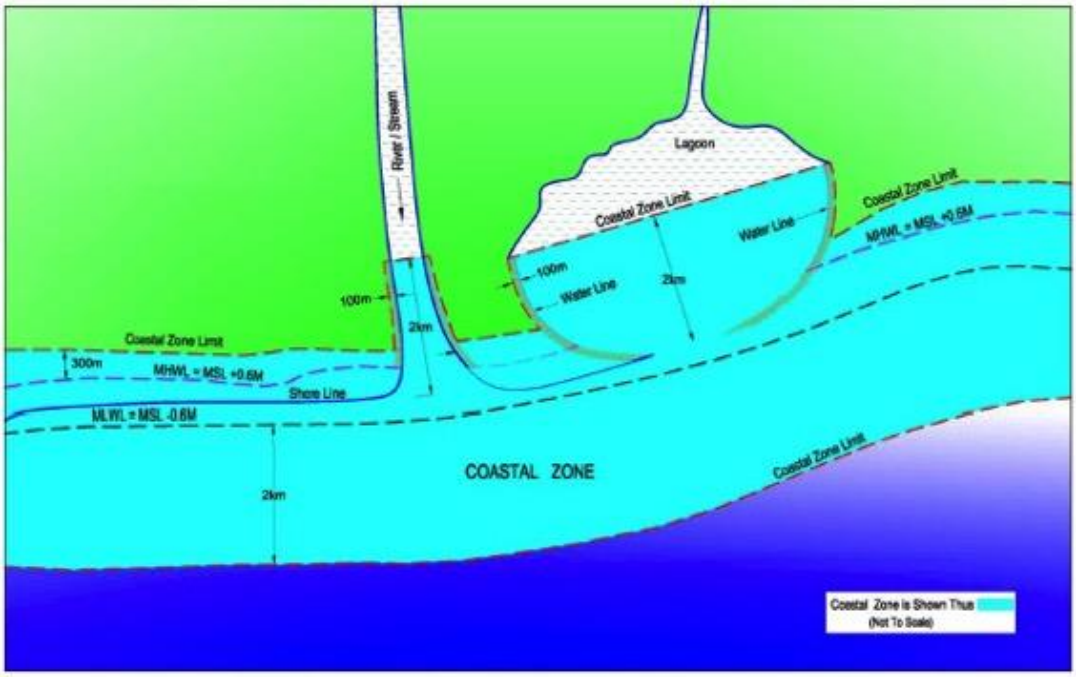
65. The Coast Conservation (Amendment) (CCA) Act, No. 49 of 2011 (Government of Sri Lanka, 2011) provides the administrative arrangements for conserving the "coastal zone". Key provisions under the Act are the survey of resources within the coastal zone, the production of a coastal zone and coastal resources management plans, and the mechanisms for issuing "permits" for developments within the coastal zone. Coastal resource as defined under the act includes all living and non-living resources found within the Coastal Zone. (Government of Sri Lanka, 2016b). It should be noted that the definition of "management" under the Act "means the managing of renewable and non-renewable coastal resources, either separately or in an integrated fashion but excluding fisheries and aquatic resources which fall within the provisions of the Fisheries and Aquatic Resources Act, No. 2 of 1996." (as amended).

66. The Act also allows for the declaration of "Affected areas", "Beach Parks", "Conservation Areas", and "Special Management Areas (SMA)" and for the development and implementation of "Coastal Access Plan(s)" and "Special Area Management Plans (SAMP)". The Act also includes restrictions on the extraction of coastal resources including coral (31.A(1)), and sand (31, E (1).

67. Section 14 of the CCA identifies that "no person shall engage in any development activity other than a prescribed development activity within the Coastal Zone except under

the authority of a permit issued in that behalf by the Director, Coast Conservation." The Coastal Zone is defined as "the area lying within a limit of 300 m landward of the Mean High Water Line (MHWL) and a limit of 2 km seaward of the Mean Low Water Line (MLWL); and in the case of rivers, streams, lagoons or any other body of water connected to the sea either permanently or periodically, the landward boundary shall extend to a limit of 2 km measured perpendicular to the straight base line drawn between the natural entrance points identified by the Mean Low Water line thereof and shall include waters of such rivers, streams and lagoons or any other body of water so connected to the sea." These areas are shown diagrammatically in **Figure 2-1.**

Figure 2-1: Coastal Zone Definition



Source: Government of Sri Lanka, 2016b

68. The proposed development scope of works associated with the PPFHDP fall within the coastal zone and as such the project will require a development permit to be issued by the Coast Conservation and Coastal Resources Management Department (CCCRMD) according to criteria prescribed by the Minister. In addition, CEA is responsible for issuing Environmental Protection licenses for prescribed activities that may cause pollution within the coastal zone and all land-based activities associated with the project. Marine Environmental Protection Authority (MEPA) is responsible for the prevention and control of marine pollution.

69. The project is a prescribed development under the NEA as indicated above, but development guidelines issued by the Coast Conservation Department (CCD) state that "all public works within the coastal zone are subject to CCD permit procedure. Hence Public Institutions must consult CCD prior to commencing the development activities." The guidelines indicate that there are two types of permits, "Minor Permits" are required for small dwelling houses, small scale commercial structures, and removal of sand and sand bars; and "major permits" are required for 19 larger-scale specified undertakings. These include ten activities that will or may be part of the PPFHDP project: i) Dwelling houses and related structures of total floor area 1000 sq. feet (93 Sq. m) or more; ii) Harbour structures and navigational channels; iii) Public and religious structures; iv) Shoreline protection works; v) Sewage treatment facilities and ocean outfalls; vi) Disposal of solid wastes; vii)

Dredging, filling landscaping and grading; viii) Removal of sand, sea shells or vegetation; ix) Breaching of sand bars; and x) Reclamation

70. The guidelines provide specific development requirements for fisheries related buildings and infrastructures. This includes specifically set back area (buffer zone) of 200 m for all fisheries structures. However, set back (buffer zone) exceptions can be granted by the Director for nationally important projects and fisheries related building and infrastructure, both of which are significant factors for the PPFHDP.

71. In addition, the development guidelines include seven specific activities that are prohibited within the coastal zone. One of which is required within the PPFHDP scope of works, i) the removal of corals other than for research purposes. The construction of the fisheries harbor will include the reclamation of coral reef including corals and as such a detailed assessment of the impacts of the project activities on the corals and their ecosystem is included in this IEE and results presented. This issue will be presented and discussed with the CCD when the application for a Major Permit is submitted.

Fisheries and Aquatic Resources Act (FARA) as amended to 2016

72. The Fisheries and Aquatic Resources Act (Government of Sri Lanka, 2016) provides for the management, regulation, conservation and development of fisheries and aquatic resources in Sri Lanka and to give effect to Sri Lanka's obligations under certain international and regional fisheries agreements. The Act includes definitions of "Aquaculture", "Aquatic Resources" and "Fish" (see Glossary).

73. The Ministry responsible for implementing the provisions of the Fisheries and Aquatic Resources Act is Ministry of Fisheries and Aquatic Resources (MFAR). The Act makes a number of administrative provisions including, many of which are relevant to proposed investments in the NPSFDP:

i. **Licensing:** the "licensing of fishing operations" including the refusal of licenses, the granting of licenses with conditions and the renewal on grounds of sustainability;
ii. "**Protection of fish and other aquatic resources**": including the designation of "**Fisheries Management Areas**" (FMA) and associated fisheries management "coordinating committees" responsible for the development of a "fisheries development and management plan"; formation and operation of "fisheries committees"; designation of "closed or open season for fishing";
iii. "**Conservation**": including the designation of "fisheries reserves";
iv. "**Aquaculture**": including the leasing of state lands and licensing of aquaculture operations.
v. Other administrative provisions cover the "settlement of disputes", "offences and penalties" and "general" matters including regulations (section 61) and use of terms (section 66).
vi. **Regulations**: Directions regarding regulations are wide ranging covering matters such as: (a) the taking and landing of fish and other aquatic resources and the control and management of landing areas (61.1); (b) the collection of statistics and the provision of information by persons who are engaged in fishing, marketing or processing of fish and aquaculture enterprises (61.s) including – the protection of fish breeding ecosystems (61.sc); the prevention of the disposal of industrial and domestic waste in Sri Lanka waters, and the prevention of the filling of Sri Lanka Waters, in a manner detrimental to fish and aquatic resources in such waters (61.sd); the establishment of the National Fisheries Federation and Fisheries Organizations at District and village levels (61.si); (c) implementing conservation and management measures adopted including those under UNCLOS (Section 61 (t)(i)); IOTC (Section 61 (t)(ii): the fish stocks agreement (Section 61 (t)(iii)); and the United Nations Agreement on Port State

Measures to Prevent, Deter and Eliminate Illegal Unreported and Unregulated Fishing IUU (Section 61 (t)(iv).

Fauna and Flora Protection (Amendment) Ordinance, No. 22 of 2009

74. The Fauna and Flora Protection (Amendment) Ordinance, No. 22 of 2009 (Government of Sri Lanka, 2009) enables the creation and management of national reserves and sanctuaries and also provides schedules of fauna and flora that are protected. A National Reserve can be made only on state land while a sanctuary can be declared on state and/or private land. The ordinance provides the protection, conservation and preservation of the fauna and flora of Sri Lanka and prevention of the commercial exploitation of such fauna and flora. Amendments have been made to include the control and management of national reserves, the protection of elephants and buffaloes in areas outside national reserves and sanctuaries, the capture and keeping protected animals, offences and penalties, prohibition of the import or export of protected animals, and protection of plants.

75. The Department of Wildlife Conservation (DWC) is the agency responsible for implementing the provisions under the Act which includes the responsible for all fauna and flora within national parks, reserves, sanctuaries and for all protected species throughout Sri Lanka that are listed in the schedules to the Act.

76. A number of national parks, reserves and sanctuaries exist in the Northern Province.

- The Vankalai Sanctuary (Vankellei), which was declared 2008 and has a total area of 4839 hectares (ha) and is a RAMSAR wetland site. The sanctuary is located in the Mannar District and as such is outside of the PPFHDP site.
- Adam's Bridge National Park was declared in 2015 and has a total area of 18,990 ha. The sanctuary is located in the Mannar District and as such is outside of the PPFHDP site.
- Chundikulam National Park was declared in 2015 and has a total area of 19,565.33 ha. The sanctuary is located in the District of Kilinochchi and as such is outside of the PPFHDP site.
- Kokilai Sanctuary was declared in 1951 and has a total area of 1,995 ha. The sanctuary is located in the District Mullaitivu and as such is outside of the PPFHDP site.
- Vedithalathivu Nature Reserve was declared in 2016 and has a total area of 29,180 ha. The sanctuary is located in the District of Mannar and as such is outside of the PPFHDP site.

77. Section 75 of the 1970's Fauna and Flora Protection Ordinance (Chapter 469) specifies that "The Provisions of the Fisheries Ordinance shall cease to be in operation in any National Reserve or Sanctuary as from the date on which such National Reserve of Sanctuary is duly constituted under section 2; but subject as aforesaid, the provisions of the Ordinance shall continue to be in operation in any area outside a National Reserve or a Sanctuary".

78. The Fauna and Flora Act also stipulates that "no person or organization, whether private or State shall within a distance of one mile of the boundary of any National Reserve declared by Order made under section 2, carry out any development activity of any description whatsoever without obtaining the prior written approval of the Director General".

79. Sri Lankan protected fauna and flora in the schedules of the Act, of particular relevance to the PPFHDP, include:

(i) **Marine Mammals:** including and number of Whales and Dolphins (*Ballaenopteridae*, Physeteridae, Delphinidae) and the Dugong (Dugong *dugon*).

(ii) **Reptiles**: Two species of Crocodiles *Crocodylus palustris* - Marsh or Mugger and *C. porosus* - estuarine and 5 marine turtles *Caretta* - Loggerhead, *Chelonia mydas* - Green, *Eretmochelys imbricata* - Hawksbill, *Lepidochelys olivacea* - Olive ridley and *Dermochelys coriacea* - Leatherback.

(iii) **Birds**: Large number, 240 are breeding residents with 46 endemic.

(iv) **Fish**: Several species of fish including certain reef fish (sharks are not mentioned).

(v) **Invertebrates:** All species of Lepidoptera; A number of coelenterates including certain corals; certain annelids (fan worms); certain molluscs including giant clams (*Tridacna sp.)*, chambered nautilus (*Nautilus sp*.) and the paper nautilus (*Agronauta sp.);* certain echinoderms including the slate pencil urchin and the royal sea cucumber (*Pseudicolochirus sp.*)

(vi) **Plants**: Various plants including plants associated with mangrove environments such as Nipa palm (*Nypa fruticans)*, and the common mangrove trees (*Lumnitzera littorea*, *Ceriops decandra* and *Sonneratia aptelata),* 28 species in total.

80. In addition, the Forest Ordinance, one of the oldest ordinances in the country, first enacted in 1887 under which the Forest Department. This act has been amended several times in the past. The Forest Reserves gazetted under the provisions of the ordinance and all proposed reserves that are not gazetted under these provisions but selected for conservation based on biological and hydrological importance should be taken into account in implementation of this project.

Felling of Trees (control) Act No. 9 of 1951

81. The Felling of Trees (Control) Act published by the Minister of Agriculture, Land, Irrigation and Power in the Gazette No. 18856 of October 13, 1962 under the Felling of Trees (Control) Act No. 9 of 1951 (Chapter 452) controls the prohibition, regulation or control of feeling trees. Trees to be removed (felled) require a valid permit issued by an authorized officer.

Marine Pollution Prevention Act, No. 35 of 2008.

82. The Marine Pollution Prevention Act, No, 35 of 2008 (Government of Sri Lanka, 2008) provides the mechanism to establish the Marine Environmental Protection Authority (MEPA) and the Marine Environmental Council (MEC), with the function (among other things) of: the “prevention, reduction, control and management of pollution arising out of ship based activity and shore based maritime related activity, in the territorial waters or any other maritime zone, its fore-shore and the coastal zone of Sri Lanka”; and taking “measures to manage, safeguard and preserve the territorial waters of Sri Lanka or any other maritime zone, its fore-shore and the coastal zone from any pollution caused by any oil, harmful substance or any other pollution.”

83. Preventative measures against pollution, maritime casualties, prevention of pollution in respect of criminal and civil liability, and prevention of pollution when engaged in exploration of natural resources including petroleum or any related activity are inclusive including monetary offence penalties for all convictions (Part VII – Prevention of Pollution – Criminal Liability).

84. Paragraph 28 of the Act establishes that the owner or operator of a ship, offshore installation or pipeline may apply to MEPA for a permit to dump oil, any harmful substance or other pollutant into the coastal zone; and the preceding paragraph (29) indicates that

MEPA takes into account the type of pollutant and the disposal location, and grants the permit where it is satisfied that there will be no harm to any living species or effect on water quality and no disruption of any marine activity. The application procedure is established by the Marine Environmental Protection (Issuance of Permits for Dumping at Sea) Regulations No 01/2013, published in Gazette Extraordinary No 1816/3719 of 28 June 2013. Similarly, Schedule I of the Regulations provides quality standards that have to be met by any discharge from land based industries including fishing and fisheries harbor activities.

Pradeshiya Sabha Act No. 15 of 1987

85. The Pradeshiya Sabha Act provides the legal mechanism to provide each Pradeshiya Sabha (PS) area the local authority within such area and be charged with the regulation, control and administration of all matters relating to public health, public utility services and public thoroughfares and generally with the protection and promotion of the comfort, convenience and welfare of the people and all amenities within such area. The construction of roads, causeways, bridges, buildings, waste water and sewage systems come under the purview of the PS and as such need its approval to be developed.

The Ma-del (beach seine) Regulations of 1984

86. Ma-del (beach seine) fishing regulations of 1984 and subsequent amendments are applicable to the beach seine fishery in the entire island. The key features of these regulations are the designation and protection of special areas where beach seining can be carried out and the limitation of entry into beach seine fisheries. These features are in line with the principles of community-based fisheries management and incorporate the traditional management practices of this fishery in the past.

87. All beach seine fishing operations are to be carried out exclusively from designated beach seine warayas (bays or harbors) identified in the regulations by name and an assigned number and only by beach seine owners who are registered and issued with permits for such operations at those warayas which are reserved for their use. Many warayas have more than one padu (the reserved portion of the beach for a registered beach seine owner). The length of a padu, reserved by law for the beach seine owner's exclusive use, ranges from 500 m to 1 km. A common feature of most of these regulations is the prominence given to the concept of community-based management in the ordinances, which in many cases approved and legalized the rules made by the inhabitants of the concerned areas where the rules would apply to their fishing grounds. Key features of the beach seine regulation include:

- Where there are two or more registered owners or groups for a padu, a system rotation of turns, agreed upon by all owners, shall be observed.
- Within a beach seine waraya, the use of mechanized craft for the operation of a beach seine is prohibited.
- While a beach seine is in operation, no mechanized boats are to navigate within the waters of a beach seine waraya.
- Boats other than those used exclusively for the operation of beach seines are prohibited to be anchored in the beach seine waraya or to be beached on the foreshore adjoining the beach seine waraya.
- Within the beach seine waraya, the use of any fishing gear or fishing boat other than those prescribed by these regulations are prohibited.

Mines and Mineral Act No 33 of 1992

88. The Mines and Mineral Act No 33 of 1992 requires that all mining and exploitation for minerals in Sri Lanka is licensed by the Geological Survey and Mines Bureau (GSMB). This applies to earth and quarry materials excavated for use in construction. For the PPFHDP site all quarry material used, the site will required to possess an Industrial Mining License category A permit.

Antiquities (Amendment) Act No. 24 of 2008

89. The Antiquities (Amendment) Act No 24 of 1998, and the implementing regulations published in Gazette Extraordinary No 1152/14 of 4 October 2000 require that an Archaeological Impact Assessment is conducted in relation to every proposed development project with a land area of over 0.25 ha. The purpose of the assessment is to examine whether there are antiquities in the land, to determine the impact of the proposed development and to provide alternative measures if necessary.

Land Acquisition Act No. 9 of 1950

90. Land Acquisition Act No. 9 of 1950 falls under the responsibility of the Ministry of Lands (MoL) in partnership with other relevant ministries and District and Divisional Secretaries to manage land acquisition for public purposes and is guided by the provisions and procedures outlined in the Act. The Act includes a national involuntary resettlement policy and a mechanism for payment for compensation which includes crop damages. The Local Authority Regulations of 2008 provides further guidelines for the local management and arrangements for the acquisition of land.

Soil Conservation (Amendment) Act No. 24 of 1996

91. Soil Conservation (Amendment) Act, No. 24 of 1996 falls under the responsibility of the Department of Agriculture (DoA) and provides the mechanism to; (i) Enhancement and substance of productive capacity of the Soil; (ii) to restore degraded land for the prevention and mitigation of soil erosion; and (iii) for the Conservation of soil resources and protection of land against damage by floods, salinity, alkalinity water logging. The Act provides the authority to declare land as conservation areas and provides soil conservation guidelines associated with plantation crops in conservation areas.

2.2 National Environmental and Resource Policies

Northern Province Integrated Strategic Environmental Assessment (ISEA)

92. The Integrated Strategic Environmental Assessment for Northern Province was produced by the Central Environmental Agency (CEA) and Disaster Management Center (DMC) in 2014 (CEA, DMC, 2014). It is more an approach than a policy and includes three development scenarios proposed in the context of the impact of a number of proposed activities on Strategic Environmental Objectives (SEOs). The three scenarios include: (i) Business as usual scenario; (ii) Conservation scenario; and (iii) Development scenario.

93. The ISEA has colour coded the likely effects of the three scenarios on the SEOs and includes: White: Likely to improve their status; Red: Probable Conflict with their status and is unlikely to be mitigated, therefore needing special attention; Amber: indicating Potential Conflict with their status with mitigation options possible; and Green: No Likely interaction with their status.

94. Sea Fisheries and all water and land based activities associated with this industry is one activity identified under the ISEA that is directly relevant to the PPFHDP. None of the three ISEA scenarios indicate a likely improvement in SEOs. Under the business as usual scenario sea fisheries is in probable conflict with the status of SEOs in respect of “marine biodiversity”, is unlikely to have an interaction with respect to “disaster prone” and is in potential conflict with the other SEOs. Marine fisheries are in potential conflict with all SEOs in the conservation scenario and the development scenario.

95. The ISEA highlighted the existing small fishery harbor at Point Pedro however it does not discuss the redevelopment of this location into a significantly larger and more productive fisheries harbor (refer Proposed Developments, Opportunity Areas and Catchment Areas map page 47 of the ISEA map atlas). Nevertheless the ISEA provides

extensive information on the current status of the Northern Province and provides clear mechanisms to be considered for implementation to ensure environmental sustainable development.

Climate Change Policies

96. The Climate Change Secretariat (CCS) produced the National Climate Change Adaptation strategy for Sri Lanka (CCS, 2010), the National Climate Change Policy for Sri Lanka (CCS, 2012), and the National Adaptation Plan for Climate Change Impacts in Sri Lanka (CCS, 2016a). A key instrument for implementing climate change policy is the Intended Nationally Determined Contributions (INDC) process under the Paris Agreement of September 2015.

97. Sri Lanka submitted an initial assessment of (INDCs) in April 2016 (Government of Sri Lanka, 2016c). All INDCs are relevant to the PPFHDP and in particular: (i) mitigation measures in respect of forestry (mangroves and coastal vegetation); (ii) adaptation measures in respect of food security in fisheries, coastal and marine sector, biodiversity sector and tourism and recreation sector; (iii) compensation for loss and damage resulting from climate change.

98. Sri Lanka INDCs are now Nationally Determined Contributions (NDCs) since Sri Lanka has signed the Paris Agreement. A “Readiness Plan” for implementation of INDCs was produced in August 2016 (CCS, 2016b).

Fisheries Policy

99. Key policy documents related to fisheries that are relevant to the PPFHDP include: the ten-year Development Policy Framework of the Fisheries and Aquatic Resources Sector 2007-2016 (Government of Sri Lanka, 2007); the mid-term policy framework 2013-2016 which provides a roadmap for 2013 to 2016 (Government of Sri Lanka, 2012); and the 2015 MFARD performance report (Government of Sri Lanka, 2015). There were six major objectives of the initial strategy that are still considered to be the framework in the absence of a new framework:

1. “Increase per capita fish availability by 2013 to 60 g per day, which is the amount recommended by the Medical Research Institute for per capita consumption to satisfy the animal protein requirements of a person.
2. Increase the national fish production to 685,690 MT by 2013.
3. Establish price competitiveness of fish by promoting competitive marketing.
4. Increase the volume of fish exports to 36,700 MT by 2013 and thereby increase foreign exchange earnings.
5. Increase the living standards and socio-economic status of the fisher community through social empowerment, livelihood diversification, and improvement of civic amenities and infrastructure.
6. Manage fisheries on a sustainable basis with due recognition to obligations under the United Nations Convention on the Law of the Sea and other international treaties concerning fisheries, biodiversity and marine environment”.

100. Objective 2 has two key interventions proposed that are of particular relevance to the NPSFDP. These are: (i) Increase the fishing effort in the coastal and offshore/deep sea subsectors by increasing the fleet size; and (ii) Rehabilitate the fishing activities in the Northern Province. Seven policy reforms were also indicated:

1. “Declaration of more fisheries management areas to undertake fisheries co-management;
2. Cancellation of fees levied for registration and renewal of registration of fishing boats, issuance of fishing operation licenses, issuance of permits for collection,

transport, keeping in possession, trade, export, etc. as applicable for lobster, chank and sea cucumber;
3. Banning of the use, possession, import, transport, purchase or sale of monofilament nets;
4. Banning of trawl fishing operations except by non-mechanized canoes;
5. Compulsion of the use of live-jackets in fishing boats;
6. Exemption of the sector from paying income tax for a period of 5 years;
7. Provision of a fuel subsidy."

101. The mid-term policy framework review (Government of Sri Lanka, 2012) identifies a number of constraints to implementation of the strategy in respect of investments proposed under NPSFDP and specifically the PPFHDP, these include: (i) a shortfall in central government budget allocation; (ii) a lack of investment in offshore/deep sea vessels to be addressed by providing subsidized bank loans; (iii) lack of uptake of improved fishing (gillnets to long lines) and post-harvest technologies (refrigeration etc.); (iv) lack of management of inshore fisheries leading to overfishing; (v) fish pricing; (vi) export market constraints due to deficient compliance with certification requirements. Five specific objectives are listed for the 2013-2016 roadmaps:

1. To increase the national fish production and per capita availability of fish;
2. To improve the quality of fish landed and eliminate post-harvest losses or reduce to insignificant levels;
3. To increase fish exports;
4. To improve fisheries management to ensure long-term sustainability of the resources;
5. To improve social-security of the fisher community".

102. The roadmap indicates the production target for offshore/deep sea fisheries as 332,300 MT in 2013, 383,200 MT in 2014, 452,900 MT in 2015 and 583,900 MT in 2016. The Fisheries Statistics yearbook for 2015 (Government of Sri Lanka, 2016d) indicates that the target was exceeded in 2013 (445,930 MT) and 2014 (459,300 MT). Major issues and constraints are identified as:

1. "The low level of technology is hampering optimal exploitation of deep sea resources;
2. Investments by the private sector in large scale infrastructure development and deep-sea fishing are inadequate;
3. Post-harvest losses are relatively high (30%), and market chain and transport facilities for fish are poor;
4. Aquatic environment including the coastal environment has degraded and its management is poor;
5. Reliable and up to date marine fisheries and inland fisheries resource data are not available;
6. The fishing capacity is not commensurate with the extent of fisheries resources. Boats capable of fishing in deep sea waters account for only 9 % of the total marine fleet, and 43 % of the operating boats are non-mechanized traditional boats. Most of the other boats are outboard-engine powered boats".

103. The roadmap identifies a number of incremental outputs from a 2012 baseline by 2016 (Government of Sri Lanka, 2012, table 19). These include:

- 150 high-sea fishing vessels;
- 850 multiday boats (IMUL);
- 1800 Iday boats;

- 5400 OFRP boats;
- 7 new fishery harbors/upgrading of anchorages to fishery harbors;
- 3000 MT ice production capacity;
- 42 improved infrastructures at fishery harbors and anchorages;
- 4 fish processing zones (none proposed for Northern Province);
- 250 larger boats/multiday boats with onboard refrigeration;
- 3000 aquaculture farms including cage farms;
- 40 export certifications (MSC, organic, etc.);
- Establishment of a Vessel Monitoring System (VMS);
- 80 FMA with co-management;
- 2000 non-mechanized traditional craft withdrawn.

104. MFAR performance review of 2015 (Government of Sri Lanka, 2015) lists key landmarks of the fisheries sector in 2015 as:

- Fish Production (Jan-Sep 2015) 384,610 MT;
- Per capita fish consumption - 44.6 g/day;
- Contribution of fisheries sector for the Gross Domestic Production (GDP) at the end of 2nd Quarter - 1.7%;
- Contribution of fish and fishery products to the total export earnings - 1.8%;
- Export value of ornamental fish – Rs.1957 million.

105. The performance review also signals key activities and proposed developments in the fisheries sector many of which are relevant to the proposed PPFHDP. Most significantly the review signals efforts to improve the management of offshore/deep water fisheries by introducing Vessel Monitoring Systems (VMS), logbooks and catch certification.

106. The PPTA IEE (ADB, 2017) through discussions with Department of Fisheries and Aquatic Resources (DFAR) indicated that for the Northern Province;

- 28 Lagoon Fisheries Management Areas (FMA) have been declared, out of 116 proposed, no of which are within the PPFHDP site;
- No fisheries reserves/refugia as such are designated, just seasonal reserves (everywhere) for certain species, for example lobster from September to February;
- Coastal FMAs are proposed but not designated;
- No FMAs are proposed offshore.

107. In respect of the Code of Conduct for Responsible Fisheries (CCRF):

- **Seabirds**: Sri Lanka has not produced a National Plan of Action (NPOA) for seabirds. It is reported that “Sri Lanka has determined that seabird interactions are not a problem for their fishing fleets. However, a formal review has not yet taken place.
- **Sharks:** Sri Lanka produced a National Plan of Action for Sharks in 2013 (Government of Sri Lanka, 2013). A number of species have recently had a ban on fishing imposed due to concerns about their status including a 2012 ban on fishing of thresher sharks and a 2015 ban on fishing of oceanic white tip and whale sharks.
- **Sea turtles**: Marine turtles are legally protected in Sri Lanka. In the longline fishery only circle hooks are used (J-hooks are banned). Gillnets longer than 2.5 km are now prohibited in domestic legislation on the high-seas. Reporting of bycatch is facilitated via logbooks reserving a separated box”.
- **Illegal, Unreported and Unregulated (IUU) Fisheries**: Sri Lanka produced a Sri Lanka National Plan of Action for Illegal, Unreported, and Unregulated fishing (SLNPOA-IUU) in 2013 (Government of Sri Lanka, 2013b).

Coastal Resource Policy

108. The principal instrument of coastal resources management policy is the Coastal Zone and Coastal Resource Management Plan (CCCRMD) which is legally mandated to produce at regular intervals. The latest draft version of the plan was issued in the summer of 2016 (Government of Sri Lanka, 2016). The following is extracted from the Plan.

109. Key instruments for the delivery of the plan are: a requirement for a permit for development activities (refer **Figure 2-2)** ; permit conditions including coastal setback and other zoning conditions; and the development and delivery of management plans including for "Affected Areas", "Beach Parks", "Coastal Access Plans", "Conservation Areas", and "Special Management Areas (SMA)".

110. The plan provides updated coastal setbacks for Sri Lanka including for Northern Province. No "Affected Areas", "Beach Parks", "Coastal Access Plans", "Conservation Areas", and "Special Management Areas (SMA)" are currently specified for Northern Province. The setback distances specified in the updated coastal setbacks are not applicable in respect of Protected Areas where any protected area falls within coastal segment; it will be considered a "no build zone".

111. Protected Areas include RAMSAR Wetland sites, Buffer Zones, Sanctuaries, Reserved Forests, Conservation Forests, National Heritage Wilderness Areas, Strict Nature Reserves, National Parks, Nature Reserves, Jungle Corridors, Refuges, and Marine Reserves.

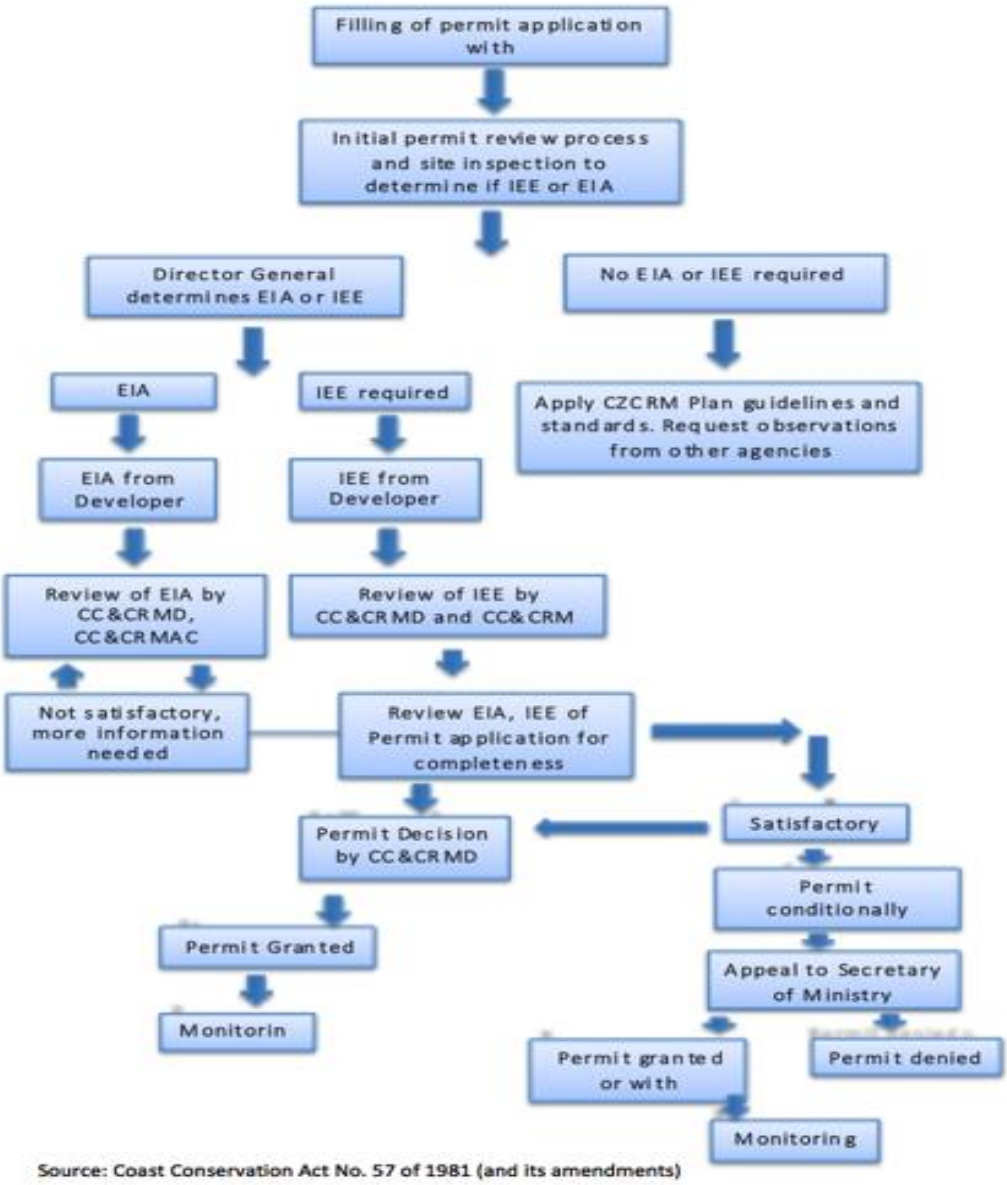
112. It is indicated that a 300m setback shall be applied to FMA, Fisheries Reserves or any other designated area or site declared by the Government of Sri Lanka. A total of 200 m setback shall be applied to all coastal archaeological sites designated by the Department of Archaeology.

113. The Plan does not propose any "Affected Areas". Two existing "Beach Parks" are listed but no new ones are proposed. Neither of the existing "Beach parks" is in Northern Province. No new "Conservation Areas" are proposed. No coastal access plans are specified.

114. The following areas are proposed to be declared as Special Management Areas in Northern Province, north of which are in close proximity to the PPFHDP site:

- Mullaitivu District: Nanthikadal Lagoon and Nai Aru Estuary;
- Jaffna District: Manalkadu Dunes; Jaffna Estuary (town area); Thondaimanaru Lagoon; Kankesanthurai and Keeramalai coastal area; Mandativu, Delft; Nainativu Islands; Karainagar (including Casuarina beach) coastal area; Navali Coastal Area.
- Mannar District: Gulf of Mannar; Thalaimannar coastal area; Sillavathurai; Arippu and Aruvi Aru coastal area; Bay of Kondachchi.

Figure 2-2: Development Permit Requirements (Coast Conservation Act No. 57 of 1981 (and its amendments).



Source: Coast Conservation Act No. 57 of 1981 (and its amendments)

Biodiversity, Protected Areas and Species Policies

115. The main policy instrument for protected areas and species is the National Biodiversity Strategic Action Plan (NBSAP) and responds to Convention of the Parties (COP) requirements under the CBD. The NBSAP (Government of Sri Lanka, 2016) covers the period 2016-2022. 12 targets are proposed to be delivered by 2022. No target is quantified. Targets of particular relevance to PPFHDP include:

- Target 3 relates to protected areas: 0.3% of marine areas are indicated to be protected by law compared with the Aichi target of 10%. There is no indication of any proposed additions to the coastal and marine protected areas network.

- Target 4 relates to species: The priority action is to update the Red List. No species are specifically proposed for additional protection. However, Target 4 action 6 specifies “regularize turtle hatcheries with appropriate guidelines for scientific management and a monitoring system established”.

- Target 6 relates to the sustainable use of biodiversity, including fisheries: Note is made of “improving harvesting methods and preventing overexploitation through proper resource management, especially in the marine sector”. Target 6 action 4 specifies “Promote best practices to minimize the destructive harvesting methods used for biological resources from terrestrial, aquatic and marine systems” and target 6 action 5 specifies “Assess the present levels of harvesting of freshwater and marine finfish/ shell fish and develop and implement recovery plans for finfish/ shell fish species stocks that are depleted due to overexploitation”.

- Target 7 relates to strengthening the traditional use of biodiversity: It is proposed to be achieved, in part, by improving community-based resource management. Target 7 action 6 specifies “Identify gaps in FMA and implement programs to address the identified gaps”.

- Target 11 relates to enhancing resilience and adaptation in ecosystems such as forests, wetlands, mangroves and coral reefs through ecosystem-based adaptation including in respect of climate change. Target 11 action 1 specifies “Initiate research and monitoring programs on the impacts of climate change, infrastructure development, and natural hazards on biodiversity” and Target 11 action 43 specifies “Implement mangrove and river bank restoration and forest conservation projects for watersheds”.

2.3 ADB Safeguard Policy (SPS)

116. The ADB Safeguard Policy Statement 2009 (SPS) has the objectives to (i) avoid adverse impacts of projects on the environment and affected people; (ii) where possible; minimize, mitigate, and/or compensate for adverse project impacts on the environment and affected people when avoidance is not possible; and (iii) help borrowers/clients to strengthen their safeguard systems and develop the capacity to manage environmental and social risks. The environment safeguard requires due diligence which entails addressing environmental concerns, if any, of a proposed activity in the initial stages of project preparation.

117. The SPS categorizes potential projects or activities into categories of impact (A, B or C) to determine the level of environmental assessment required to address the potential impacts. The ABD SPS is aligned with and compliments the country safeguard system (CSS) of the Government of Sri Lanka (GoS).

118. ADB and the PPTA consultant assigned an Environment Category B classification for the full scope of works to be undertaken within the NPSFDP project indicating that potential adverse environmental impacts are site-specific, few if any of them are irreversible, and in most cases mitigation measures can be designed readily.

119. A Rapid Environmental Assessment (REA) of the Point Pedro Fisheries Harbor Development project undertaken by the PDA environmental team confirmed the category B environmental classification. Accordingly, this IEE has been prepared as the requisite level of assessment to address the potential impacts in line with the SPS.

120. ADB’s SPS applies pollution prevention and control technologies and practices consistent with good practices as reflected in internationally recognized standards such as the World Bank Group’s Environmental, Health and Safety Guidelines (EHSG). The EHSG

provide the context of international best practice and contribute to establishing targets for environmental performance. Standards incorporated into the EHSG will be used in parallel with Sri Lankan government environmental standards throughout this document with the principals of due diligence and a precautionary approach adopted. Application of occupational and community health and safety measures, as laid out in the EHSG is required under the SPS.

2.4 International and Regional Treaties and Agreements

121. Sri Lanka is signatory to a number of International environmental agreements including those for regional agreements on atmosphere, biodiversity, marine and coastal, terrestrial and chemicals of relevance to the project. The names, purpose and the date of ratification of these agreements are provided in **ANNEX 2**.

2.5 Sir Lanka Environmental Clearance and Permits Requirements

122. The PPFHDP will need to apply for a development activity permit from the relevant permit authority. The Coastal Conservation and Coastal Resources Management Department (CCCRMD) is the development permit authority within the "Coastal Zone" (see Glossary) and the Central Environmental Authority (CEA) is the development permit authority outside the coastal zone. In addition, the i) Ministry of Fisheries and Aquatic Resources Development (MFARD) is the permitting authority in respect of fish and certain aspects of marine pollution; (ii) CEA in respect of land based sources of pollution including within the coastal zone; (iii) Marine Environmental Protection Authority (MEPA) in respect of marine sources of pollution and; (iv) Department of Wildlife Conservation (DWC) in respect of biodiversity protection areas under the Fauna and Flora Act. Detailed clearance and permits required for the PPFHDP are listed in **Table 2-3**.

Table 2-3 : Details of the clearances/permits required for the development of the PPFHDP.

	Clearance/Permit	When Required	Status
1	Approval from the Coast Conservation and coastal Resources Management Department.	Prior to start of activities.	Pending submission of IEE/EIA.
2	Approval from the Divisional Secretary, Divisional Secretariat, Vadamarachchi North.	Prior to start of activities.	Approval pending
3	Approval from National Water Supply and Drainage Board.	Prior to start of activities.	Approval provided- Annex 2.1.
4	Approval – Consent from Jaffna District Coordination Committee.	Prior to start of activities.	Approval provided. Annex 2.2
5	Approval from the Vadamarachchi North Divisional Coordinating Committee (DDC)	Prior to start of activities.	Approval provided.
6	Approval from District Land Utility Committee.	Prior to start of activities.	Approved provided by DCC.
7	Approval from District Environmental Committee.	Prior to start of activities.	Pending to be completed after submission of IEE/EIA.
8	Approval from the Point Pedro Urban Council	Initial approval for the building plans prior to start of construction and certification of conformity for the buildings.	Pending: required to submit drawings to council once design completed.

9	Approval of Ministry of Fisheries and Aquatic Resources	Prior to start of activities.	Approval provided.
10	Approval from Ceylon Electricity Board	Prior to start of activities.	CEB has confirmed availability of electricity supply for project. Annex -2.3
11	Ministry of Defense (Navy)	Prior to start of activities.	Pending.
12	Sri Lanka Customs	Prior to start of activities.	Pending.
13	Approval from Road Development Authority for transportation of heavy vehicles and equipment.	Prior to start of activities.	Pending.
14	Approval from Department of Archaeology.	Prior to start of activities.	An Archaeological Impacts Assessment has been conducted and recommendations are provided. **Annex 9.**
15	Solid waste disposal arrangement with Point Pedro Urban Council.	Prior to start of activities.	Pending. Submission after final design drawing completed.
16	Geological Survey and Mines Bureau for blasting operations.	Prior to start of activities.	Pending: To be undertaken by contractor based on IEE/EIA EMP.
17	Geological Survey and Mines Bureau for metal quarries and Borrow areas	Prior to start of activities.	Pending: To be completed after submission of IEE/EIA, GSMB to approve EMP.
18	Environmental Protection License for the operation of the quarries and Borrow areas	Prior to start of activities.	Pending: Submission and approval of IEE/EIA.
19	Police and DS approval for sand and metal/armors transportation.	Prior to start of activities.	Pending.

3 DESCRIPTION OF THE PROJECT

3.1 Description of the project

Location

123. The location of the project is 9°49'43.43"N and 80°14'8.36"E. The proposed project site is located in the Vadamarachchi North Divisional Secretariat (DS) Division (VNDS) in the Jaffna District along the AB 21 road. The proposed harbor area is located in the Point Pedro Grama Niladari Division. The surrounding area also covers the villages of Koddady in the east, Point Pedro and Supparmadam in the west. The visuals of the surrounding area and the location map of the proposed project are given in the **Figure 3-1 and 3-2** respectively.

Figure 3-1 Visuals of the surrounding area of the project

1. Western Site of project area

2.Eastern Side of project site

Figure 3-2 : Location Map of the proposed project

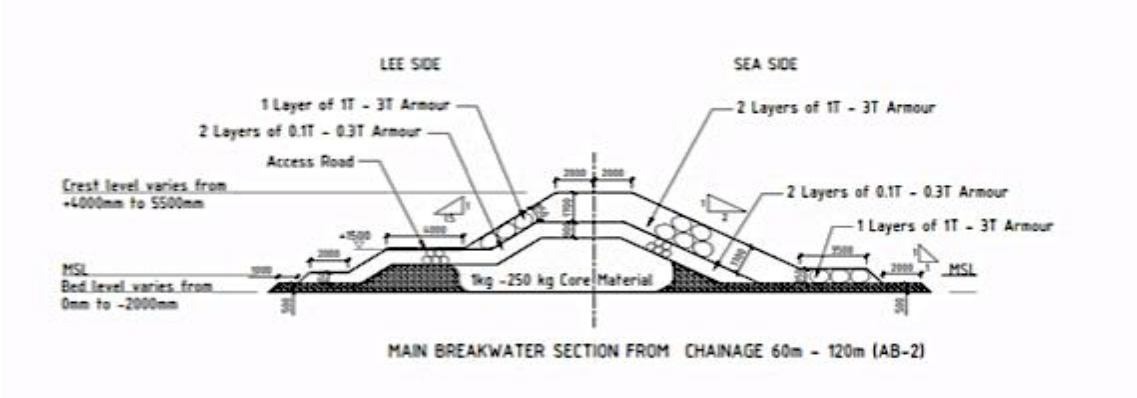
Details of Project Structures;

124. The major project structures to be constructed include; 2 breakwaters, establishment of harbor basin, jetties, quay walls, a slipway and a number of land-based infrastructure buildings. The major components of the projects are given in **Figure 3-4.** The details of the each of the major structures are given in the following section.

i. Breakwaters

125. There are two breakwater structures will be constructed. The eastern side will be the main breakwater with a length of 886 m starts from a depth of 0 MSL near shore to -10m MSL. The second breakwater has a total length of 425 m and will be constructed on the western side of the harbor basin and has a water depth of 0 to -9m MSL depth. It is estimated that a total of 327,500 m^3 rock is required to construct the breakwaters. Sample cross section of the breakwater is given in **Figure 3-3**. The predicted sea level rise for 2070 was considered 0.45 m for the designing purposes.

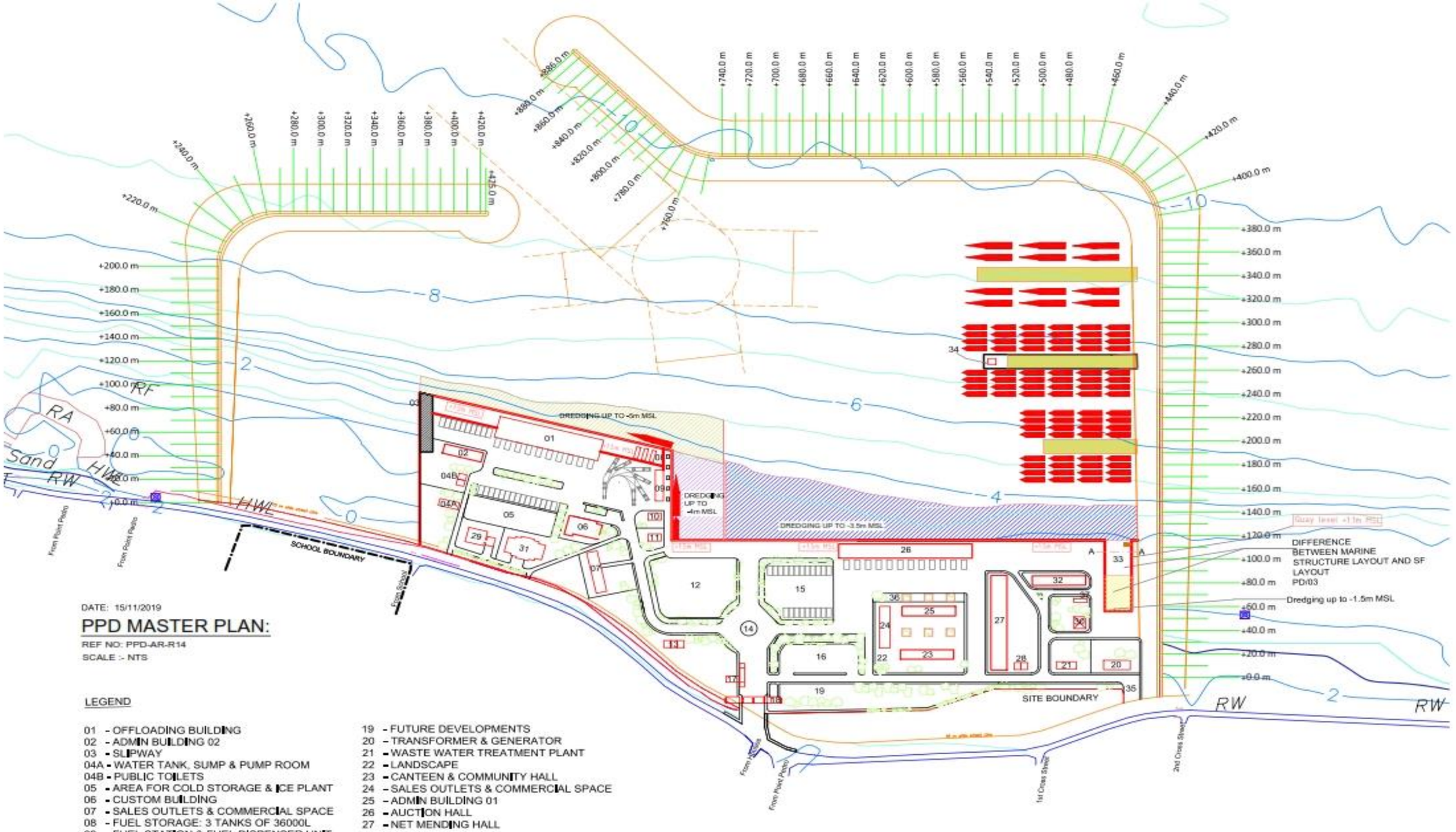
Figure 3-3 : **Sample Cross section of breakwater**



ii. Harbor Basin.

126. The size of the harbor basin is 17.8 Ha. The construction of the harbor includes dredging of 1.6 ha to remove approximately 18,000 m^3 of sea bed.

Figure 3-4: Proposed activities of the Project



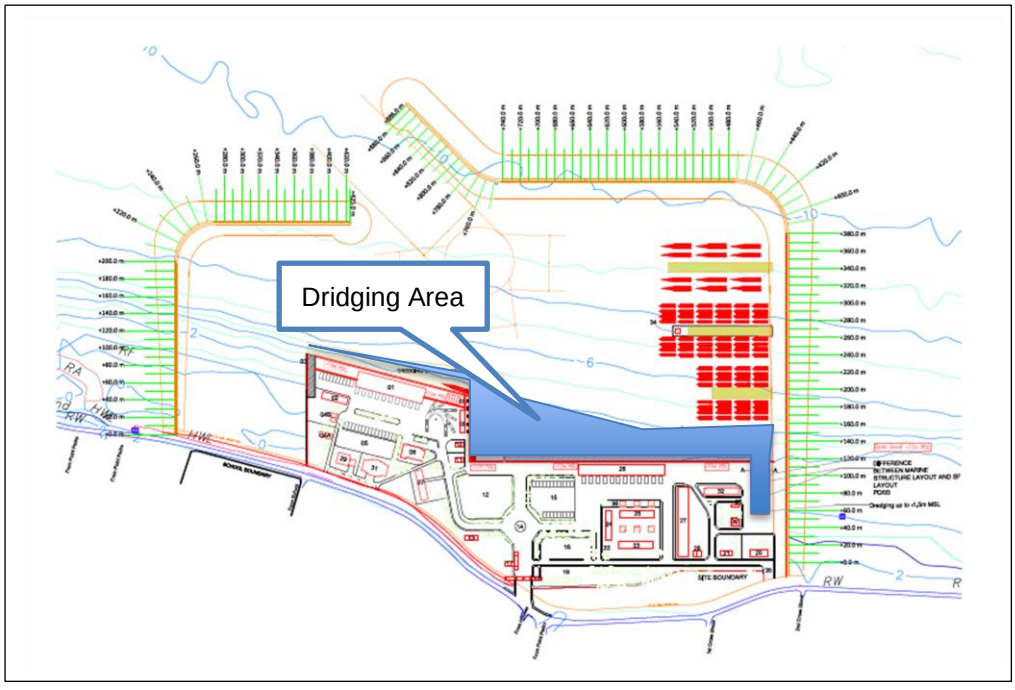
iii. Basin Dredging

127. The projects dredging program will be undertaken near the quay wall. The western side of the basin will be dredged up to - 5 m from MSL whilst the eastern side will be up to –3 m from MSL. The dredging plan is given in the **Figure 3-5.**

128. According to the bathymetric subsurface soil study the top layer about 1m depth contains soft sand, which will be removed by using a cutter suction dredger located on a barge with all material directly pumped to the filling area (reef reclamation area). The second layer about 1 m depth will be removed by the excavators and the bottom layer with hard limestone will be removed by chemical and explosive blasting. Chemical blasting will be carried out in the project area adjacent to the Methodist High School (western side) in order to reduce the noise and vibration affecting the day to day operations of the school. The use of explosives will be confined to the western sections of the harbor basin. The blasted materials will be collected by using barge mounted excavator into barrage and transported to the onshore reclamation area

129. The sea bed mainly contains of an upper layer of sand with underlying limestone. It is expected approximately 18,000 m^3 of material to be removed. This will be used for the refilling the harbor shore reclamation within the project area.

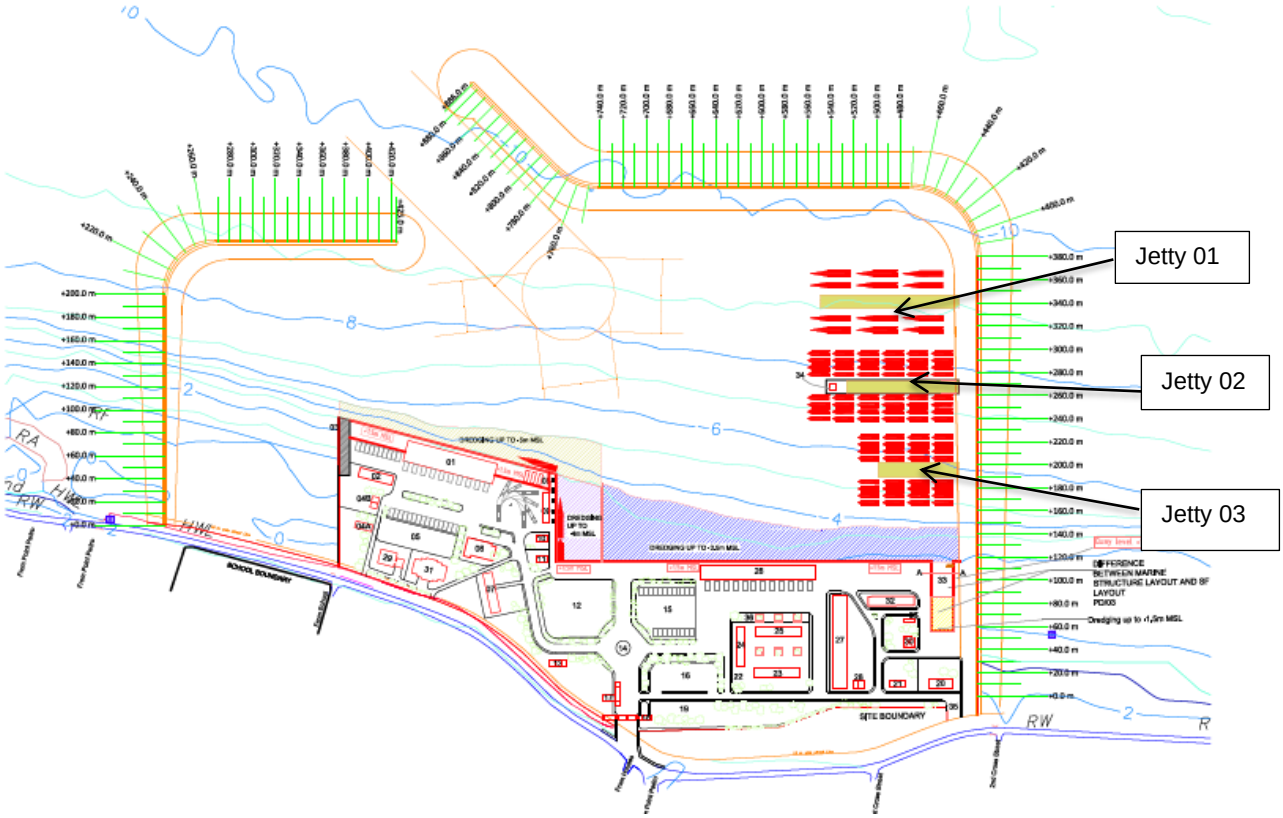
Figure 3-5 : Dredging Plan



iv. Berthing Facilities

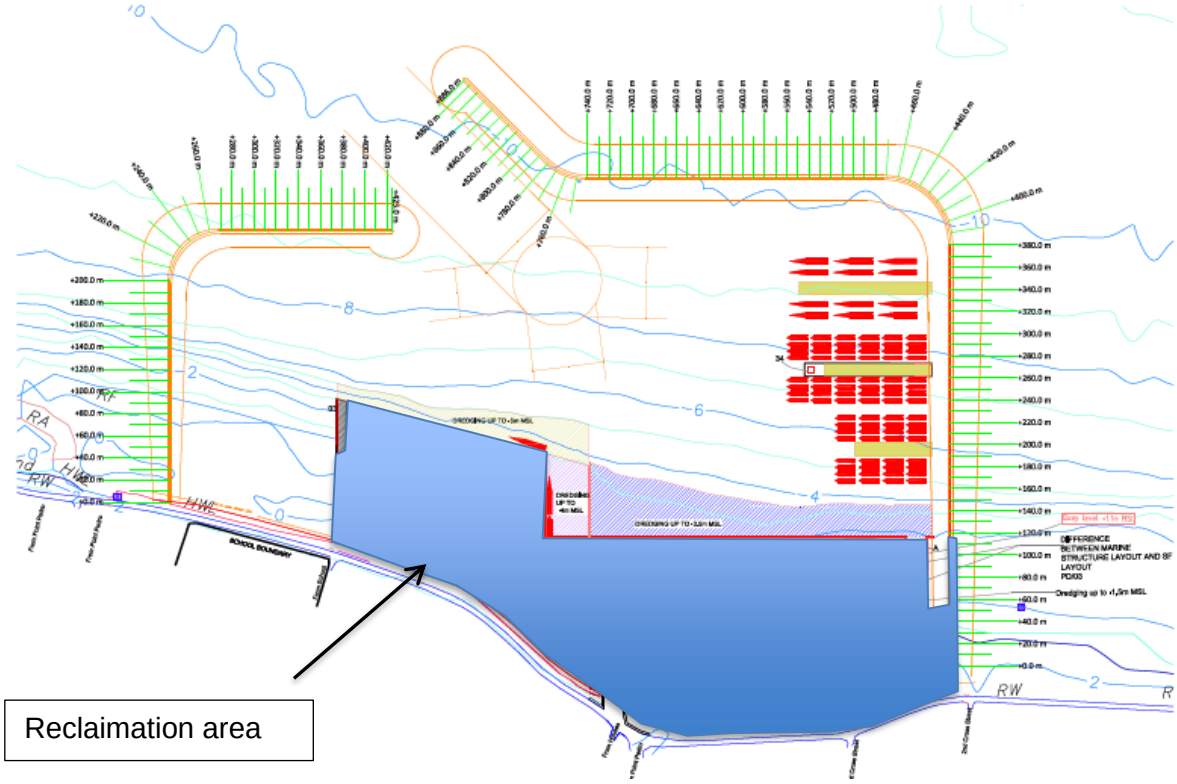
130. The fishermen take rest after each fishing trip and therefore, the vessels have to be berthed in the harbor basin alongside the berthing quay during the rest period. At the berthing quay, the fishermen take out their fishing nets either for drying or net mending and then reload the nets into their boats before proceeding on next fishing trip. There are three berthing jetties attached to the primary (eastern side) breakwater. The primary jetty has a length of 120 m and will accommodate 12 large IMUL boats (Trade vessels). The second jetty has a length 115m to accommodate 48 medium size IMUL boats. And the third jetty is having a length of 70m to accommodate 32 small IMUL boats. The location of the jetties is given in Figure 3-6 below.

Figure 3-6 : Locations of the Jetties



v. **Land Reclamation:** The shore area of the proposed site is lying about 2 m below the existing road ground level. Therefore, the shore area and the intertidal reef flat area are required to be reclaimed to accommodate the shore facilities. It is estimated that about 16 Ha area has to be refilled with suitable materials. The proposed refilling area is shown in the **Figure 3-7**. The refilling material requirement is about 117,000 m^3. And there is about 18,000 m^3 excavated materials from dredging and it can be used for the refilling. The balance 99,000m3 will be brought outside of the project area, from a licensed quarry/borrow sites.

Figure 3-7: Refilling area

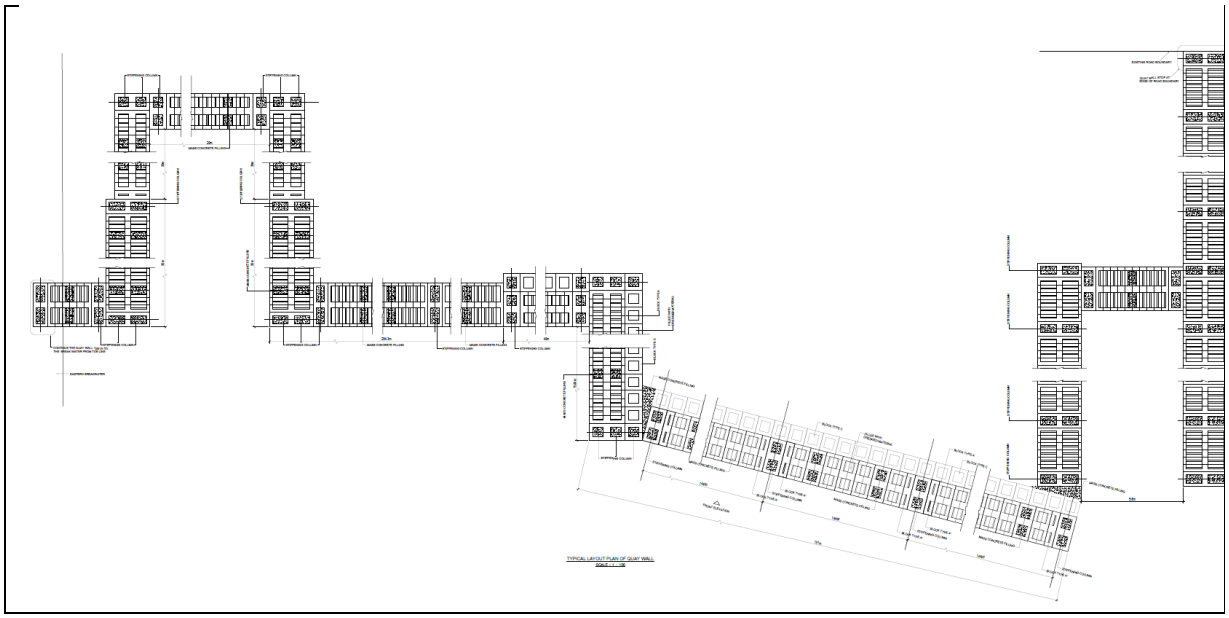


vi. Quay Wall

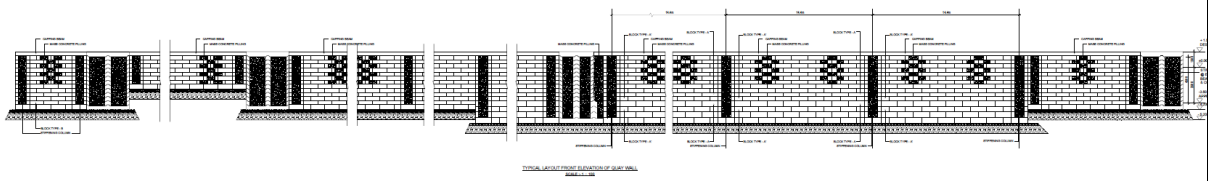
131. There will be three quay walls constructed. One each for the different sizes fishing vessels utilizing the fisheries harbor. The length of the quay wall for the large vessels will be 270 m length for a -5m MSL water depth to accommodate the parking capacity of 8 boats and the length of quay wall for the small boats is 324 m length for a -3.5 m MSL water depth with a capacity to park 35 boats. And the third quay wall is having the length of 60m and to accommodate 24 OFRP boats. In addition to these, 70 m quay wall will be provided for the fuelling the boats.

132. Plan view, Elevation view, Cross sections for -5m MSL are given below in **Figure 3- 8.**

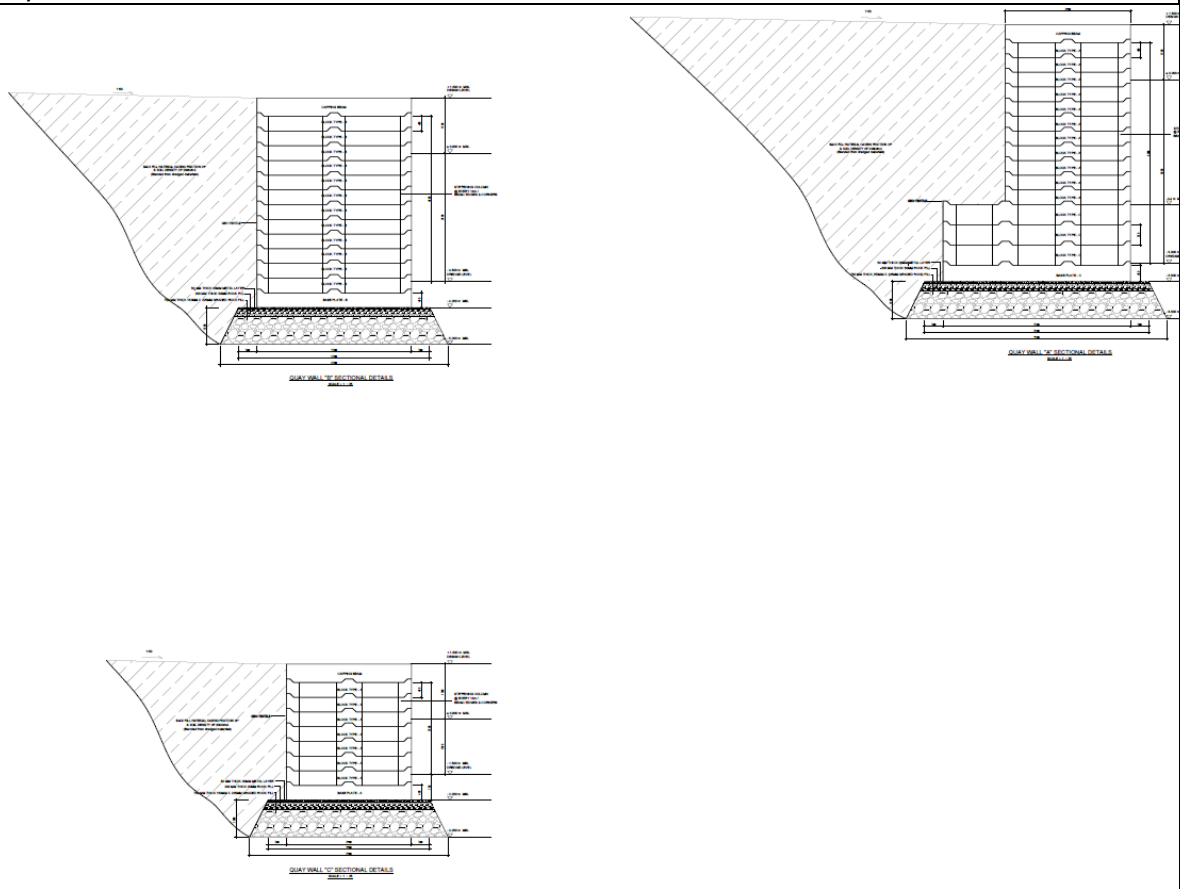
Figure 3-8: Plan view, Elevation view, Cross-sections



Quay wall Layout



Quay wall front view

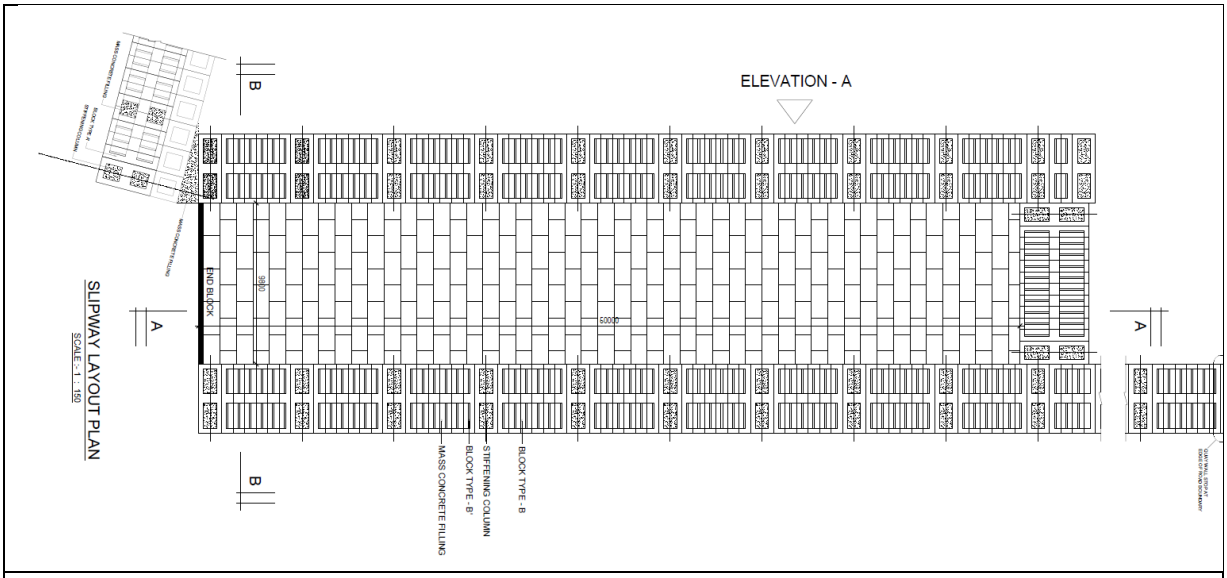


Quay wall block work arrangement

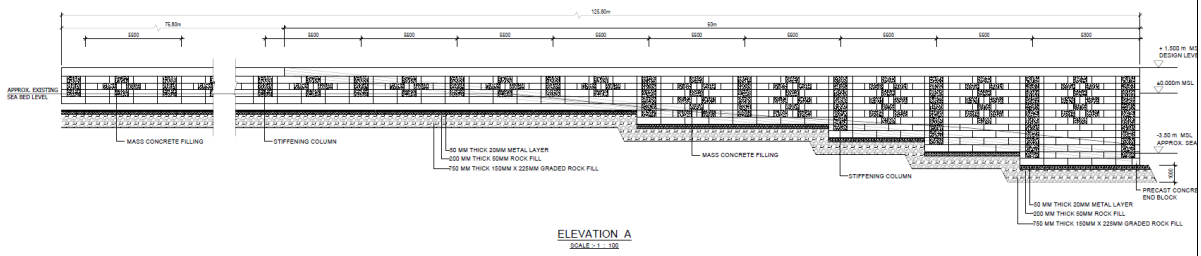
vii. Slip Way

133. The size of the slip way is 45 m x 10 m. The slips ways main purpose is for maintenance and repair of fishing vessels. The slipway consists of rail tracks usually laid on a concrete ramp or on pile structure sloping from shore to the water. Every time the fishing vessel is to be moved from water to shore or vice versa, it is pulled by a winch run on electrical or diesel operated motor. Slipway can easily handle vessels up to 75 tonne and as such, they can take most of the bigger size fishing vessels. The most economical and convenient slope for the slipway is 1: 12 (8.3%). The longitudinal section of the proposed slipway is given in **Figure 3-9**.

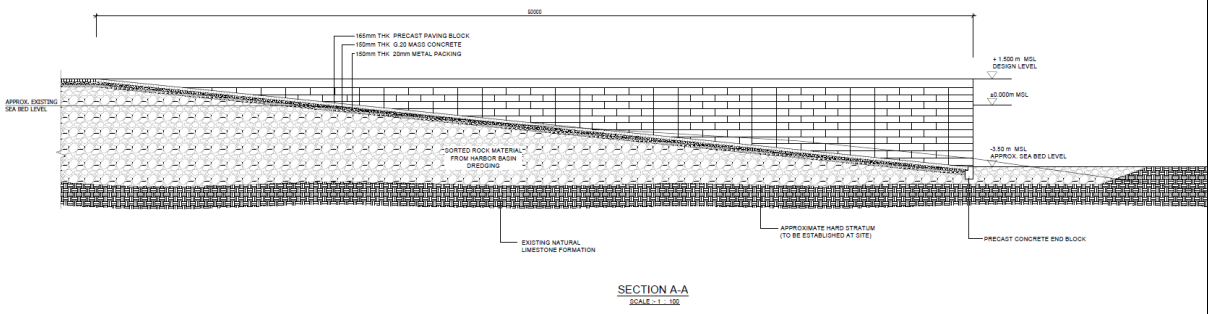
Figure 3-9 : Longitudinal section of the proposed slipway



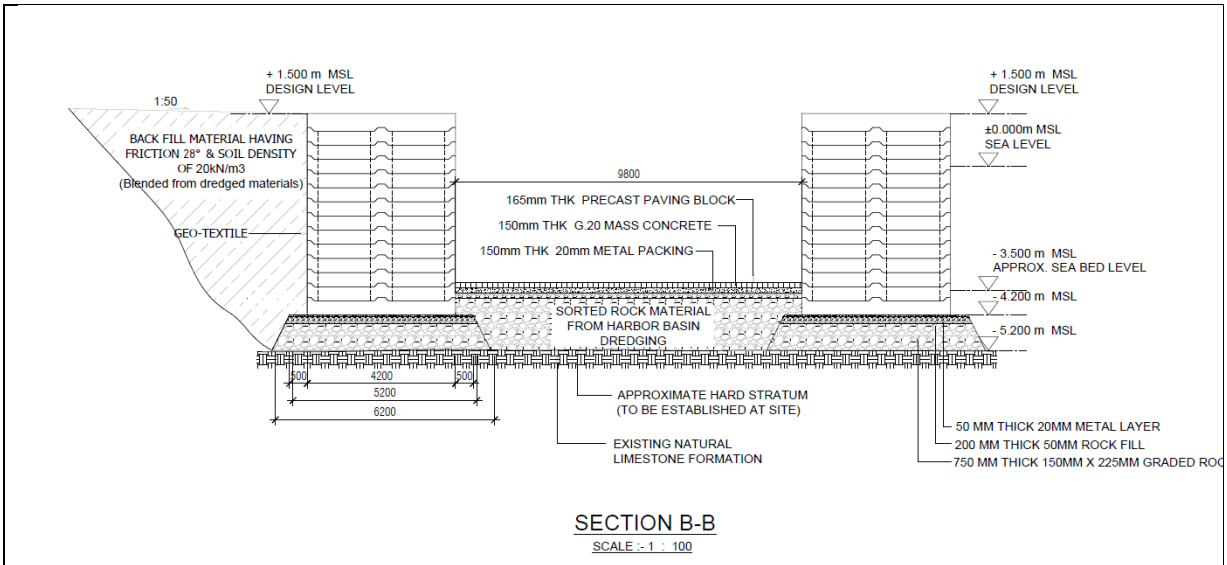
Slipway Layout



Slipway Elevation



Slipway Section A-A



Slipway Section B-B

On shore Infrastructure Facilities

Net Mending Hall The net mending hall is a single-story building with a floor area of about 1,050 m^2. Half wall will be constructed with the earth brick and concrete exposure. The floor will be cement- rendering and the roofs are tiled.

Community Hall and Canteen: The community hall and canteen building is a two-story building. The total floor area is 890 m^2. The ground floor is allocated for the canteen while the upper floor is allocated for the community hall. The canteen will be provided facilities, such as kitchen, space to accommodate 6 staff, and the seating capacity of 75 to 100. The upper floor consists of a society office and community hall with a capacity of 125 seats.

Bachelor Quarters: It is a single-story building with a total floor area of 420 m^2. There are four twin bed rooms to accommodate eight senior office staff and dormitory to accommodate 10 junior officers. Four bath rooms will be provided for twin bed rooms and three common bathrooms will be provided for the dormitory. In addition to this, common dining room and living area also will be provided.

Harbor Manager Quarters: Harbor Manager Quarters will be a two storied building. Ground floor consists of a garage, stores and accommodation facility. Two cars could be parked in the garage, one for Harbor Manager (HM) and the other one for the Deputy Harbor Manager (DHM). The ground floor with floor area 223 m^2 is allocated for the HM and the upper floor with floor area 156 m^2 is allocated for the DHM. Both floors consist of two bed rooms and two bath rooms, pantry, dining area and utility rooms,

Surveillance Building: The size of the building is 1,600 m^2 (40m x40m). The surveillance building is a two-story building with facilities to accommodate marine police, coast guard and high sea fisheries. The ground floor is offices for the above officers. The coast guard office and the marine police office will be provided with the facilities to accommodate three senior officers and two junior officers, supporting assistants and a bath room in each facility. The high sea fisheries office consists of facilities to one senior officer, one assistant, four supportive staff and seats for visitors. Radio office accommodation facilities also provided in the ground floor. The 1st floor will be used as accommodation facility to the marine police, coast guard and high sea fisheries. The marine police accommodation consists of 5 beds and one bathroom. The coast guard accommodation consists of two bedrooms, 2 bathrooms, pantry, living area and dining area. High sea fisheries

accommodation facilities consist of one bed room, one bath room, living area and dining area.

Auction Hall : Action hall is a single story with a floor area of 1,200 m^2 (100 m x 12 m) will be located close to the sea area 2 m away from the quay wall and 50 m away from the closest residential areas in order to reduce the smell and the noise to the community in the vicinity. There will be 16 lorry bases for loading and unloading and 28 inbuilt concrete auction tops. Drainage facility is provided for the collection of wastewaters. All wastewater generated in the auction hall will be directed to a collection pit and then directed to the Wastewater treatment system that has been designed to accommodate the expected number of users and will use a septic design system.

Parking area: Two parking areas are provided for the proposed fishery harbor. One for public area and other one for the auction hall. The public parking area has a total floor area of 3,750 m^2 to park 30 vehicles and an auction hall parking area is plan to accommodate 90 bicycles, 50 motor cycles, 51 tractors, 6 lories and 21 other vehicles.

Public toilets: The total area for the public toilet is 82 m^2. Five toilets, three washing basins and four urinals are provided for males and five toilets and four washing basins are provided for females. One disabled toilet for male and female is provided.
All toilet and waste water systems utilized within the project site have been designed to meet the expected demand based on the anticipated number of users. All systems will be connected to an on-site wastewater treatment plan. (see below)

Wastewater Treatment Facility: The treatment facility will be provided within the project area to treat all wastewater, including sewage generated from the operation of the fishery harbor. It is estimated that about 61.8 m^3/day wastewater will be generated. The concept of suitable treatment system is discussed in **Section 3.6.2.**

Security Facilities: Two security blocks will be constructed, one at the entrance and the location of the other will be considered during the construction stage. Total floor area of each toilet bock is 30 m^2 with a bathroom.

Weighing Bridge and Control Room.: The fisheries harbors weighing bridge is to be located near the sites main gate. The total land area is 70 m^2. Initially, 40T weighing facility will be provided and the design could accommodate 60T facility, if necessary, in future.

Fuel Facility: There will be fuel office and 3 x 36,000-liter capacity tanks with 3 x dual dispenser units to cater for both small and lager boats. The floor area of the fuel office is 30 m^2. The fuel facility will be located near the offloading area and will include Sri Lanka standard security and safety requirements.

Off Loading Building: Total floor area of the offloading building is 1,100 m^2. There will be a total of three processing cool rooms, each cool room will contain a store, office and hanging rooms. There will be an elevated flat plate form for each cool room. The wastewater generated from the cool rooms will be directed to the wastewater treatment plant.

Transformer and Generator Facilities: Facilities will be provided to install A 800 kVA transformer and standby generators with the capacity of 250 kVA and 350 kVA. Alternative solar power will be provided and used within the fisheries harbor with excess sold to the local electricity provider.

Security Fence: 1m high rubble wall and chain link fence above with green vegetation is proposed.

In addition, space for a public recreational zone with restaurant (4,115 m^2), sales outlet and commercial space (35 m x 8 m /2 units), cold storage and ice plant will be provided to the private sector for investment.

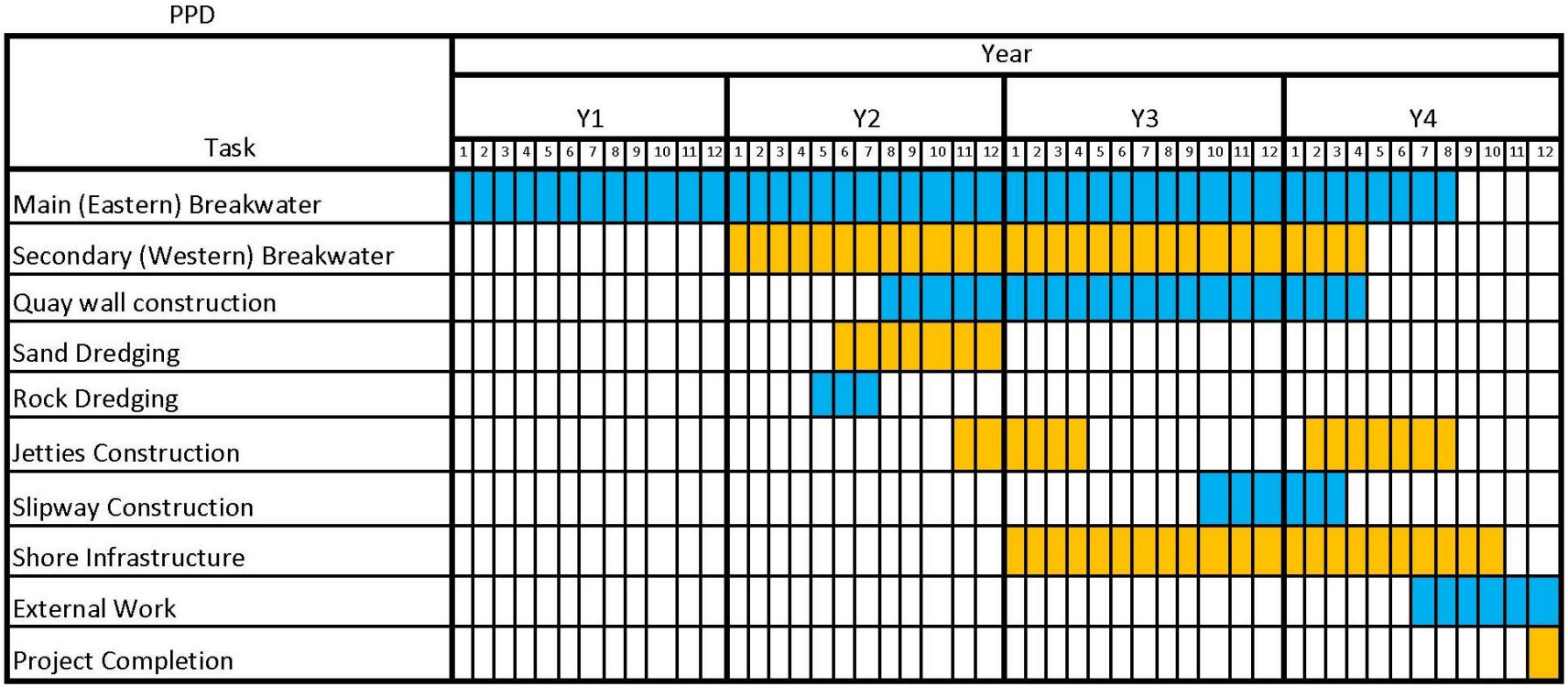
3.2 Detailed drawings indicating all project components

134. A drawing indicating breakwaters, jetties, quay walls, harbor basin, entrance canal，proposed dredging areas, dumping sites, off shore facilities access roads to the site, reservation etc. is given in **ANNEX 3.**

3.3 Time period for the development and construction

135. The estimated project construction time frame is five years which includes the period of procurement of works Contractor for 15 months. Construction contractor will prepare a detailed work plan and get the approval from the PIMU prior to commence the works. The tentative construction work schedule is given in **Figure 3.10.**

Figure 3-10 : Tentative construction work schedule



3.4 Financial allocations and investments

136. The project is estimated to cost Rs 12 billion ($ 75,840,000.00), it is proposed for ADB funding with GOSL funding local taxes.

3.5 All other natural resources consumption and Green building concepts

137. Major portion of the natural resources will be rock boulders, which will be sourced from approved quarries and lumber that will either be imported or purchased from local market.

138. The buildings will be constructed to be climate resilient, energy efficient/saving and green building concepts to ensure international acceptance. Sustainable building materials and energy requirements will be utilized. The building materials sourced, where possible, will be from eco-friendly materials. Designs have included the energy reduction activities (direction towards wind for cooling buildings etc.) to ensure efficiency of design. See **Figure 3.11.**

Climate Resilient

139. Climate resilient features incorporated in the shore facilities building designs have included:

- Wide Roof Eaves to control effects due to sea breeze and rain.
- Corridors designed alongside office areas to avoid the areas getting wet.
- Cement use to be minimized to reduce efflorescence.
- Use of clay bricks & tiles to increase indoor comfort.
- Covering of the building roof systems to decrease impacts of the coastal weather marine conditions.
- Use of external sealant to prevent moisture absorption for walls/columns
- Use of Anti-corrosive application for steel elements / using galvanized steel.

Energy conservation and green building concepts include;

140. The followings green building concepts are considered for the offshore buildings:

- Maximum provisions have been kept for cross ventilation and natural lighting.
- Use of locally available materials (i.e. bricks, timber, clay tiles).
- Minimal use of cement & steel.
- Effective master planning considering the functional and environmental requirements.
- Use of Solar energy.
- Landscaping to reduce heat island effects.
- Rain water harvesting systems.

Figure 3-11 : Concept design of the proposed buildings

Administrative Building -Front View

Administration Building Front Verandah 1st Floor

Administrative Building – Rear View.

Administrative Building – Rear Verandah.

3.6 Details of Construction and Operational Activities

Water Requirement (Constructional and operational Phase)

Water requirements / Water Supply system

141. The estimated water requirement for the construction period is 20 m^3/day including construction water and about 111 m^3 /day during the operational period. The water requirement is given in the **Table 3-1.**

Table 3-1 : Water requirement.

Component	No. of persons/area/unit	Rate	Total water (L/per day)
Auction hall/net mending	2500 m^2	10 l/m2	25,000
Boats	400 unit	100l/boat	40,000
Staff – full time resident	50 persons	120 l/d/person	6,000
Staff –fulltime, non-resident	50 persons	50 l/d/person	2,500
Fishermen and crew	500 persons	50 l/d/person	25,000
Visitors	500 persons	25 l/d/person	12,500
Total generation per day			**111,000**

142. **Construction stage:** There is no adequate good quality water near the project for construction purposes. As such premix concrete will be used where required to minimize water requirements for the project. The remaining water contractor required to locate suitable water for construction. The construction of the offshore infrastructure facilities is to commence by the year 2021. By this time the proposed Jaffna de-salinization plant will be completed and operational by 2020. Through discussions with NWSDB, water quantities required for the project can be provided.

143. **Operation stage:** Total water operational requirements of the project has been estimated at 111 m^3/d. The NWSDB has confirmed that the about 50 m^3 of the required amount of portable water can be provided once the Jaffna Killinochchi Water Supply Project de-salinization plant is complete and operational. The plant is expected to be commissioned in 2020 and as such will be fully operational before the expected operational requirements of the harbors land-based facilities (expected 2023). The balance will be utilized from the ground water for the washing purposes.

Wastewater

Type of effluents

144. Wastewater from the construction period is mainly generated from the workers' activities, including domestic use. All domestic wastewater during this period will be discharged into portable septic systems.

145. As indicated in the **Table 3-2,** 61.8 m^3 of wastewater will be generated from the operational phase. The wastewater will be generated mainly from the fish processing area, washing of auction hall and general bathing requirements. The wastewater generated from the auction hall and the fish processing area contaminated with blood water, water discharges from washing and cleaning, scraps of flesh, blood and soluble substances from entrails, detergents and other cleaning agents. All wastewater generated from the harbors operational activities will be discharged into the onsite waste water treatment plant.

Table 3-2 : Total quantity of wastewater generation

Component	**No. of persons/area/unit**	**Rate**	**Total water (L/per day)**	**Generation rate**	**wastewater Quantity (L/day)**
Auction hall/net mending	2500 m^2	10 l/m2	25,000	100%	25,000.00
Boats	400 unit	100l/boat	40,000	0%	-
Staff – full time resident	50 persons	120 l/d/person	6,000	80%	4,800.00
Staff –fulltime, non-resident	50 persons	50 l/d/person	2,500	80%	2,000.00
Fishermen and crew	500 persons	50 l/d/person	25,000	80%	20,000.00
Visitors	500 persons	25 l/d/person	12,500	80%	10,000.00
Total generation per day			**111,000**		**61,800.00**

Arrangements for disposal of sewage (both during construction and operation),

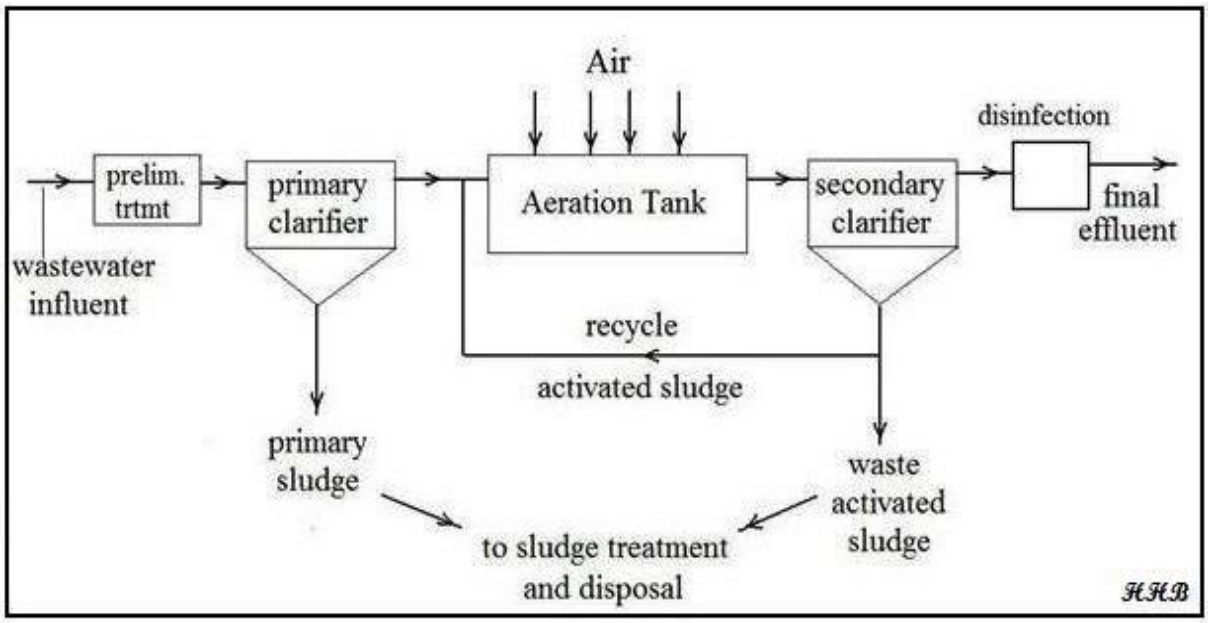
146. During construction period it is proposed to discharge all wastewater and sewage into portable septic tanks. The temporary septic system will include a soakage pit. During the operational period the wastewater will be directed to the onside wastewater treatment plant.

Proposed method of treatment and disposal of wastewater

147. The management and treatment of the wastewater generated from the operational phase of the fish harbor will utilise an activated sludge process. The main advantage of this systems process is the efficient and effective removal of BOD, COD and other nutrients from wastewater. This type of wastewater treatment plant is successfully operated at Dikkowita Fisheries harbor to treat the similar type of wastewater.

148. The conceptual activated sludge treatment flow chart is given in the **Figure 3-12** and includes;

Figure 3-12: Activated sludge Water Treatment Flow Diagram



1. **Pretreatment**: The wastewater generated from the processing area and market area will be sent through screens to remove the scales and the other fish parts entering to the treatment plant. The scales and settled material will be removed from the screens and disposed within the harbors normal organic waste management regime.
2. **Primary clarifier**: The pretreated wastewater will be directed to the primary clarifier where large particles will be settled and removed at the bottom of the clarifier for disposal. The wastewater will be directed to an Aeration tank.
3. **Aeration tank:** Air is mechanically supplied to the wastewater to aerobically activate the microorganism to decompose the organic matters and to form large size flocculants, which are easily settled at the bottom of the clarifier. The treated water (mixed liquid) is discharged to the secondary clarifier
4. **Secondary Clarifier:** The mixed water is discharged into the secondary clarifier where live bacteria settle to the bottom, dead bacteria rise to the top and form a crust with a clear liquid in the middle. This clean water is then discharged into either a watercourse or a soak away. The live bacteria, called activated bacterial sludge, are returned to the Aeration tank to re-seed the new raw sewage entering the tank and the dead bacterial crust is removed as sludge in dry beds to dispose.

5. **Sludge Drying Bed**; Sludge from the primary and secondary settling tanks will be collected in a dry bed make dry solid before disposal to reduce the moisture contents. The wastewater generated from the drying beds either will be re-directed to the treatment plant or let it for soak in the dry bed itself.

Final point of discharge of treated wastewater, methodology according to the National standards.

149. The wastewater generated will be treated in accordance to the National Environmental Act up to the Tolerance Limits for Industrial and Domestic Wastewater Discharge into Marine Coastal Area as well as to comply with the World Bank's Environmental Health Standard (EHS) guidelines. A pipeline will be provided through the eastern side break water about 100 m away from the shore area to get adequate dilution.

Solid Waste

Construction stage

150. It is expected that there will be about 500t of waste material generated during the construction stage.

151. **Construction wastes:** All construction waste will be segregated as recyclable materials and non-recyclable. All recyclable materials will be sold out for local recycle materials collectors. The non-recyclables material will be used for proposed refilling activity. Any remaining waste (small quantity) at the final stage of construction will be disposed at the local authority disposal site or at an approved site.

152. **Municipal Solid Waste**: The municipal solid waste generated by the workers' camps will be segregated at the source and collected separately. The recyclable materials will be given to the local recyclable materials collectors and the others will be disposed through the relevant local authority collection system.

153. **Operational Waste**

Solid waste during the operational phase includes principally, fish waste, domestic waste and sludge from the wastewater treatment plant. The quantity of each waste is tabulated below.

Component	**No. of people**	**Floor area (m^2)**	**Loading rate**	**Bulk solid waste volume (L/day)**	**Solid waste (kg/day)**
Community hall and canteen	-	890	0.86L/m2/day	765.4	202.1
Staff Quarters	24	799	0.85kg/person	-	20.4
Public recreational area	-	4115	0.05L/m^2/day	205.7	54.3
Surveillance	-	1600	0.05L/m^2/day	80	21.1
Total					**297.9**
Sludge from treatment plant					**50-100** kg/month
Fish waste					**50- 100 kg/day**

154. All domestic solid waste generated from the harbor canteen, boats and other common areas will be source segregated (by keeping different colour bins for separation).

The separated recyclable wastes will be sold out to local recyclable waste collectors and the un-recyclable waste will be disposed through the local authority collection system.

155. Collection facilities (barrels/bins) will be provided in the auction hall sales centre and the processing centre to collect the fish waste separately and used for the production of silage, which can be used as animal feed by a private contractor.

156. About 50 to 100 kg of dry sludge/month will be generated during the peak operation. This consists mainly organic matter, which will be used for landscape purposes in the harbor area, principally along the harbor boundary and eastern side locations.

157. A central storage facility for waste collection will be provided in a location easily accessible to the waste collectors during operational phase. All organic wastes will be collected in bins with proper lid to avoid the spreading of waste by the scavengers. No waste disposal site will be maintained by the harbor management for the MSW. All MSW wastes generated due to the harbor operation will be disposed through the local authority collection systems and recyclable materials will be sold out for recycling.

158. All common areas will be provided with separate colour code bins to separate the different type of wastes which could easily sold out for recycling purposes. The Waste Management Plan is given in **Annex 4.**

3.7 Requirement of labor during construction and operation period.

Construction period

159. About 100 skilled and unskilled labourers will be required during the construction period.

160. The DS data reveals that 51% of the population receive incomes of below Rs 3,000/= and the major portion of the people in the coastal area are involved in part time fishing activities for their livelihoods. Therefore, adequate unskilled labor could be sourced for the surrounding area for the construction purpose.

161. During the construction period, the average and peak laborer strength likely to be deployed at the proposed fishing harbor will be about 50 and 100 respectively including skilled, semi-skilled and unskilled labor. Priority will be given to the local people in the area.

Operational Period

162. It is estimated that approximately 37 employees will be required to operate the harbor functioning in a number of different categories. Considering the future needs, it is assumed as 50 employees full time residential and 50 employees full time non-residential. Priority, will be given to the local people during the operational period for work opportunities. In case of lack of required labourers in the local area, outsiders will be recruited. Canteen operations will be out sourced and it will be tendered competitively, giving an opportunity to fisheries organizations in the areas to operate this facility. The tentative employees requirement is given in the **Table 3-3.**

Table 3-3 : Requirement of employees during the operational period

Location	Place	No. of Person
1	Canteen	6
2	Harbor Manager +Assistant Harbor Manger	5
3	Surveillance Building	
	Police	7
	Coast Guard	7
	High Sea Fishing	6
4	Security	2

5	Weighing room	2
6	Fuel supply	2
	Total	**37**
	Considering the future needs Total	**50**

3.8 Details of the methodologies to be adopted during the construction.

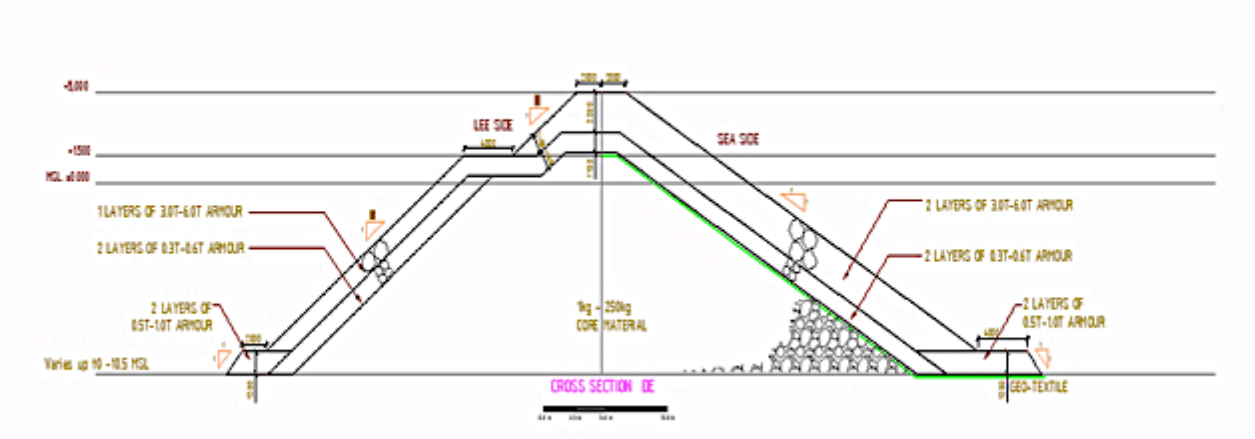
163. Construction will commence with the establishment of the safety measures, such as providing the boundary wall along the Ponnalai-Point Pedro road, placing barricades around the working area, signage (warning) notices and construction of internal working access without disturbing existing roads.

Construction methodology

1. Break Water Construction

164. It is proposed to construct two breakwaters. The eastern side will be the main breakwater with a length of 886 m starts from a depth of 0 m near the shore and ending at (-10) MSL in the sea. The secondary breakwater with 425 m length will be constructed on the western side starts from 0 MSL near the shore and ending at (-9) MSL depth. A sample cross section of the Point Pedro breakwater is given in the **Figure. 3-13.** The construction of breakwater consists of core, filter layer, toe, inner layer or secondary layer and primary layer or armour layer and the crust.

Figure 3-13: Sample Cross Section of the break water proposed for Point Pedro harbor



165. **Core:** The construction of core will be stared from the beach end and moved towards the sea. 1 to 250 kg quarry run will be tipped from 4-5 T tippers from 0 to -10m MSL. The width of the base will be 6 m and the height 15 m. Initially, this core will act as an access road to reach the offshore end of the breakwater for construction purposes. Then the cores will be shaped from the offshore end to toward the land side with a slope of 1:2.

166. **Filter Layer:** The massive rubble stone structure should be stable against disintegration due to excessive settlements due to leaching, undermining or scouring due to wave and current induced turbulence and quick soil conditions, particularly on sandy beds. Filter or bedding layer is required to retain the breakwater structure while passing large volumes of water through it.

167. **Toe Mound Construction:** The tipper Lorries, are taken over the core layer carrying the stones required for constructions of toe mound. The sizes of stones for toe mound are 1 to 5 T armour with two layers. The height and the bottom width will vary with

the distances. These stones shall be handled by a suitable crane with sufficient boom length and placed in toe mound location on both sides of the breakwater.

168. **Inner Layer (Secondary layer):** There will be two layers of stones of sizes 0.3 to 0.6 T armour will be used for construction of secondary layer. This layer is to be laid either manually of placed by excavator of minimum 8/10T capacity. The thickness of the secondary layer will be checked by soundings chain to ensure sufficient thickness of secondary layer is laid along in all the locations. In any location, if less quantity of stones is placed as found by taking soundings, then that area will be filled up to arrive at sufficient thickness of the layer.

169. **Armor layer (Primary layers):** Armor layer is to be placed over the secondary layer on the slope 1:2. Two layers of stones of sizes 3 to 06 T armor will be used for the construction of secondary layer. The breakwater construction shall be carried out in lengths of 10 m until the tip of the breakwater structure is reached. This ensures that breakwater is always safe during cyclonic period. The construction contractor has to ensure the safety of core and secondary layer during construction. The alignment of breakwater shall be checked for every 50 m interval by using total a station instrument. After reaching to the tip of the breakwater, head section is formed. For placement of toe mound section at head section, a crane of 8 to10T capacity will be deployed.

170. **Crest:** Four-meter width of crest will be maintained throughout the two breakwaters except for changes from 480 m to 498 m in the eastern breakwater at the jetty and the changes from 175.8 m to 193.8 m the western breakwater jetty, where the crest width will be 8 m.

2. Dredging

171. It is proposed to dredge 18, 000 m^3 of materials from the sea bed. According to the geotechnical investigation about -1 to -2 m MSL is sand and remaining is lime stone. There are two methods to be used to remove these materials, such as dredging and blasting.

172. **Selection of Dredging Equipment:** There are various types of dredging equipment available for executing capital and maintenance dredging works. These include the following:

- Trailing Suction Hopper Dredger (TSHD),
- Cutter Suction Dredger (CSD),
- Grab Dredger.
- Backhoe Dredger.
- Bucket Dredger.

173. Large dredging outputs are required in order to execute the dredging works for initial capital dredging. This implies that the CSD and Grab Dredger are the only two types of dredging equipment which can be used for executing the dredging works at harbours.

174. A **Cutter Suction Dredger** (**CSD**) is equipped with a rotating cutter head, for cutting and fragmenting hard soils. The soil is sucked up by means of dredge pumps and discharged through a floating pipeline and pipes on shore, to a deposit area.

175. **Grab Dredger:** Blasting operation is needed to remove the limestone bed. Grab or clamshell dredgers will be used to remove the blasted materials from sea bed.

176. **Blasting:** Limestone removal will be explosive blasting with delay detonator and chemical blasting. The explosive blasting will generate more vibration and noise when compare to the chemical blasting. The chemical blasting is more expensive than the explosive blasting. Chemical blasting will be used in areas directly adjacent to the Methodist Girls School to reduce potential noise and vibration impacts, whilst dynamite blasting is expected to be undertaken in all areas further away. Both techniques will be used.

3. Land Reclamation

177. The shore area of the proposed site is lying about -2m from the existing ground level and is required to be reclaimed and filled. It is estimated that about 16 Ha area has to be refilled with suitable materials. All dredged materials on site will be used to refilling. Additional materials required will be sourced from out licenced quarry sites.

4. Construction of Jetties

178. For this type of structure, individual support piles are proposed to resting over the bed rock (2.5m). The piles provide support to the pile cap and deck superstructure.

5. Construction of Quay walls

179. Quay walls are earth retaining structures at which boats can berth. They are equipped with bollards and fenders.

6. Construction of shore building

180. **Land Preparation and Land clearing;** No major clearing is involved as most of the structure will be constructed on the refilled area. The land clearing will be done before refilling the land. Generally, this activity involves using of heavy machinery like backhoe.

181. **Construction of foundation;** The construction of foundation involved in excavation of soil and rubble works**.** Excavation activities will be done manually and using backhoe.

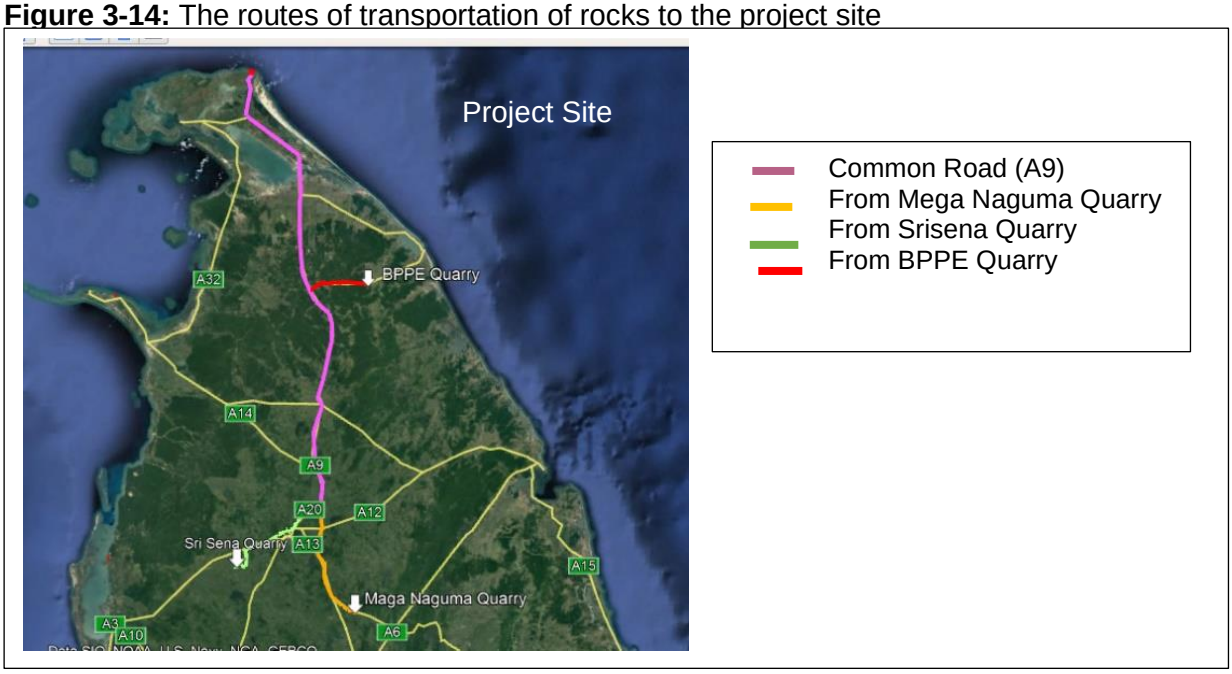
182. **Construction of super structure;** The construction of super structure includes concrete works and building walls with masonry works. Concrete floor construction, masonry work, wood work (Doors and windows fixing) Electrical wiring and fittings installation, water supply, Wash rooms fittings are manually done.

183. **Construction of Roof Structure:** Approved timber/lumber will be used to roofing structures and no asbestos will be used for roofing or within the fisheries harbor site

3.9 Sources of construction materials and transportation, Traffic Management plan

184. The estimated armor requirement is 327,500 m^3. There are no large-scale metal quarries in Jaffna district to source such a large quantity of armor/metals require for the projects construction. Therefore, the material will be sourced from areas of a considerable distance from the project site. The material survey conducted by the DDT has identified three potential quarries in Mullaithivu and Anuradhapura districts. The details of the transport routes are given below. The transport routes from the selected quarries to the project site is given in **Figure 3-14**

Figure 3-14: The routes of transportation of rocks to the project site

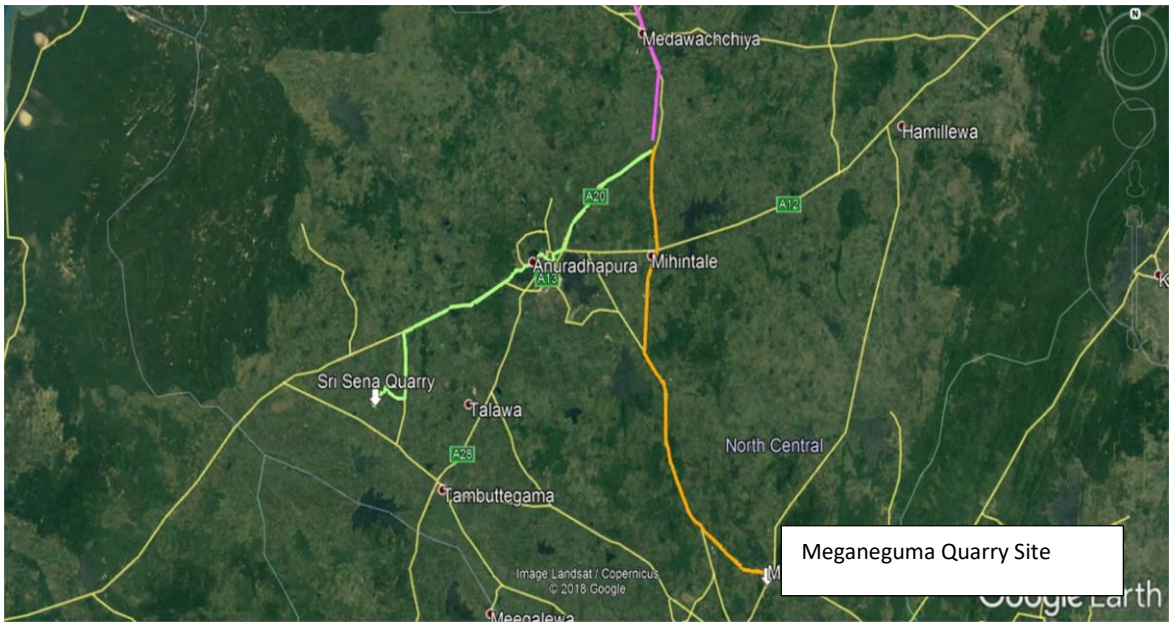


i. P.G.K.D.Sirisena Quarry, is located at Kurula Patha Gala, Nochchiyagama, in Anuradhapura District. The distance from the quarry to the project site is about 225Km.
Transport route: Site → Noichchiyagama → Anuradhapura → Rambewa→ Kandy/ Jaffna (A9) road.

Figure 3-15 The route starts from the Sirisena Quarry to Rambewa Kandy-Jaffna A9 road (light green color) route

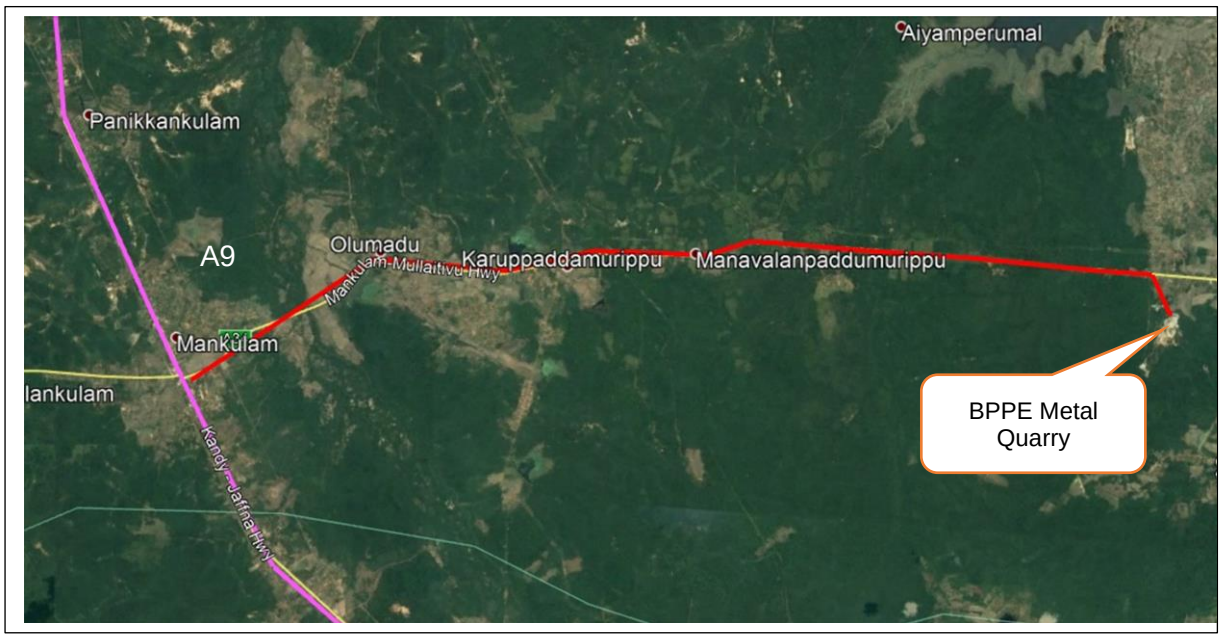
ii. Maga Neguma Quarry, is operated by the RDA and located at Kekirawa road, Ganewalpola in Anuradhapura District. The distance from the quarry to the project site is about 225Km.
Transport Route: Site → Ganewalpola Junction → Habarana, Madankadawala road → Kandy/Jaffna highway (A9)

Figure 3-16 The route starts from the Meganaguma Quarry site to Rambewa Junction (A9) road.



iii. Business Promoters and Partners Engineering (BPPE) Quarry, is located at 14th Mile Post, KATE Quarry, Oddusuddan in Mullaithivu district.
The distance from the quarry to the project site is about 135 Km.
Route: Site → Oddusuddan, Mankulam way → Kandy -Jaffna highway (A9)

Figure 3-17: Routes starts from BPPE quarry to Mankulam Junction A9 road.



a. Kandy- Jaffna highway (A9) → Soran Pattu -Thalayadi Road (B402) → Point Petro - Maruthnkerni Road → East Coast road → project site
b. Kandy- Jaffna highway (A9) → Puloly- Kodikamam – Kachchai road →Jaffna Point Pedro road → project site.
c. Kandy – Jaffna highway (9) → Puloly- Chavakachchari road (B75) → Point Pedro Jaffana road → project site

Figure 3-18: Different options from A9 road

185. It is estimated that about 327,500 m^3 of rocks/armor/metals are required for the construction works. This requires a large number of vehicle traffic movements between the quarry and the project site. The transportation routes pass several cities and urban centers. There could be considerable traffic congestions when passing these places.

186. The selection of quarries is up to the construction contractors' decision. The contractor should carry out a transport impact assessment prior to the commencement of the construction activities to determine the most viable route and determine times of travel.

187. **Stockpiling:** Rock armors are transported from far distances. it is ensured the continuous supply of armors during the construction stage as the lack of armors will inhibit the smooth progress of the construction activities. Therefore, temporary stockpiling area is recommended. The rock armors will be stored in the reef area within the project site in the proposed land reclaim.

188. **Filling Materials**: It is estimated that about 99,000 m^3 of filling materials are required for the reclaim of land for the shore facilities. There are no suitable borrow areas in the Jaffna District. Therefore, the filling materials to be brought from the neighboring districts.

189. As in the **Table 3-4**, it is estimated that about 945 trips vehicle movement is needed for a day for the transportation of construction materials. Therefore, a detail transport impact assessment will be conducted by the construction contractor, prior to commencing the work on the quarry sites and borrow areas are finalized.

Table 3-4 : Estimation of number of trips/days for the transportation of construction materials

Material	Rock armors	Filling Materials
Quantity Required	327,500 m^3	99,000m^3
Total weight (a)	629,375 t	262,350t
Dump track Capacity	10 t	10 t
No. of loads	62,937.5	26,235
Construction period	3 years	1 year
No of trips/day (b)	840	105

Note: a- Density -2.65 t/m^3. b- Working day- 250days/year

3.10 Infrastructure facilities required / provided

i. Details of Infrastructure Facilities provided by the project.

190. The proposed project is to construct a large-scale fishery harbor. The facilities referred in the **Section 3.1** will be provided the general basic infrastructure facilities, such as access roads, electricity is available in the project area.

ii. Electricity requirements / Electricity Supply during construction and operation stages separately.

191. Required electricity will be utilized from three phase electricity from Ceylon Electricity Board supply available in the area for both construction and operational stages. Facilities will be provided to install A 800 kVA transformer and standby generators with the capacity of 250 kVA and 350 kVA during the operational phase. Solar power will also be utilized during the operational period.

iii. Details of Access / parking facilities

192. A good road network system is available to the site. The following roads connect the project site and the outside of the Jaffna District.

i. AB20 – Jaffana - Point Pedro Road
ii. AB21 – Jaffna – Ponnalai – Point Pedro Road
iii. B370 – Point Pedro – East Coast Road
iv. B371 – Point Pedro – Marudamkerni Road

193. In addition, the internal roads are tar roads with good motorable condition. Therefore, no additional access road is necessary.

194. **Parking**: Adequate parking within the harbor footprint is provided within the design. Two parking areas are provided for the proposed fishery harbor. One for general public usage and other one specifically for the auction hall. The public parking area has a total floor area of 3,750 m^2 to park 30 vehicle and auction hall parking area is planned to accommodate 90 bicycles, 50 motor cycles, 51 tractors, 6 lorries and 21 other vehicles.

195. **Beach Access:** The eastern side about 300 m beach will be lost due to the project. But beyond this area, the beach has open access to the Koddady landing site. Therefore, no new beach access will be developed under the project

iv. Communication

196. Adequate communication facilities are available in the area. Private sector mobile phone and landlines are available for the local community. Necessary internal communication system with mobiles phones will be provided.

v. Infrastructure facilities provided by the project to the community and other benefits to the local community.

197. Generally, adequate infrastructure facilities are available to the community in the area. The Road Development Authority (RDA) has already planned to improve the existing Ponnalai-Point Pedro road. Six anchorages and seven landing sites will be improved in Jaffna district under this project.

3.11 Occupational health and safety

198. Occupational health and safety issues during the construction and commissioning of large fishing harbor are common to those of other large-scale projects. These issues include, exposure to dust and hazardous materials that may be present in construction materials and hazardous materials in other building components and physical hazards associated with the use of heavy equipment, or the use of explosives.

199. The following construction safety requirements will be implemented during the construction period:

- Compliance with requirements for the safety of the workmen as per the International Labor Organization (ILO) convention No. 62, No. 167 and Safety and Health regulations of the Factory Ordinance of Sri Lanka to the extent that those are applicable to this construction work;
- Supply of all necessary safety appliances, such as safety goggles, helmets, masks, boots, etc., to the workers and staff;
- Conduct continuous training and awareness programs on health & safety, HIV.
- Pay special attention to Dengue control programs imposed by the Ministry of Health;
- Take necessary actions to prevent breeding of mosquitoes at work sites and labor camps;
- Prevent water stagnation in all areas including gutters, used and empty cans, containers, tires, temporarily dug pits;
- Apply approved chemicals to destroy mosquitoes and larvae regularly;
- Keep all work sites, labor camps, office and store buildings clean and devoid of garbage to prevent breeding of pests, such as rats and other vectors, such as flies;
- Report any outbreak of infectious disease of importance in a labor camp to the Engineer and the Medical Officer of Health (MOH) or to the Public Health Inspector (PHI) of the area immediately. Contractor shall carry out all instructions issued by the authorities, if any;
- Provide a first aid kit at work site as per the regulations
- Provide a sufficient number of bathing facilities, latrines and urinals at every workplace and labor camp in accordance with the Health and Safety regulations
- Ensure emergency fire-fighting equipment is available on-site;
- Prepare fuel storage plan and fuel spill response plan.

3.12 Operation and Maintenance

Requirement of water and sources

200. Required water for construction and operational activities will be provided by the NWS&DB. The estimated water requirement for the construction period is 10 m^3/day and about 111 m3 /day during the operational period.

Proposed methods to be adopted in sewage and wastewater discharges

201. As detailed in **Section 3.6. 2**, All wastewater generated from the operation of the harbour will be discharged into a waste water treatment plant and the treated wastewater will be discharged into the sea.

Waste Oil reception facilities to be employed

202. A centralized waste oil collection facility is provided for the collection of waste oil within the harbor facility. In general, as evidenced in other habors, the boat owners will collect and sell the waste oil to be used in industrial furnace, timber treatment (common practices), extraction of fuel oil etc.

Details pertaining to maintenance dredging.

203. According to the sand movement study, sand accumulation will be minimal and none is expected to occur within the harbor basin (Sediment Transport Study of PPD, EML

2018). The marginal accumulation is expected on the eastern side (estimated at 1,330 m^3 per annum) of the project area. The same study predicts that the transport capacity west of the harbour is only 75 m^3/ annum westward. Though the harbour structures prevent the passage of sand moving from east across the harbour structures, there will be minimal (or no) beach erosion on the western side, since the transport capacity on the west side is very small. No maintenance dredging is envisaged. However, continuously accumulated sand on the eastern side could be excavated/ dredged once in five years, and deposited on the western side of the development.

3.13 Aesthetic and visual environmental

204. At present, the proposed land area is an open sea, and there is no obstruction to the sea view. There will be obstructions to the sea view for the pedestrians and tourists once the buildings are constructed. However, there is no major obstructions to the viewers from a higher elevation, such as multi storied buildings, particularly from the Methodist Girls' High School. All buildings are located and designed to minimize the obstruction of the sea view.

3.14 Future Expansion

205. The project design provides for future developments of the harbor if required. Some activities, such as ice plants and recreational facilities are open to be considered by private party investments, once the harbor is operating.

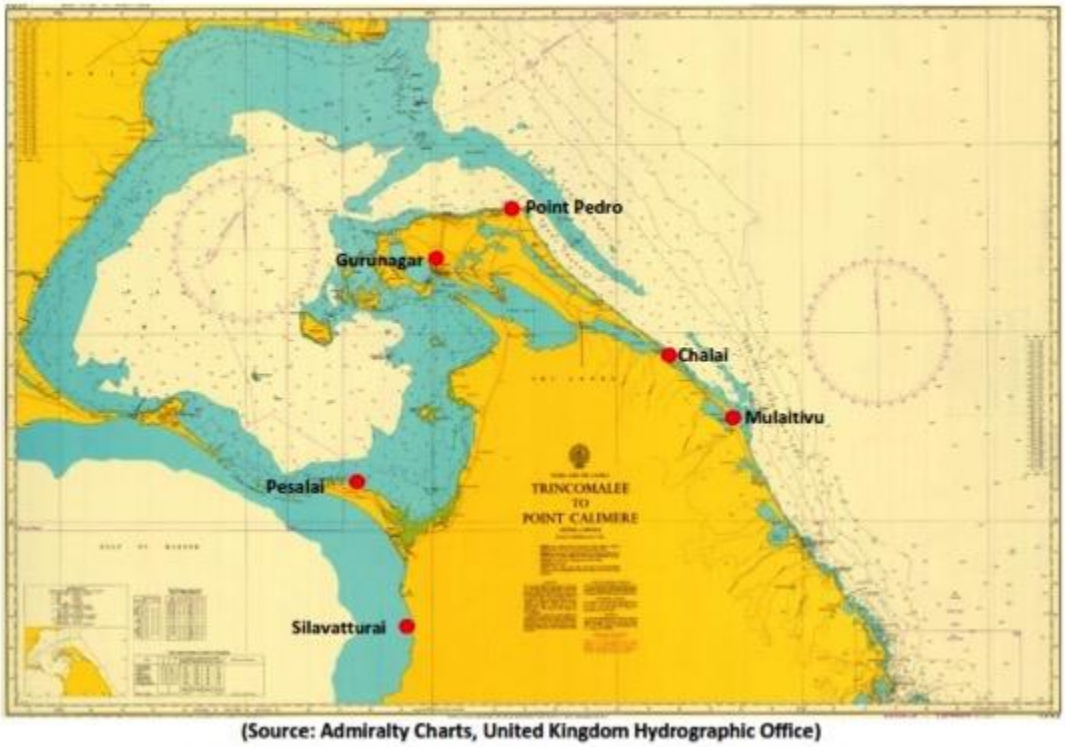
3.15 Evaluation of Alternatives

206. The MFAR had identified a number of potential sites in the Northern Province for development of Fishery Harbor Facilities. However, the feasibility studies concluded that Chalai and Mulaithivu in the Mulaitivu District are located on straight sandy coastlines and close to sea outlets of major lagoonal ecosystems. Thus, these sites possess significant seasonal variation in sedimentation loads and any development could lead to significant issues on sedimentation and coastal erosion issues in the vicinity. In addition, demand for such developments at these locations is very low in the present context, in comparison to that in the Point Pedro area. Pesalai and Silawaturai in Mannar District are located in shallow areas and any development on these locations will be limited to a depth of approximately 3.0 m MSL which would impose restrictions for the operation of larger fishing crafts, such as IMUL boats and Deep-Sea fishing vessels. Gurunagar in Jaffna District is also located in a lagoon environment and has a limitation of depth with the feasibility study indicating a possible depth of -2.5 m MSL. In view of these circumstances, the northern coastline of Jaffna Peninsula was considered as the most suitable area for a development of a deep drafted harbor facility in the Northern Province. Based on the above considerations, Point Pedro was identified as the most suitable location for the development of a deep drafted fishery harbor in the Northern Province[7].

207. As such the development of the PPFHDP site was agreed to be the most suitable site for a major port facility in the Jaffna region.

[7] Feasibility study report -

Figure 3-19 : Potential sites assessed in the feasibility study for fishery harbor developments in the Northern Province

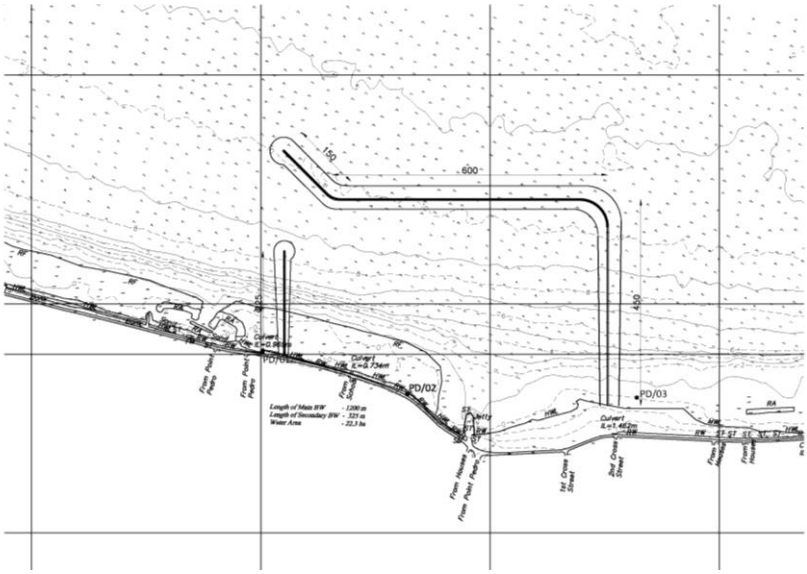


(Source: Admiralty Charts, United Kingdom Hydrographic Office)

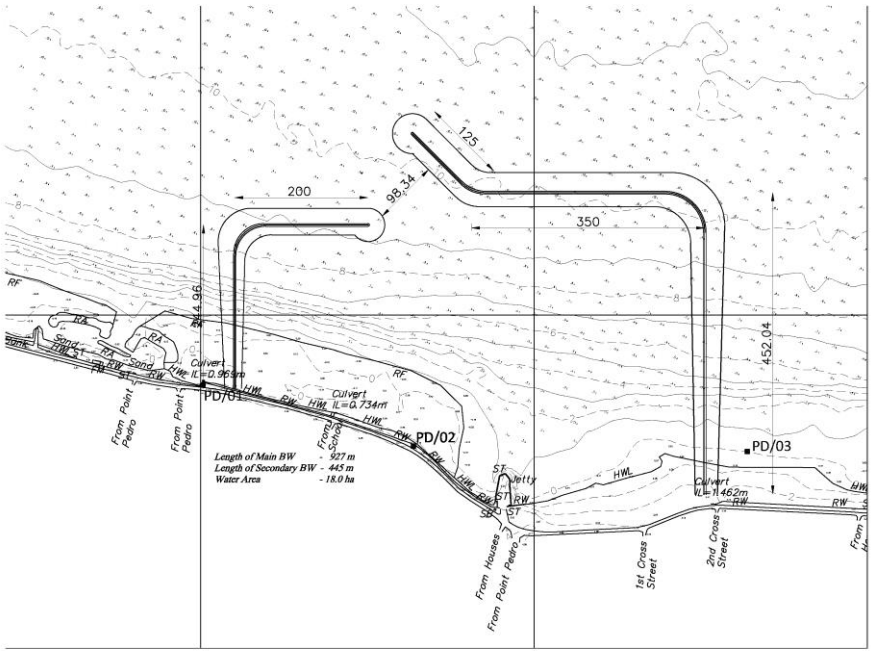
Technical Alternatives:

208. In developing the technical alternatives, the operational aspects, presence of the near shore reef, and navigational aspects have been considered. In this respect, 3 technical alternatives were considered.

209. **Alternative 1:** The layout fulfils the adequacy of water basin area for accommodating the projected boat fleet. Further, it provides the required shelter from the northeast (NE) waves. However, the harbor entrance is located at a westerly direction, in the midst of a shallow reef area. In the presence of NE waves, fishing boats approaching in a westerly direction would be difficult. Further, presence of the shallow reef area causes a navigation hazard under stormy situations.



210. **Alternative 2:** Alternative 2 has been developed as an improvement to the Alternative 1. While many of the features in the Alternative 1 are retained, the harbor entrance is moved away from the shallow reef area, and further made it to direct at a Northern direction. While this has rectified the deficiencies identified in Alternative 1, this option has not optimized the internal navigational movements. The IMUL boats are to be concentrated at the western basin and the larger IMULS are to be concentrated at the eastern bay. The larger IMUL boats have to go pass through the western bay area to reach the eastern bay for berthing. This is not a very convenient arrangement for larger IMULs, while movement of IMULs are somewhat hindered by the movement of larger IMULs. Hence, a third alternative was considered.



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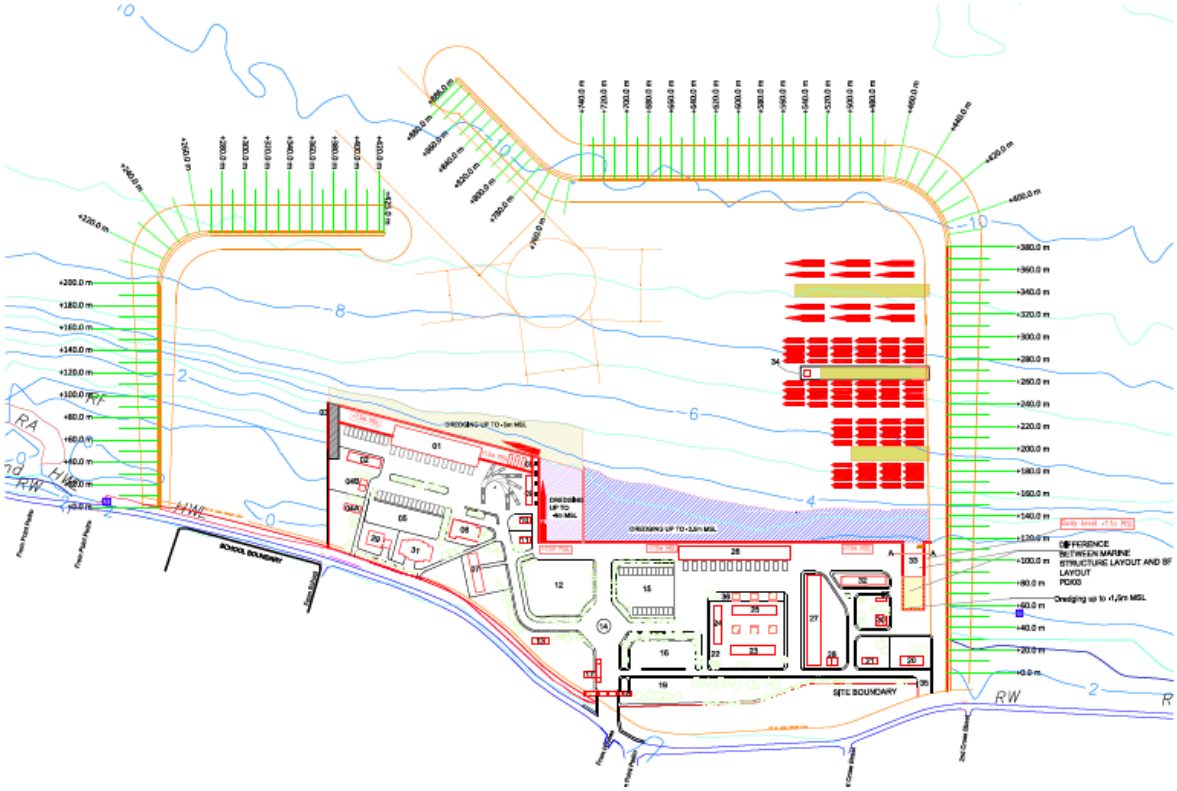
Alternative 3:



211. Alternative 3 has been developed by locating the harbor entrance at the middle of the harbor footprint, directed in a northerly direction. This would prevent larger IMULs crossing through the IMUL basin area, and movement of larger IMULs inside the harbor is optimized.

Alternative 3 has been selected as the best option out of the three alternatives.

4 DESCRIPTION OF THE ENVIRONMENT- BASELINE DATA

4.1 Overview

212. The section below provides the baseline conditions of the physical, biological and socio-economic environment of the Northern Province, and specifically Jaffna District and the Point Pedro Fisheries Harbor Development site. Information presented is based on site visits and reports and information provided and acquired over the duration of the assessment. Information detailed in the project's PPTA Final IEE Northern Provincial Sustainable Fisheries Development Project (ADB, 2017) study has been used and this report is referred for additional background information.

213. The Northern Province is covered by tropical forests, possesses the majority of the nation's offshore islands (western side) and is divided into two distinct geographic areas: Jaffna peninsula which is irrigated by underground aquifers fed by wells, and the "Vanni", which has irrigation tanks fed by perennial rivers. The province also has a number of lagoons, the largest being Jaffna Lagoon. The Jaffna Peninsula includes floodplains, coastal plains, sand dunes and beaches with a total land mass of roughly 1,130 km^2 of which lagoons occupy roughly 4 percent (46 km^2) with the highest ground approximately 10 m above Mean Sea level (MSL).

214. The climate patterns of the Province are directly influenced by the two distinctive monsoons periods in the area: the hot and dry South-West (SW) monsoon from February to September and the cool and wet North-East (NE) monsoon from October to January. January is the coolest month and May is the hottest month. Relative Humidity varies from 70% during the day to 90% at night.

215. The coastal foreshore region associated with the northern side of the Jaffna Peninsula, which includes Point Pedro, is characterized by a distinctive coastal fringing reef that parallels the coastline for the majority of this coastline. The shoreline is characterized by rocky and/and sandy beaches that enters a distinctive horizontal intertidal reef flat bordered by a small but distinctive hard coral reef crest, edge and small gentling sloping reef slope that enters an offshore sand dominated substrate that descends into the deeper waters offshore (**Figure 4-1**). The fringing reef is open both naturally and artificially (small boat entrances) throughout the area allowing direct access through the reef to the shoreline (**refer Figure 4-2 a**). The fringing reef and shoreline rock beaches provides protection against coastal erosion due to wave action and has formed numerous small naturally sheltered basins suitable for the mooring of fishing vessels throughout the region (**Figure 4-2 b**).

Figure 4-1 : Example of the Northern coastline, in close proximity to Point Pedro Fisheries Harbor.

Figure 4-2 Natural protected fishing vessel basin along the northern coastline.

(a)

(b)

216. The proposed fishery harbor at Point Pedro is located at 9°49'41.68"N, 80°14'7.59"E. The harbor location, its past usage (e.g. small industrial), development (dredging) and highly modified terrestrial and foreshore environment (e.g. clearing, compacted, flattened, land fill and built on) has limited natural vegetation resulting in an extremely low terrestrial floral and faunal biodiversity. Similarly, the intertidal shallow water reef flat and to a lesser degree the sub tidal reef edge and slope have been highly modified in areas associated with the boat harbour. This has been impacted by the daily activities associated with the fisheries harbor that have greatly reduced benthic and sessile marine flora and fauna coverage and biodiversity. The intertidal reef flat is horizontal and exposed during periods of low water and as such contains a low presence of sessile benthic marine resources. There are no freshwater ecosystems, mangroves or sea grass ecosystems associated with this site nor is the site high in marine biodiversity. The paucity of terrestrial and shallow water marine flora and fauna at the proposed site, especially the intertidal reef flat is as expected and is consistent with a small-scale fisheries jetty site. Neighbouring marine ecosystems to the east and west of the fisheries harbor reflect similar long term marine impacts and diversity of flora and fauna. Therefore, in general terms, habitat

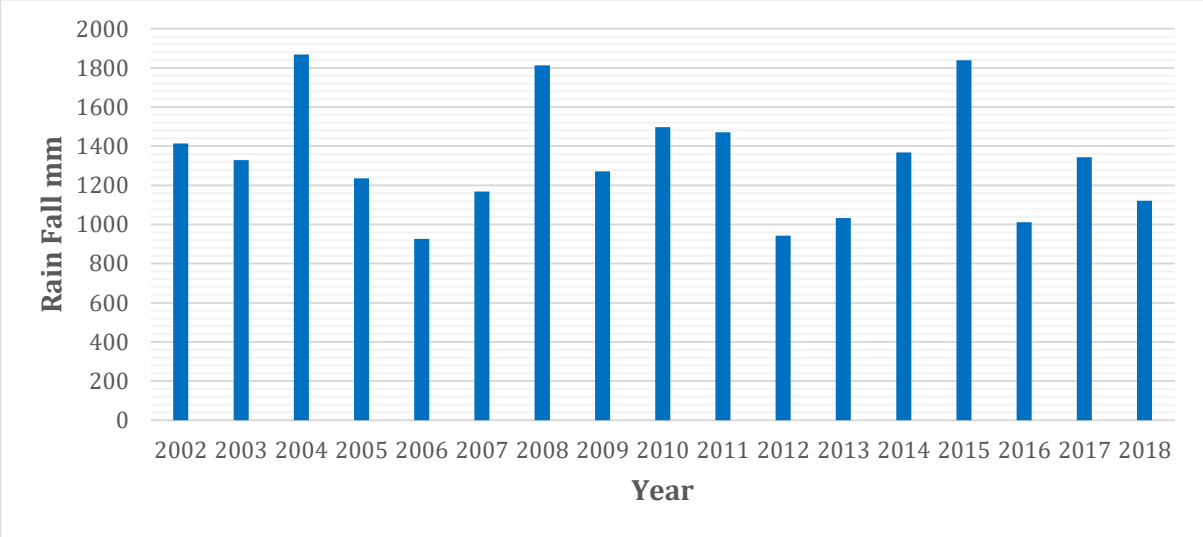
alteration and building construction at the proposed site have no flora and fauna terrestrial and marine biological impacts of any significance.

4.2 Physical Environment

4.2.1 Climate

- The climate of Sri Lanka is influenced by its topographic features (mountains in the central and southern areas, and flat landscape in the rest) and the southwest and northeast monsoons. The annual climate is broadly classified into 4 seasons: (i) First inter-monsoon, March – April, (ii) southwest monsoon, May – September, (iii) second inter-monsoon, October – November, and (iv) northeast monsoon, December – February.
- The Jaffna Peninsula is in Sri Lanka's dry zone, which covers much of the north, east and south-east of the country, and its climate is strongly influenced by the north-east monsoon, which brings higher winds and rainfall between October and February, and much lower rainfall over the rest of the year.
- **Temperature:** Point Pedro mean minimum air temperatures range from 20 to 26ºC and mean maximum temperatures range from 28 to 33 ºC throughout the year with an annual average of 28^{0}C. The months of January through to March are the coolest months whilst the months of April and May record the highest annual air temperatures. Sea surface temperatures at Point Pedro have an annual average of 28ºC with the month of May (30ºC) and January (26ºC) recording the highest and lowest sea surface temperatures, respectively.
- **Precipitation:** The average annual rainfall ranges between 1,000 and 1250 mm with peak rainfall occurring during the months October to January associated with the north east monsoons producing about 75% of the total annual rainfall in this area (**Figure 4-3**). Rainfall throughout the rest of the year is scattered with the driest months extend from June through to September. Relative Humidity varies from 70% during the day to 90% at night.

Figure 4-3 : Average Annual Rainfall from 2002 to 2018 of Jaffna District of Sri Lanka



Source: Metrological Department 2018

217. **Tides:** Historical tidal data for the northern coastline of Jaffna, including Point Pedro, is limited and as such comparisons of time series data are difficult to develop. However more recent tidal information indicates that the basic tidal parameters for the Northern Province, including Point Pedro, is a semi – diurnal regime (a twice daily) with

diurnal inequalities with a maximum tidal variation of 0.6 meters (micro-tidal). Point Pedro on the open Northern coastline experiences a spring tidal range of 0.6 m, from Mean Low Water Spring Tides (MLWS) of 0.1 m to a Mean High-Water Spring Tides (MHWS) of 0.7 m and a neap tidal range of 0.3 m all levels relative to Chart Datum (CD). The corresponding values for Jaffna Lagoon area are 0.4 m for MLWS and 0.2 m MHWS, respectively. Measurements at Karainagar show that the months of June through to August experience the lowest sea level of approximately -0.1 m whereas the November through to December period experiences the highest sea level of +0.2 to +0.3 m (ADB, 2017).

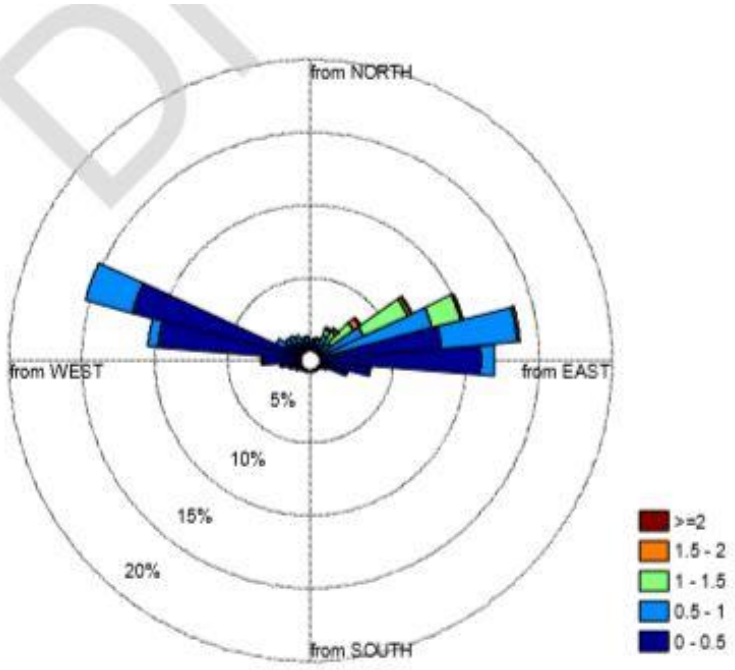
218. Small seasonal and daily tidal fluctuations have been recorded, which have been related to sea conditions associated with weather patterns existing at the time of the recording. Inclement weather conditions e.g. tropical lows do have a marked impact on the tidal height and can cause increased coastal erosion and in extreme events inundation if they coincide with high water periods.

219. **Waves:** Waves are generated by a forcing wind but continue to travel away from the area of generation as swell. The observed wave field at any point therefore reflects both the locally generated waves (the wind sea) and waves, which may have been generated a great distance away and travelled to that location (the swell). Thus, variability of the wind-wave climate at any location is not only a property of the local wind field, but also the integrated variability of the wind field across large areas of the ocean over which the waves have been generated.

220. The wave climate associated with Point Pedro is dominated by the two monsoon seasons, and mainly characterized with short period wind waves. The long period Swell component is found to be insignificant. The south western monsoon runs between May and September and results in higher waves and wind from the southwest. These waves, after diffraction, are approaching from a north-westerly direction. Waves generated during this season have limited direct impacts on the Point Pedro Fisheries Harbor due to its position along the northern coast. The north eastern monsoon, which runs between October and February, and results in higher waves and wind from the northeast have a direct impact on the fisheries harbor. In the period in between wind and waves shift from one dominant direction to the other, as noted in the Wave Rose derived for the location. It shows two clearly identifiable directional clusters, viz.50-90 deg. N, and 270-290 deg. N, as found during the Wave Study carried out under the Detailed Design Phase.

221. A wave and wind study undertaken on the Point Pedro Fisheries Harbor (ADB, 2016) and repeated in 2018 (EML 2018) identified that the average wave height varies between 0.5 – 1.5 m and possess wave periods that vary between and 4 and 9s. This data is represented in **Figure 4-4**. A detailed description of the wave and wind climates associated with the Point Pedro Fisheries Harbor site are reported in EML 2018 and should be referred for additional information.

Figure 4-4: Near shore wave rose for Point Pedro annual scenario, maximum wave height of 1.5 m (Source: EML, 2018).



222. **Storm Surge Rise:** An assessment of cyclone induced storm surge rise caused by the action of high winds and low pressure accompanying a cyclone is very important in designing marine structures and associated facilities in the proposed harbor.Two independent studies carried out in the past in predicting the storm surge rise in this region with different return periods were used in the present study. Out of these two studies, the study conducted by UNESCO-IHE in 2014 that includes the tropical cyclone effects to obtain the storm surge exceedance statistics is given more attention. This study analysed 19 years of hourly measured water levels at the Chennai Port and performed extreme value analysis using a generalized Pareto Distribution (GP) to predict storm surge rise for 20, 50 and 100-year return periods. The storm surge rise corresponding to 50-year return period, which is 0.69 m above MSL, was used in the design of marine structures (ADB, 2016).

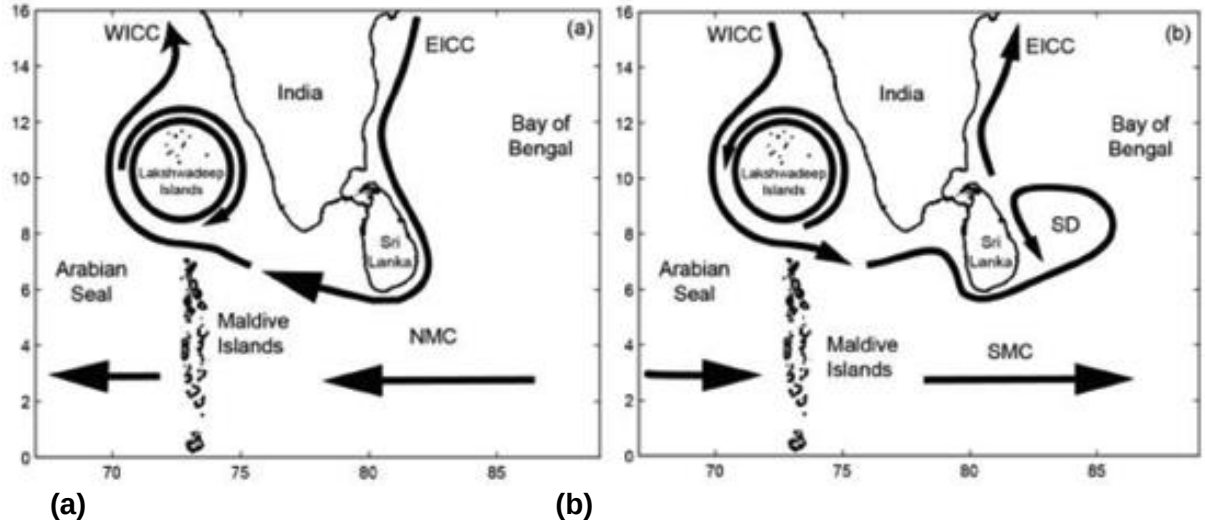
223. The proposed harbor basin is protected against the water level rise due to storm surge effect as the breakwater segments that protect the jetties and other harbor facilities are designed as non-overtopping sections by setting the crest elevation high enough to prevent any overtopping over the structure. There will not be any significant change or any adverse impact on the coastal stretch due to cyclone induced storm surge rise as a result of the construction of proposed harbor. In addition, sea level climate change prediction has been factored into the PPFHDP. The Sea Level Rise prediction for a 50-year period has been taken as 0.45m as the worst case scenario, where no effective action taken to reduce emission of GHGs.

Currents and Sediment Transport

224. Surface currents in the Bay of Bengal and the wider Indian Ocean are driven by the monsoon winds and show distinct seasonal changes as a result. During winter periods in the northern hemisphere, the Asian land mass is cooler than the sea, so when warm air rises over the Indian Ocean it is replaced by cool air flowing from the land, which creates the north-east monsoon between November and April. The Coriolis Effect causes ocean currents to move to the right of the wind direction in the northern hemisphere, so the north-

easterly wind drives ocean currents from east to west, principally via the North Monsoon Current (NMC) south of Sri Lanka **(Figure 4-5a)** (Schott & McCreary, 2001). Between April and September, the land is warmer than the sea, so rising warm air is replaced by water-saturated air from the ocean, causing the south-west monsoon and the associated rains. The south-westerly wind drives ocean currents eastwards via the South Monsoon Current (SMC), (**Figure 4-5 b**) (De Vos et al., 2014).

Figure 4-5: Ocean circulation around Sri Lanka and southern India: (a) North-east monsoon; (b) South-west monsoon.



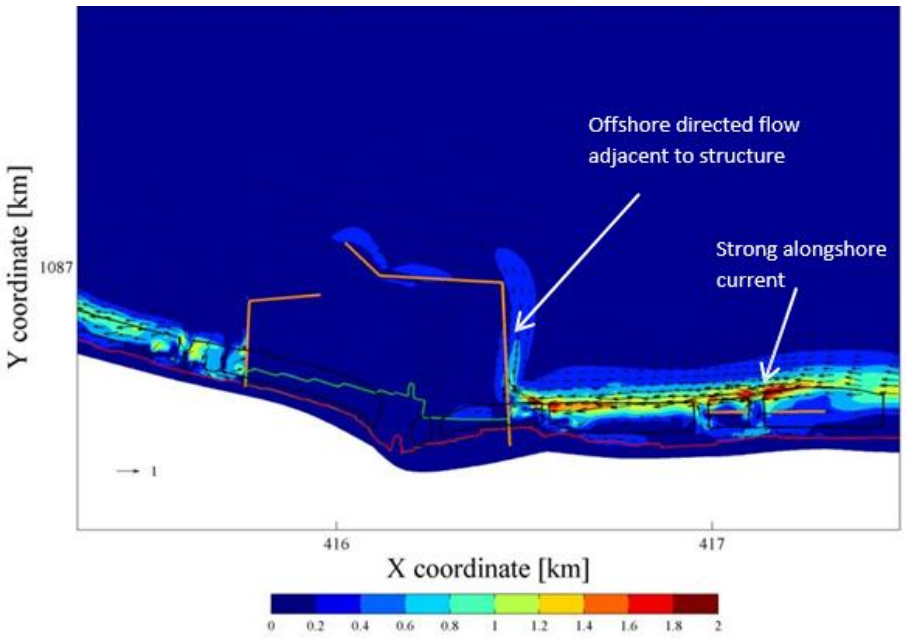
(a) **(b)**

WICC - West Indian Coastal Current; EICC - East Indian Coastal Current; SMC - South Monsoon Current; NMC- North Monsoon Current; SD- Sri Lanka Dome.

225. There remains scientific debate on the seasonal oceanic circulation currents around the eastern coasts of Sir Lanka. However, the general accepted view as shown in **Figure 4-5 (a)** is where during the north-east monsoon the East Indian Coastal Current (EICC) is drawn southwards along the east coast of Sri Lanka and joins the North Monsoon Current flowing from east to west. During the south-west monsoon the South Monsoon Current (SMC) flows from west to east and combines with the West Indian Coastal Current (WICC) flowing south along the west coast of India, and an anti-clockwise eddy, known as the Sri Lanka Dome (SD) forms off the eastern coast of Sri Lanka **(Figure 4-5 (b**). The SD carries the majority of water south along the eastern coast of Sri Lanka, while some is deflected northwards along the East Indian coast.

226. Nearshore currents are highly dependent on wave condition and modified whenever engineering structures are placed on the coast. The depth averaged current field corresponding to a NE wave condition likely to drive a strong alongshore current is shown in **Figure 4-6** together with the most prominent features. The current velocities along the outer reef area are found to be fairly strong, with magnitudes reaching values of 1.4-1.6 m/s.

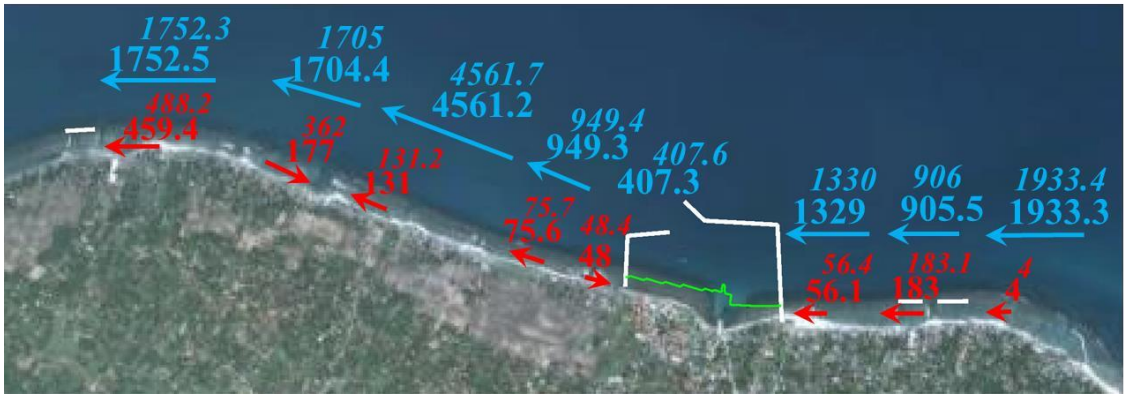
Figure 4-6: Near shore current field associated with NE wave conditions.



Vectors show current directions and magnitudes while the underlying color contours and the colourbar indicates current speeds (m/s). The green line within the harbor indicates the outline of berths.

227. A site-specific sediment transport study undertaken at Point Pedro (EML, 2018) has identified that there is a net transportation effect from east to west running parallel to the northern shore outside of the fringing reef system. The resultant longshore (net) sediment transport (LST) rate is in the range of 400 – 2000 m^3/yr, which is by normal standards, insignificant. The LST rates in between the reef and the shoreline (in red), which could potentially affect the shoreline position, are even smaller ranging between 5 and 500 m^3/yr.

Figure 4-7: Summary of the sediment transport associated with the coastal waters adjacent to Point Pedro Fisheries Harbor (EML, 2018)



Net and gross (italics) annual longshore sediment transport rates seaward of the reef (blue) and between the reef and the shoreline (red) over the first year after structures are constructed. The green line within the harbour indicates the outline of berths.

Climate Change

228. There have been several well-documented events that show the increase of extreme weather events, such as tropical storms and typhoons in the Indian Ocean. Most climate change modelling shows that tropical storms will increase in frequency and severity and will be a characteristic of the Northern Province coastal areas including the PPFHDP site in the future.

229. It is anticipated that with global warming trends, increased intensity, albeit with less frequency, extreme weather events may be expected. Adopting an integrated 'all hazards' approach to disaster risk management will be vitally important for the future development of the PPFHDP and for the region itself. The main vulnerabilities faced by the people residing in the Northern Province as well as elsewhere within the nation can be summarized as (i) sea-level rise which exacerbates the severity of sea surges, increased rates of coastal erosion and heightened risks to public and private infrastructure (ii) more intense and more frequent storms, which increase risks of damage from sea surges, high winds and strong inundation on public and private infrastructure and (iii) more frequent and longer periods of drought: which cause both intense short term difficulty and, of greater concern, long term damage to the freshwater lenses systems, especially within the Jaffna area.

230. Climate change adaptation measures have been considered and integrated into the design and program of works for the PPFHDP project and incorporated into the project's final design and scope of works. Increases in extreme weather patterns and events specifically associated with increased oceanic wave and swell events will have a direct impact on the PPFHDP. The management of these events have been factored into the design. The offshore structures are designed to accommodate storm surge of 0.69 and sea level rise of 0.45m.

231. It is anticipated that the project will itself not contribute significantly to any additional greenhouse gas emissions. The harbor, as it will concentrate fishing vessels in a confined area may increase localized emissions, however overall levels will remain similar as the vessels are in the most part operating currently in neighbouring areas. Improvement in vessel maintenance, new and more efficient engines will subsequently reduce emissions and greenhouse impacts. Energy requirements of the facility will use electricity supplied from the grid and on-site generation will be used only as a backup when grid power is not available (e.g. outages). Considerations for alternative power generation sources (e.g. solar, panels on rooftops) are being included in the design.

232. Some of the identified risks posed by climate change and natural hazards in the tropics are indicated in **Table 4-1,** which has been adapted from the ADB report 'Climate Risks and Adaptation in the Agro-Industrial Sector' to meet fisheries harbor requirements. It includes various adaptation options that could be considered for the risks identified in respect of the PPFHDP.

Table 4-1 : Identified risk posed by climate change to the PPFHDP.

Climate Change Hazard	Potential Impact	Potential Resilience Measure Incorporated in the design.	Complementary Measures
Sea –level rise	The site is located on the coastal strip of land directly adjacent and boarding the sea including a harbor constructed on the reef flat. Therefore, it will be impacted from sea level rise. Increased sea levels may affect the integrity of the construction material and inundate the site.	Breakwater height has been adjusted to withstand sea level rise	Coastal zone protection and ensure building /construction codes to manage these events are incorporated into the facility's design. Breakwater heights have been designed to with stand a sea level rise of 0.45 m

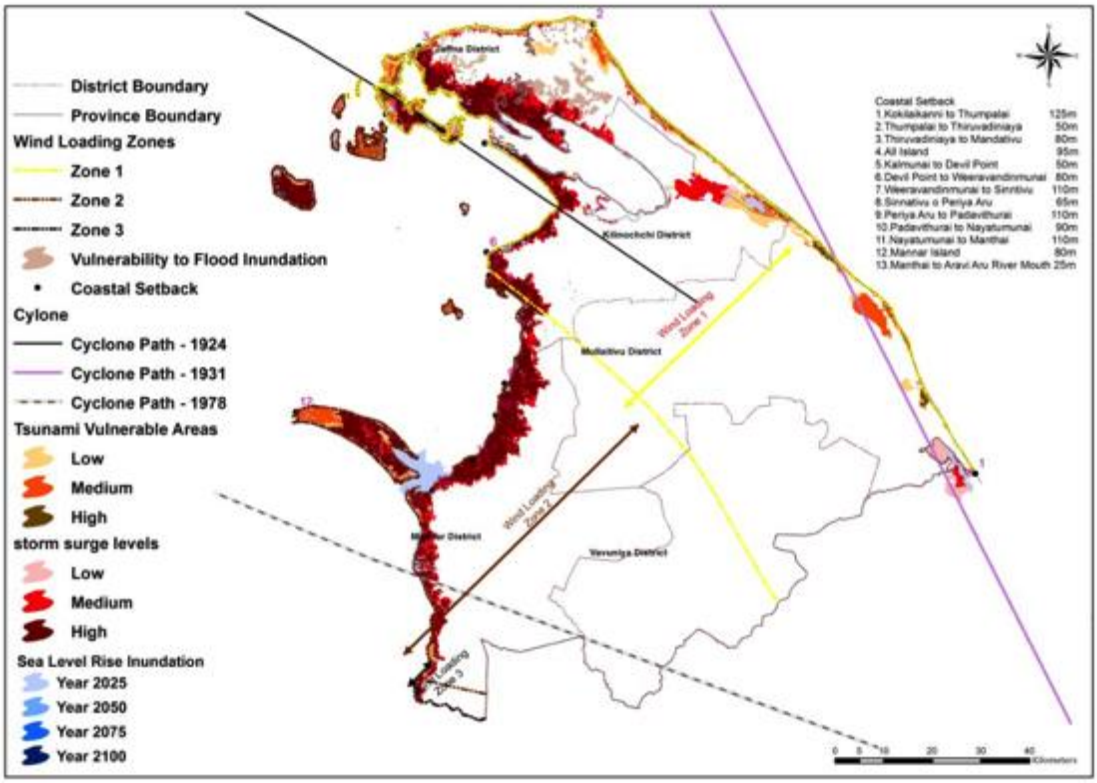
			and storm surge of 0.69 m
Increase/decrease in rainfall	The project will require water from the main town water system facility to clean the fisheries harbor facilities. Fluctuations in the availability of water and its quality may reduce and/or disrupt the fisheries harbor's production capabilities.	No particular measures adhered to	Implement water management system to conserve and utilize water efficiently within the fisheries harbor and ensure all staff has the knowledge and skills. Water supply to be provided by the Jaffna desalination plant and as such rainfall pattern will not affect water available for the project.
Cyclones/hurricanes & frequent strong storms.	Potential flooding and salt water inundation of coastal areas could adversely affect the fisheries harbors operations.	Design more robust infrastructure for heavier flooding and extreme events and improve water discharge outlet within the fisheries harbor areas.	Ensure disaster management protocols and guidelines are in place and staff are fully aware.
Increased Temperature	May stimulate increase in cooling costs affecting the economics of the project and worker's OH&S.	Incorporation of insulation and cooling systems in the buildings to maximize heat exchange.	Ensure disaster management protocols and guidelines are in place and staff are fully aware.

233. In summary, Climate Change projections for Sri Lanka (CCS, 2016) indicate that there are three major types of atmospheric change; i) Gradual increase in ambient air temperature, ii) Changes in distribution pattern of rainfall and iii) Increase in frequency and severity of extreme weather events. In addition, sea level rise within the Asian region that includes Sri Lanka has been observed at 1-3mm/year and is expected to continue to rise throughout the 21st century (15-20 cm by 2050). Ocean acidification is also expected to increase in the future, with negative impacts on coral reef ecosystems.

Natural Hazards

234. Tropical storms, cyclones and tsunamis are the principal hazards facing the coastal areas of Sri Lanka, resulting in storm surges, land inundation, flooding and extensive physical and structural damage. **Figure 4-8** identifies the areas and level of vulnerability to natural disasters for the Northern Province; highlighting the PPFHDP site representative of a relatively high vulnerability for wind, storm surge and tsunami impact.

Figure 4-8: Vulnerability levels of natural disasters for the Northern Province. (Source: CEA/DMC, 2014).

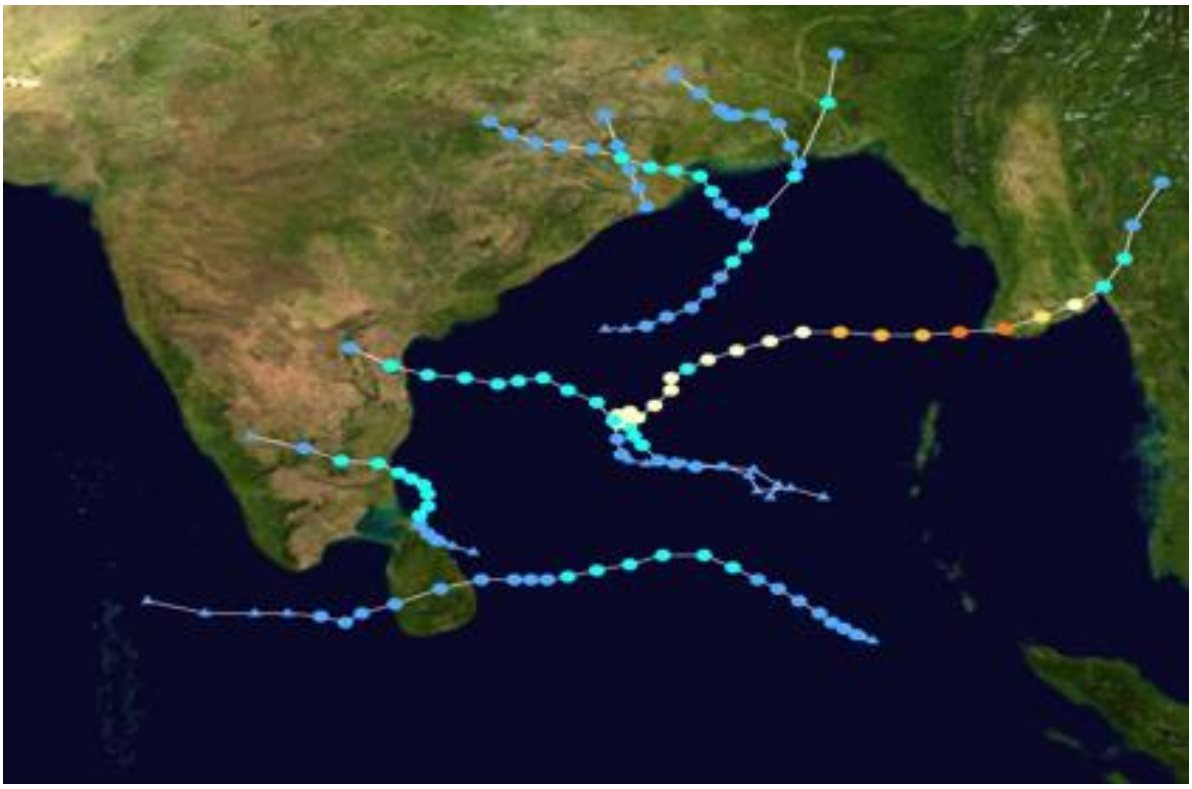


235. Volcanic activity within Sir Lanka is very rare with no reported cases during the past century whilst earthquakes within the island and in close proximity to the nation's coastal areas are rare.

236. **Cyclones:** The Bay of Bengal, located in the North-East of the Indian Ocean, bordered by India, Bangladesh, Myanmar, Sri Lanka and Thailand is responsible for the formation of some of the strongest and deadliest tropical cyclones in the world. The Eastern, Northern and North Central provincial regions of Sri Lanka lie within the nation's cyclone belt and have been affected by a number of cyclones during the past 100 years. Cyclones of severe intensity struck Sri Lanka in 1922, 1931, 1964, 1978 and 2008. The Cyclone Nisha hit northern Sri Lanka on November 25-59, 2008, causing heavy rains and flooding that reportedly killed 15 people and displaced between 60,000 to 70,000 people in Vanni area and 20,000 people in Jaffna District. Jaffna recorded the highest rainfall since 1918, of 520.1 mm of rain within a week, with one day recording a rainfall of 389.8 mm, being the highest in nine decades. Cyclone wind speeds of 85 km/h have been reported.

237. The **Figure 4-9** shows the cyclones of North Indian Ocean for the Cyclone Season–2008, which also shows the path of the Cyclone Nisha in 2008. The passage of a cyclone is accompanied by high winds, high seas (large waves) and an increase in sea level due to the reduction in atmospheric pressure and other causes. The impacts of possible cyclones need to be taken into consideration in designing the marine structures and shore facilities.

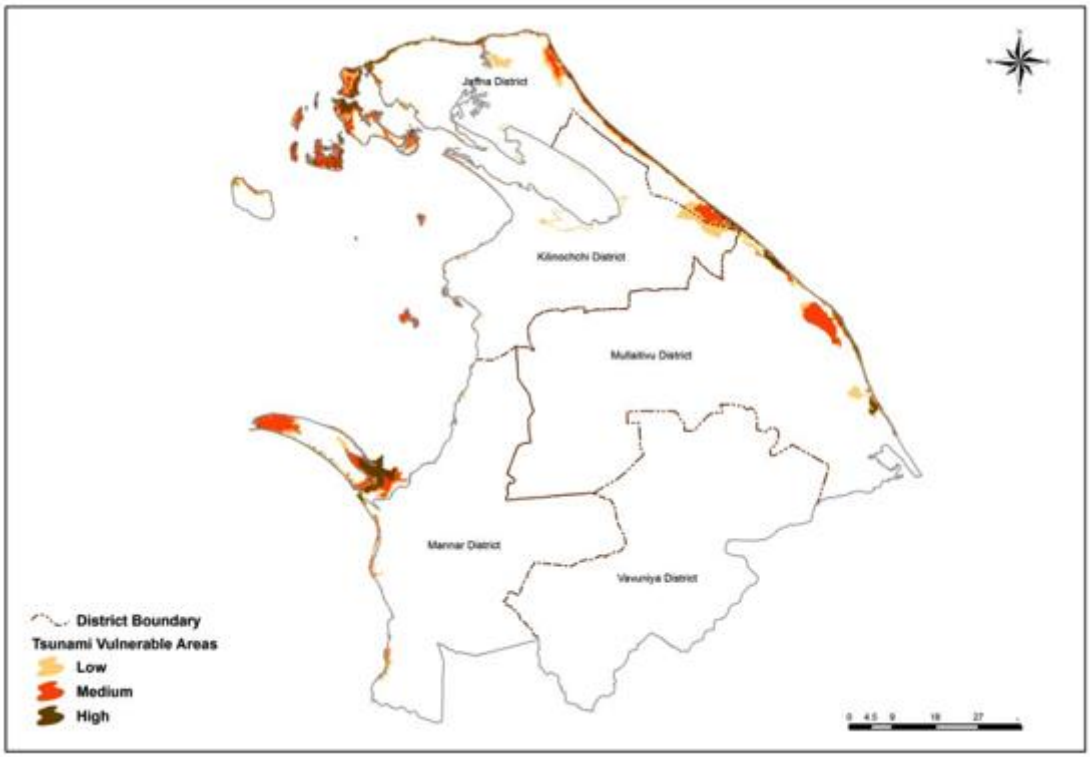
Figure 4-9: Cyclones of North Indian Ocean – 2008 Cyclone Season



238. **Tsunamis:** Tsunamis are caused by vertical displacement of seabed fault lines during earthquakes, or by other processes such as a volcanic eruption, volcanic collapse or submarine landslide. Tsunami-generating earthquakes tend to be shallow and of relatively-large magnitude (i.e. greater than Richter Magnitude 7), hence the occurrence of a large, shallow earthquake located beneath the ocean will more often than not produce a tsunami, providing there is vertical offset of the sea floor.

239. Sri Lanka has been impacted by tsunamis in the past, albeit they are rare events, with the most recent occurring on the 26th of December 2004 resulting from a large submarine earthquake (9.3 magnitude) in the Andaman-Sumatra subduction zone. This tsunami caused significant coastal infrastructure and damage to land along the entire eastern coastline of Sir Lanka, including the Northern Province districts of Mullaithivu and Jaffna and significant loss of life. **Figure 4-10** is a computer generated model of the potential inundation of the coast line of Sir Lanka resulting from the tsunami.

Figure 4-10 Sri Lankan coastline area vulnerable to Tsunami (CEA/DMC, 2014).



4.3 Topography, Geology and Soils

240. Jaffna District adjoins Kilinochchi District on the mainland, and consists of the peninsula and seven inhabited islands, with a total land area (including inland lagoons) of 1,012 km^2. The topography of the peninsula is low and relatively flat, with a maximum height of 11 m recorded in the western central area near Tellipallai. The peninsula was covered by the sea up to the Miocene epoch and limestone is the dominant substratum, in an area of entirely coastal landforms, comprising floodplains, coastal plains, low sand dunes and beaches.

241. The geology of the Jaffna peninsula is comprised of five types of significantly distinguished features; i) lagoon deposits, ii) estuarine deposits, iii) unconsolidated brownish grey coastal sands, iv) red beds and v) dune sands. Miocene limestone and reed beds cover the top middle part of the peninsula whilst dune sand / beach sand is restricted to the eastern coastal region and as a thin layer in the northern coastal part from Karainagar to Point Pedro. The dominant underlying bedrock throughout the Jaffna peninsula is a high-grade Pre-cambrian crystalline metamorphic rock although in some areas it is underlain by sedimentary layers of upper Jurassic age.

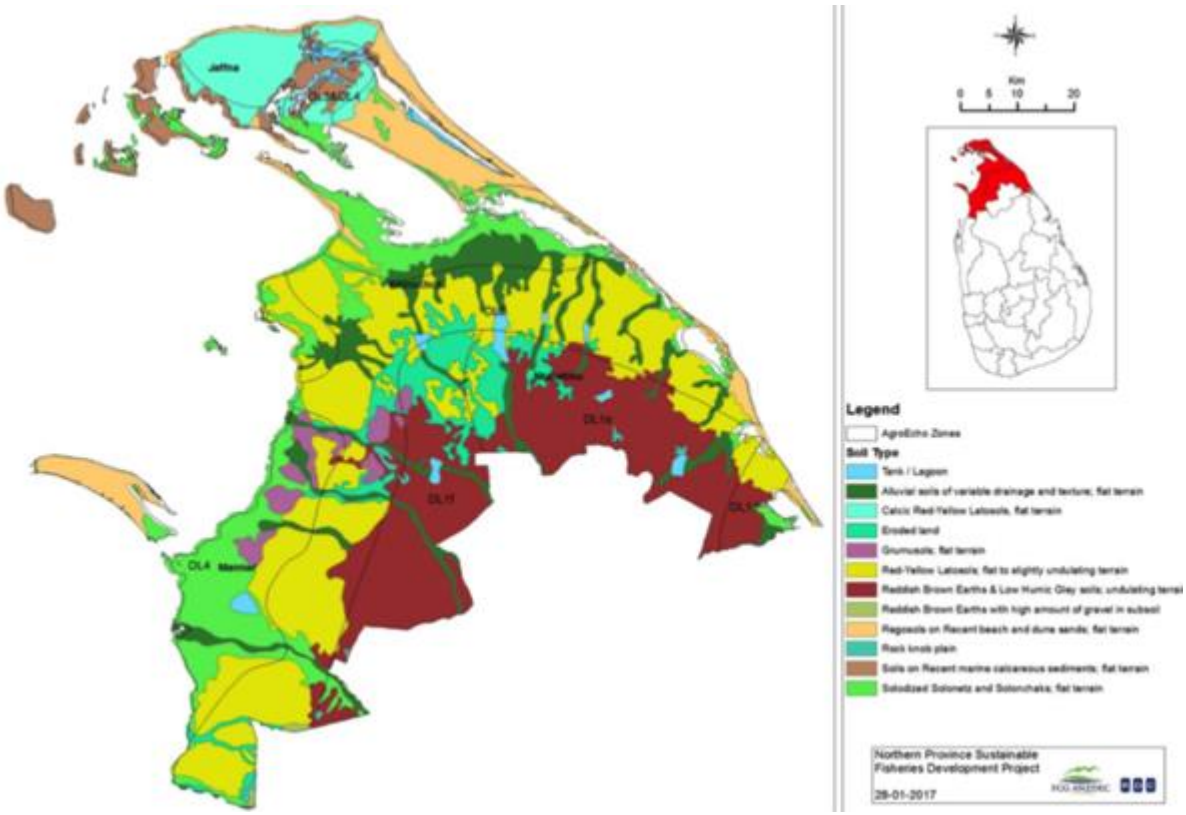
242. Jaffna Limestone is of Miocene age coral reef formation and is poorly bedded and generally flat, except in some areas where it shows a slight dip to the west. It is massive in places but some layers are richly fossil ferous, forming a honey-combed structure and the ready solubility of the limestone produces a number of underground solution caverns, which contain the main ground water reserves on the island. The upper surface of the limestone slopes gently to the south-east from the relatively high areas in the north-west where it forms the land surface in the general vicinity of Chunnakam. To the east of the Uppu Aru Lagoon, the limestone is generally obscured by younger formations.

243. The surface cover of unconsolidated deposits is the youngest of the geological layers and produces the sandy soil that is present over much of the peninsula. The sediments north east of the Vadamarachchi lagoon form deeper beds, which can reach 8-17 m in places.

244. The soils map **Figure 4-11** (sourced from the PPTA) of the Northern Province shows that the coastal areas of the Jaffna peninsula and a part of the Vanni mainland's (Mannar, Kilinochchi, Mullaithivu districts) overburden mantle is covered with five different types of soils classified according to agricultural suitability. They are;

- Regosols on recent beach and dune sands;
- Soils on recent marine calcareous sediments;
- Solodized Solonetz and Solonchaks;
- Calcic Red Yellow Latosols;
- Red Yellow Latosols.

Figure 4-11: Soil Map of the Northern Province.



245. In general, the soils are a mixture of marine deposits and sediments formed by the influence of wind and waves on the limestone. The soils associated with the north coast of Jaffna peninsula including Point Pedro consist of Regosol and support horticulture, mainly coconut and sandy soils sustain palm trees, such as coconut and Palmyra, and in some areas paddy rice is grown during the wet season under rain-fed conditions. There are pockets of loam earth (mixture of sand, clay, silt and humus) suitable for some crops scattered throughout the peninsula. Jaffna islands mainly consist of soils on recent marine calcareous sediments and Solodized Solonetz and Solonchaks, which also occur in the South-West part of the Peninsula.

4.4 Bathymetry, seabed and the coast

246. The northern coast of Sri Lanka is dominated by coralline limestone, sandstone or rocky reefs, which parallel the shoreline providing shoreline protection from waves and providing habitats for inter-tidal biota including soft and hard corals. These habitats were located within the PPFHDP site.

247. The coastal waters and coastline associated with the PPFHDP site is characterized by a shallow water inter-tidal reef flat that ranges in width between 75 m on the eastern side of the harbor and extending to approximately 100 m in the western side of the harbor, however the reef width reduces to about 20 m close to the existing wharf and is exposed during low tide. The southern end of the reef flat is bordered by a man-made rock retention wall (**Figure 4-12 a**) whilst the northern (seaward) side extends through a small shallow sub-tidal reef flat onto a wave dominated reef crest (**Figure 4-12b**) and edge before the reef drops steeply down a small sub-tidal reef slope before the substrate changes into reef slope proper and extends northwards, slowly decreasing in water depth offshore. The reef crest and edge vary throughout the area and in some cases is not well defined.

Figure 4-12: Intertidal reef system adjacent to the PPFHDP site.

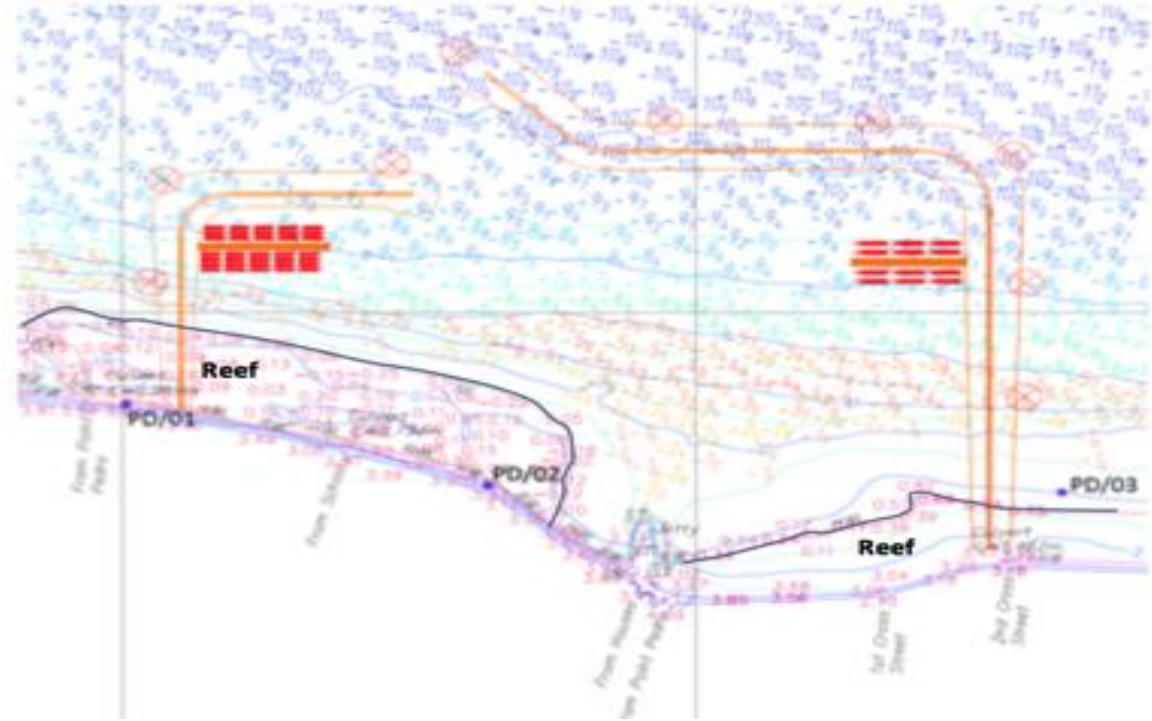
(a)

(b)

248. Hard reef habitat and associated benthic resources are located within the inter-tidal, sub-tidal and reef crest, edge and slope with the remaining habitat that extends north wards is dominated by loose sand and sediments, which does not support any coral reef benthic habitat or resources.

249. Detailed bathymetry maps of the project area (see **Figure 4-13**) were developed and have indicated that the beach slope on the eastern side of the wharf is around 1:35 up to -8 m bed contour which is located about 280 m distance from the shoreline. In addition, the water depth reaches -10 m at a distance of 400 m from the shoreline. The seabed slope is relatively steeper on the western side of the jetty compare to the eastern side and the slope is around 1:11 up to -7 m bed contour which is located about 75 m seaward from the reef edge. The water depth reaches -9 m at a distance of about 170 m from the reef edge. The projects proposed navigational channel is about 9 to 10 m deep, which is more than sufficient for the proposed PPFHDP harbor.

Figure 4-13: Near shore bathymetry associated with the PPFHDP site.



250. The seabed associated with the harbor area, starting with the intertidal reef flat, is mostly hard, concretized coral reef and includes coral rubble and rocks (refer **figure 4-12 a & b),** except in areas adjacent to the wider beaches located in the east, where sand and small coral rubble are mixed with the reef platform and larger coral boulders (**Figure 4-14 a**). The areas to the east of the existing jetty adjacent to the PPFHDP site include a number of natural reef channels through the fringing reef that are used by the local fishing fleet to enter the shoreline and for protection (**Figure 4-14 b**).

Figure 4-14: Photos of the shore line both sides of the PPFHDP site

(a)

(b)

251. Benthic marine invertebrate and vertebrate communities associated with the PPFHDP site were assessed in detail – refer to the marine assessment report (**ANNEX 5**). There is a low presence and low biodiversity of sessile marine invertebrates in the project area and similar results were documented in adjacent coastal habitats (east and west) - especially on the reef flat. There is virtually no sediments on the reef flat (where the majority of the PPFHDP work will take place – it is a flat horizontal hard reef flat that is exposed daily during low tide and subjected to current and wave movement) and the

intertidal reef crest, edge and slope are characterized with little if any sediment – the substrate is hard as expected on a wave battered reef front.

252. The reef edge and upper and lower reef slope adjacent to the fisheries harbor are composed of a hard-coral reef structure that is exposed to daily wave action and energy (increasing during storms). It is also mixed with some coral rubble, the latter more dominant in the areas surrounding the existing jetty, which has no intertidal reef flat systems. There was no documented evidence located during the assessment identifying if the inter-tidal reef systems surrounding the existing jetty has been previously removed to allow boat access. However, as this is an abnormality along this coastline it is strongly expected that this has occurred. The resulting marine habitat observed during the assessment supports this assumption.

253. The reef slope is composed of a hard reef structure with a surface veneer of living hard corals that descends vertically at 45% to the sea floor that is composed entirely of reef derived sediments, which descends slowly offshore. A detailed summary of the marine assessment of the inter-tidal and sub-tidal reef systems associated with the PPFHDP site is documented in **Section 4.7.2** of this report, based on the marine assessment (**ANNEX 05**).

254. As part of the geotechnical studies undertake for the PPFHDP, seven boreholes (3 located offshore and 4 located on the inter-tidal reef flat) (**Figure 4-15**) were drilled to provide the substrate profile of the proposed project site (MFAD, 2018). All boreholes showed similar substrate/soil characteristics (**Table 4-2**) with loose sand dominating the surface layer, followed by a densely compacted very dense sand layer and limestone bedrock, which ranged between 2.0 and 4.6 meters depth from the surface. The average depth (m) of the three different layers recorded 0.0 - 2.4 loose sand, 2.4 -2.8 m for the very dense sand and 2.8 m to 4.6 m for limestone bedrock. In addition, ground water level (GWL) depths were also recorded and ranged between 0.30 m and 1.40 m.

Figure 4-15 : Location of the seven-geotechnical boreholes associated with the PPFHDP.

Table 4-2 : Details of the bore hole in meters within the PPFHDP project site.

	BH01	BH02	BH03	BH04	BH05	BH06	BH07
Elev.(mMSL	+.811	+1.040	+1.613	+0.516	+1.502	+0.799	-0.665
Depth to Sand	0	0	0	0	0	0	0
Depth to Dense sand	1.00	2.70	2.60	2.60	3.50	2.40	2.80
Depth of bedrock	3.60	2.00	4.10	3760	4.60	2.80	3.30
Depth of Borehole	3.60	5.00	7.10	4.60	4.60	5.80	7.80
Depth of GWL	0.30	0.50	0.30	1.00	1.40	2.80	3.30

4.5 Water Parameter and Quality

Surface Water and Drainage

255. The topographic and climatic conditions found within the Jaffna Province inhibit permanent flowing rivers and, as such, no flooding of the area has been recorded within the area around the PPFHDP site. Two seasonal rivers (Thondaman Aru, west of Point Pedro; and Valuki Aru, west of Jaffna City) both around 10 km in length and several small streams, carry water during the region's distinctive wet season. Rather, the majority of surface water within the Province consists of coastal lagoons that contain seawater, or brackish water. The lagoons are major sinks for this runoff, but because of the proximity of the sea and the porosity of the subsurface strata, the water they retain remains strongly brackish.

256. The topography also precludes any development of large-scale reservoirs as there are no suitable landforms to accommodate large dams and no significant depressions in which large quantities of river or rainwater could be held. Some natural depressions have been enhanced with earth bunds and removal of soil to increase the depth, and these and other low-lying areas form a series of over 600 "tanks" or "ponds" in which individual small quantities of rainwater are retained during and after the rainy season for use in agriculture.

257. There is limited freshwater associated with the PPFHDP site, however the area during the wet season receives water through the discharge of a number of storm water drainage systems. The project area directly receives storm water discharge from a large drain that is located along the western boundary of the Methodist Girls' High School (**Figure 4-16a**) whilst two other smaller storm water drains into the sea, adjacent to the PPFHDP boundaries. One drain is located on the second cross street (**Figure 4-16b**) and the other is located near the Suppamadam fish landing sites (**Figure 4-16c**), east and west of the PPFHDP, respectively. The drain associated with the school will be redirected during the construction phase to discharge to the west of the port reclamation system.

Figure 4-16 : Location of the storm water drains associated with the PPFHDP.

(a)

(b)

(c)

Groundwater

258. The absence of perennial surface water reserves means that groundwater is the only source for domestic supply on the Jaffna Peninsula, and is also used in agriculture in the long dry season. Both karstic and sand aquifers are present on the peninsula, but the limestone deposits are larger, with far greater storage capacity and are therefore the main groundwater source. Four main aquifers with varying hydro-geological characteristics are located below the four mainland masses within the peninsula. This includes the Chunnakam aquifer located to the north of Jaffna city, including the area surrounding Point Pedro; Kayts on the eponymous island; Thaemaradchi between Jaffna Lagoon and Vadamarachchi Lagoon; and Vadamarachchi aquifer alongside the north-eastern coast (Panabokke & Perera, 2005)

259. The freshwater lenses are thicker towards the center of each aquifer and thinner in coastal areas where the deeper water is brackish, so potable supply is more reliable inland. All of the aquifers are replenished during the rains in November and December and are then gradually diminished by abstraction and natural subsurface flow throughout the rest of the year. Annual recharge for Jaffna has been calculated at between 10-20 x 107 m^3, of which approximately half is used for domestic supply and agriculture and the other half drains into the sea during the monsoon Balendran et al., 1968). There are no community wells or ground water access locations within the proposed PPFHDP site, however a common community well is located to the south of the project site outside of the projects area of influence ($9^0$49'40.52" N, $80^0$14'8.22" E).

260. Groundwater through wells are used throughout Point Pedro for agriculture, domestic use and apart from drinking. Limited pipe borne water supply by the NWS&DB is available in the area. In addition, drinking water is secured through rain water catchments and bottled water, however the area is to have a de-salination plant commissioned by 2020, which will provide additional locally available water for this purpose.

261. Groundwater quality was investigated by collecting water samples from 4 different ground water wells located in the surrounding urban areas adjacent to the proposed PPFHDP site (**Figure 4-17**) Samples were taken from water within the wells and the water analysis was conducted by a government accredited laboratory following standard methods for the analysis of water and wastewater (EML, 2018a). A total of 30 water, quality physical and chemical parameters were tested for each of the 4 wells. The data obtained is presented in **ANNEX 06**. The results indicated that each of the wells, recorded parameter levels that exceed the Sri Lanka water quality standards (SLS 614: 2013) for potable water and thus water from these wells are not suitable for human consumption. High chloride levels clearly indicated intrusion of saline water and the excessive hardness levels is a result of high levels of limestone associated with the water. In addition, high levels of *E. coli* recorded in all wells provides clear evidence that faecal contamination of the ground water is common within the Point Pedro area resulting from less than ideal functioning septic sewage systems. These levels are a health issue and water should not be consumed.

262. Until the Jaffna Kilinochchi water supply scheme is ready to meet the water demand of the project in 2020 water required will be met from the ground water sources. However the water demand for construction activities during the 1st year of the project is very small.

Figure 4-17: Location of the 4 freshwaters well sampling locations.

Seawater

263. Seawater quality was investigated by collecting water samples from 3 different marine sites adjacent to the coastline and opposite the PPFHDP site. Surface water samples were recorded for all sites whilst sea water site 01 included a 5 m water depth sample (**Figure 4-18**). Samples were taken from a boat and the water analysis was conducted by a government accredited laboratory following standard methods for the analysis of water and waste water (EML, 2018b). A total of 27 water quality physical and chemical parameters were tested. The data obtained is presented in **ANNEX 07**.

264. The results indicated that at all sites, the assessed sea water parameters are similar and represent a typical inshore coastal marine seawater site. That is characterized by possessing an exposed site open to ocean influenced (currents, swell, waves), tidal fluctuations. Higher suspended solids were recorded for the samples closer to the substrate than those at the surface. The absence of petro-chemicals and high levels of nitrogen compounds reflect the water circulation and movement at this site ensure dispersion. Faecal coliform results indicate sewage from the community is discharged regularly into the water. These results will be diluted due to the daily water exchange rates at this site (tides, currents, swells) and as such levels entering this area if no water exchange would be considerable higher. Mitigation measures throughout the coastal and town areas to reduce sewage discharge need to be addressed; similarly, all PPFHDP activities need to ensure sewage and waste water is managed to acceptable GoSL and international standards.

Figure 4-18 : Location of the 3 seawater sampling sites adjacent to the PPFHDP.

4.6 Air and Noise Parameters and Quality

Ambient Air Quality

265. Ambient air quality parameters were investigated at four different site locations (**Table 4-3)** within Point Pedro town adjacent to the PPFHDP site in April, 2018. (**Figure 4-19**).

Table 4-3 : Air quality sampling site locations

Reference No.	GPS	Location Description
L1	90.82'8 N 800.23'8 E	At the starting point of 2nd cross street.
L2	90.82'8 N 800.23'6 E	Middle of the harbor area, near harbor fisheries office.
L3	90.82'6 N 800.23'6 E	Near the bicycle service station, 300 m away from the middle of the harbor.
L4	90.82'9 N 800.23'2 E	Near the Methodist Girls High school

Figure 4-19 Location of the air quality sampling site locations.

266. Data at each of the 4 sample site locations were collected over a 24-hour period using standard air quality collection equipment (EML, 2018c). All data was compared to the maximum permissible levels as stipulated under the National Environmental Act of Sri Lanka. All data collected is presented in **Table 4-4**

Table 4-4 : Ambient air quality data collected at the four sampling sites and the GoSL maximum permissible standards.

Pollutant	L1	L2	L3	L4	Max Permissible Levels (μg/m3)
Particulate Matter less than 10 μg in size (PM10)	12.9	18.4	8.2	12.2	100
Particulate Matter less than 2.5 μg in size (PM2.5)	5.3	12.2	5.09	8.4	50
Nitrogen Dioxide (NO2)	11	16	28	8.0	100
Sulphur Dioxide (SO2)	22	8	18	<25	80
Ozone (O3)	<20	<20	<20	<20	200
Carbon Monoxide (CO)	<500	<500	500	<500	10,000

267. Analysis of the data collected at all four sampling sites showed that the ambient air quality is well within the maximum permissible levels and as such there are no non-compliant air emissions sources currently within and adjacent to the PPFHDP site.

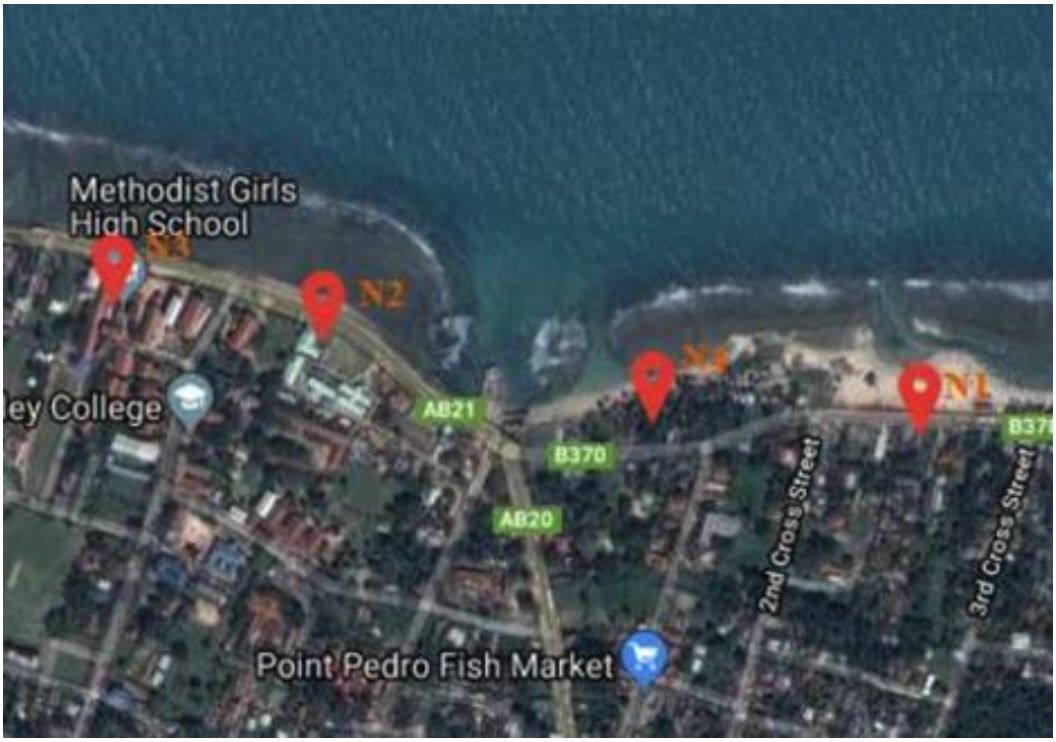
Ambient Noise Quality

268. Ambient noise quality parameters were investigated at four different site locations (**Table 4-5)** within the Point Pedro town adjacent to the PPFHDP site in April, 2018 (**Figure 4-20**).

Table 4-5 : Ambient noise quality sampling site locations.

Reference No.	GPS	Location Description
N1	90.82'8 N 800.23'9 E	Near 2nd cross street.
N2	90.82'9 N 800.23'4 E	Near Army Welfare office.
N3	90.82'9 N 800.23'2 E	Near the Methodist Girls High School.

Figure 4-20 : **Location of the noise quality sampling site locations.**



269. Data at each of the 4 sample site locations were collected over a 24 hour period using standard noise quality collection equipment (EML, 2018d). All data was compared to the maximum permissible levels as stipulated under the National Environmental Act of Sri Lanka for urban council areas (regulation 2 of Gazette Notification No. 924/12/1996). The maximum noise level permitted in urban council areas utilizes the Medium Noise and, as such, the permissible noise level for day time is 63dB (A) and 50 dB (A) during night time hours. All data collected is presented in **Table 4-6.**

Table 4-6 : **Ambient noise quality data collected at the four sampling sites and the GoSL maximum permissible standards.**

Site No.	Day Light Hours		Permissible Noise level	Nigh Time Hours		Permissible Noise level
	Ambient LAeq(t) dB	Background LAeq(t) dB		Ambient LAeq(t) dB	Background LAeq(t) dB	
N1	56	52	63dB	51	50	50dB
N2	62	57		50	49	
N3	60	57		53	52	
N4	64	54		57	50	

270. Analysis of the data collected at all four sampling sites showed that the ambient and background noise quality data collected during the day is within maximum permissible levels for medium level noise within an urban area. However, both ambient and background noise levels recorded during the night recorded readings slightly above the maximum allowance for urban areas. In addition, several administrative buildings and the schools are located within 500 m radius of the project boundary. As the/Methodist Girls' High School is located within 100m from the boundary of the project area, it falls under the Silent zone of the zonal categorization under the National Environmental Act under the Noise control regulations. Therefore, the applicable maximum permissible noise levels are, 50 dB(A) during the day time and 45 dB(A) during the night time. As such current noise levels associated with the road adjacent to the PPFHDP and the high school during the day and night do not meet the noise level requirements. The non-compliance is understood to be a direct response of isolated traffic noise, particular local transport (buses) and large trucks that utilize the main road.

4.7 Biological Resources

271. Sir Lanka's biodiversity is significantly important, both in a regional and global scale, as the nation has the highest species density for flowering plants, amphibians, reptiles and mammals in the Asian region (IUCN, 2012).

Marine and Coastal Reef Habitats, Flora and Fauna

272. Sri Lanka has a total land area of 65,000 km, a coastline of about 1, 585 km of which 300 km are beaches and sand dunes and a maritime area of 517,000 km^2 which includes an area of 21,500 km^2 for the nation's territorial sea. The nation has a narrow continental shelf (average 22 km) covering 27,800 km^2 with an average depth of 66 m and includes barrier, fringing and offshore reefs systems. All reef systems are within 40 km of the coastline.

273. The coastal and marine environment in the Northern Province contains a large proportion of the nation's coastal ecosystems and include; coral reefs, marine, brackish water and freshwater lagoons, mangrove forest, sea grass beds, salt marshes and streams. These conditions have provided the northern coastal and marine environment with a unique setting not found elsewhere in the country and as such possess a rich and diverse marine and coastal biota.

274. Sri Lanka's reef systems have been categorized into three main habitat types. i) true coral habitats consisting of live coral as well as calcareous substances, ii) sandstone and iii) rocky reef habitats.

275. The presence of coral reefs around Sri Lanka is influenced predominately by the nation's monsoonal climate patterns that have a significant impact on the level of turbidity and fresh water input into the coastal waters. As a result, extensive coral reef habitats are limited to areas with lower levels of sedimentation with semi-dry climates found in the north-western and eastern coastal areas of the nation. Coral reef development in the south-western sector of the coastline is poor due to heavy rainfall during the monsoon and the resulting impact from sedimentation and turbidity.

276. Sri Lanka's reefs are characterised either by a surrounding outer barrier reef that include subtidal lagoons and intertidal reef flats that terminate directly onto the shoreline or inter-tidal fringing reef flat system that terminates directly onto the coast (fringing reefs occur on only 2 percent of the national coastlines) and offshore island in the Northern Province. The width of the inter-tidal reef lagoon and fringing reef flats varies around the island and substantial reef derived sand beaches are located throughout the nation. A fringing reef system that is exposed during low water is associated with the Point Pedro Fisheries Harbor site and terminates directly onto coastline.

277. Sandstone and rocky habitats are extensive and widespread throughout the nation and are found from near-shore areas to offshore areas to depths more than 50 m. Although hard and soft corals do colonize these ecological systems their percentage coverage is low (generally less than 10% coverage). These biological systems are not associated with the PPFHDP site.

278. The nation has an open marine tenure system that allows anyone to fish the inshore coastal waters and is subsequently managed by the national and provincial governments through a number of specific laws and regulations. Historically, communities claim some authority (which varies between districts) over adjacent community marine and coastal areas with respect to resource extraction.

279. The Northern Province's main fisheries zones include: the extensive brackish water in land and coastal lagoon systems; the shallow fringing coastal reef including the back reef lagoons or intertidal zone; the sub-tidal zone including the reef slope and associated fissures or canyons in the reef slope (to about 25 m depth); the deep reef and near-shore deep-water areas below 25 m that extended a considerable distance from shore on the regions continental shelf; and the open ocean or pelagic fishery. These areas are of critical subsistence and small-scale income generation importance to the local communities. The first four zones are usually considered to be part of the 'inshore fishery' and the latter referred to as the 'offshore fishery'. Commercial fishing (local fishing licenses focusing on pelagic resources – tuna species specifically) are permitted to fish from the territorial water 2 nautical miles from the coast to the Exclusive Economic Zone (EEZ) limit some 200 nautical miles out from the shoreline.

280. The Northern Province's marine systems, especially the first four zones (inter-tidal, sub tidal, inshore reef and offshore continental shelf areas) have been heavily exploited for subsistence and small scale artisanal/commercial livelihood activities. These activities use a wide range of traditional and modernized fishing gear and techniques targeting a wide range of resources.

281. A detailed marine baseline ecological assessment survey was undertaken for the area of influence of the PPFHDP as part of the project's IEE. The full Marine Ecological Assessment Report is provided in **ANNEX 05** and the summary findings of the inshore marine baseline ecological survey for this report are presented in Section 4.7.2 There is a paucity of marine and coastal biological, ecological and resource baseline assessment data sets for the Northern Province, due to the social unrest of the past three decades making time series data comparisons difficult for the current study.

282. **Coral Reefs:** The marine flora and fauna of Sri Lanka is considered highly diverse within the Asian region. 183 species of hard coral within 68 genera have been recorded, with the largest reef habitat and diversity located in the northern areas of the nation. These reef systems support a high diversity of marine fish with a total of 606 marine species identified. The coral reefs are mainly fringing reefs associated with the nation's coastline and offshore islands and occur along shallowest coastlines where the water is clear and warm and maintains a constant level of salinity. Coral reefs support extraordinary diversity of species by providing food, shelter, nursery and feeding grounds for many fish species and crustaceans. The reefs protect coastal areas from storms and erosions by forming natural breakwaters. Furthermore, Sri Lankans depend on the coral reefs and their resources for both subsistence and livelihoods.

283. **Marine Mammals:** Of the 27 species of cetaceans recorded from the EEZ of Sri Lanka three (3) species are registered as Endangered (Blue whale – *Balaenoptera musculus*, Fin whale *B. physalus* and the Finless Porpoise *Neophocaena phocaenoides*), two (2) species registered as vulnerable (Sperm Whale *Physeter breviceps* and the Indo-Pacific Humpback Dolphin *Souse chinessis* with the remaining species registered as either Low Risk (7) or Data Deficient (16) (IUCN, 2006 and 2007).

284. The waters adjacent to the northern coastline of Jaffna and particularly the coastal waters associated with the PPFHDP site do not have suitable marine habitats conducive to whales and to the majority of the nation's smaller cetaceans. There is the unlikely possibility that several species of the smaller mobile coastal orientated dolphins may move through the waters adjacent to the PPFHDP site. However there is no literature identifying resident populations within this area. Therefore, the PPFHDP scope of works will have no impact on the cetaceans.

285. **Dugong:** Dugong (Dugong *dugon*) is a medium sized marine mammal (up to 3 meters long and 400Kg) that can travel long distances and spends its entire life in the ocean, predominately in shallow coastal areas. Their status on the IUCN threatened red list is Vulnerable (IUCN, 2012). The animal is exclusively herbivorous feeding only on sea grass and as such is closely linked with sea grass habitats. Dugong populations in Sri Lanka have decreased considerably over the past century and current population stocks are very low. They were originally found and remain predominately in the shallow seas of the Palk Strait between India and Sri Lanka and within the Gulf of Mannar. Previously, a significant coastal fishery operated within these areas targeting the meat, skin and oil.

286. The waters adjacent to the northern coastline of Jaffna and particularly the coastal waters associated with the PPFHDP site do not have sea grass beds and as such do not possess suitable marine habitats conducive to support Dugong populations. There is the possibility, albeit rare, that individuals or family groups of Dugongs may move through the waters adjacent to the PPFHDP site, however these animals would be only travelling through and as such are transients. Therefore, the PPFHDP scope of works will have no impact on the Dugongs.

287. **Turtles:** Five species of marine turtles are reported to inhabit the waters of Sri Lanka, they include; Loggerhead (*Caretta caretta*), Green (*Chelonia mydas*), Hawksbill (*Eretmochelys imbricata*), Olive Ridley (*Lepidochelys olivacea*), and Leatherback (*Dermochelys coriacea*). All species are listed as threatened on the IUCN Red list, two species are Critically Endangered, (Hawksbill and Leatherback), whilst the three remaining species are Endangered (Green, Loggerhead and Olive Ridley) (IUCN, 2012).

288. All five species have been recorded to nest in Sri Lanka however none are reported to nest in the Northern Province. The coastal waters of the northern coastline of Jaffna in close proximity to the PPFHDP site's ecological habitats provide potential food sources for the Hawk's bill and Loggerhead turtles, however these species are not reported to feed in this area. Similarly, there is the possibility that individuals of all 5 species may move through the waters adjacent to the PPFHDP site whilst travelling to other coastal and open ocean waters and as such are transients.

289. **Crocodiles:** Two species of crocodiles are found in Sri Lanka. They include the estuarine - *Crocodylus porosus* and the Marsh or Mugger - *C. palustris*. Both species are listed as threatened on the IUCN Red list with *C. porosus* listed a Low Risk whilst *C. palustris* in Vulnerable and are protected in Sri Lanka. Both species are found in the Northern Province, the larger estuarine crocodile inhabits the rivers, wet lands, lagoons and coastal areas, whilst the smaller species habitat preference is wetlands, freshwater and brackish lagoons.

290. The coastal waters of the northern coastline of Jaffna in close proximity to the PPFHDP site do not have rivers nor direct access to the coastal wetland swamps and, as such, do not possess suitable marine and coastal habitats conducive to support crocodiles. There is the possibility, albeit very rare, that individuals C. porosus may move through the waters adjacent to the PPFHDP site, however these animals would be only travelling

through and as such are transients. Anecdotal information collected during the assessment did not indicate that this has happened in the recent past. Therefore, the PPFHDP scope of works will have no impact on the crocodiles. Similarly, the threat to human safety from these animals is seen as very low.

291. **Mangrove:** Mangroves are woody shrubs and trees that are salt and flood tolerant and are found in coastal habitats that are associated with estuaries, foreshore, inter-tidal and lagoonal areas and play a significant role in coastal biological diversity, erosion control and are a natural barrier of protection for the islands.

292. 21 species within 14 genera of true mangroves have been recorded in Sri Lanka covering an estimated area of 10,000 hectares (ha) (IUCN, 2012). In addition, there are a number of additional mangrove associated species located throughout the nation. Within the true mangroves species two species are Critically Endangered (*Ceriops decandra*, *Lumnitzera littorea*) on the IUCN red list of threatened species, three species are listed as endangered (*Bruguiera cylindrical*, *Sonneratia alba* and *Xylocarpus granatum*), five species listed as vulnerable (*Bruguiera gymnorrhiza*, *B. sexangula*, *Nypa fruiticans*, *Sapium indicum*, *Scyphiphora hydrophyllacea*), with the remaining species classed as Least Concern (5) or data deficient (6).

293. There is no definitive list of species of mangroves located within the Northern Province. However, mangroves are located in all four districts (very limited on the exposed northwest and northern shoreline) with the highest abundance in terms of species numbers and area coverage is associated with the north eastern lagoons and coastal shorelines, including the offshore island. It is understood large tracts of mangroves were removed during the conflict, for security purposes.

294. The major mangrove areas associated with Janna district are associated with the offshore islands, including Mandativu islands, Kayts Island, Uppuaru lagoon and Chalai lagoon comprise of important mangrove stands. The dominant species reported includes *Avicennia marina* and *Rhizophora mucronata*.

295. There are no mangroves located within or in close proximity to the PPFHDP site and as such the PPFHDP scope of works will have no impact on these resources.

296. **Sea grass:** Sea grass communities (meadows) are a significant coastal habitat and contain high biodiversity value in Sri Lanka. They are essential marine ecosystems as they are the main diet for species such as the endangered green sea turtle (*Chelonia mydas*) and dugongs (*Dugong dugon*). Sea grasses grow fully submerged and rooted in soft bottom estuarine and marine environments and can be found in habitats extending from the intertidal zone to sub-tidal, along mangrove coastlines, estuaries, shallow embayment's and also coral reef, inter reef and offshore islands. The shallow water marine lagoons and intertidal reef flats associated with the Northern Province have the highest abundance and species diversity within the nation. Fourteen species of sea grass have been identified within the nation. None were located within the PPFHDP site.

Marine Assessment

297. A detailed rapid marine assessment of the inter-tidal and sub tidal marine ecosystem, specific habitats and resources adjacent to the fisheries harbor site was undertaken during March 2018 by the project's consultants. The assessment was undertaken using free diving (snorkelling) and SCUBA diving by the assessment team.

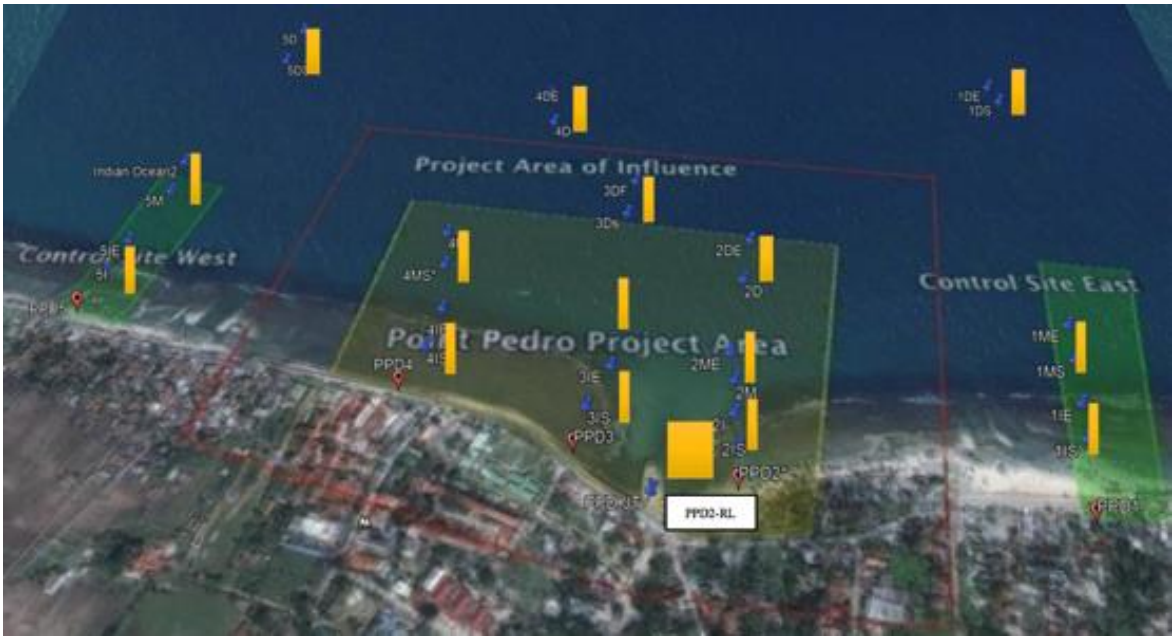
298. This assessment is documented fully in a separate report titled: "Point Pedro Marine Environmental Assessment" (**ANNEX 05).** The information detailed by this assessment identifies key potential marine environmental impacts associated with the construction and operational phases of the project, which are discussed within this report and articulated in the project's EMP.

299. In total, 15 (5 intertidal and 10 sub tidal) reef transects (30 m x 2 m) were undertaken directly adjacent to the proposed fisheries harbor scope of works and to the

east and west (control site) of the fisheries harbor site and an area direct next to the existing Point Pedro jetty were assessed separately to identify the marine benthic habitat and associated benthic resources (**Figure 4-21**). Information was collected in situ for all sites and included photograph and video recordings. Fishers at two landing sites were interviewed to acquire information pertaining to resources captured in the area with both benthic and pelagic mobile resources were discussed.

300. The inter-tidal transects (snorkelling and/or walking) included the reef benthic habitats from the exposed foreshore rock wall (west) or beach (east) to the reef edge in all locations and were undertaken during low water thus allowing ease of access to all sites. The sub-tidal transects (SCUBA diving) included the reef benthic habitats from the reef slope directly offshore and water access was undertaken from a boat.

Figure 4-21 The marine assessment intertidal and sub tidal assessment survey sites in relation to the Point Pedro project area.



301. Coralline limestone and sandstone reefs were found running parallel to the shore, protecting the shore from waves and providing habitats for intertidal biota, including soft and hard corals. Sandstone, limestone and rocky reefs are one of the common features of the northern coast of Sri Lanka. The intertidal reef flat varied in width (70 m to 150 m), terminated at the reef edge and descended down the short reef slope at an angle of 450 to terminate at the benthic substrate at around 6-8 m depths at which point the substrate is dominated by sand is devoid of a hard substrate and associated benthic invertebrates.

302. All reefs assessed have been impacted by anthropogenic sources for well over a century and include physical/structural impacts; (i) coastal and shoreline reclamation projects (the rock revetment wall running along the shoreline), (ii) the construction of the wharf; (iii) subsistence and artisanal fishing activities and natural impacts associated with drainage discharge and associated sediments and pollution during major weather events (e.g. rainfall, cyclones).

303. The percentage of live hard and soft coral coverage was very low throughout the inter-tidal and sub-tidal marine areas of the PPFHDP site and adjacent control assessment sites to the east and west. The sub-tidal marine area located close to the existing wharf recorded the assessments highest percent live coral coverage of 6 percent. The highest inter-tidal percentage hard and soft coral coverage was 5%. However, the majority of the

inter-tidal and sub-tidal reef areas adjacent to the PPFHDP and neighbouring control sites recorded percent coral coverage below 1 percent.

304. The shallow water inter-tidal sandstone reef, especially towards the eastern side of the jetty, possessed a substrate that was mostly coral rubble and sand (**Figure 4-22 a**) that had low numbers of recently recruiting hermatypic corals (< 30 cm size) scattered throughout the assessment area. The branching hard corals (e.g. Acropora sp. and Montipora sp.) (**Figure 4-22 b**) were the main hard coral genius located in this area. The hard coral massive and boulder coral morphological forms (*Porites sp*., *Platygyra sp.* and *Favia sp.)* (**Figure 4-23**) dominated the deeper water areas associated with the inter-tidal reef flat and shallow water sub-tidal reef slope areas assessed. Towards the deeper areas of the sub-tidal reefs benthic substrate were mostly covered with soft corals, such as Sinularia sp.

Figure 4-22: Examples of (a) benthic substrate and (b) hard corals located within the deeper areas of the intertidal reef areas within the PPFHDP.

(a) (b)

Figure 4-23: Examples of hard corals located in the sub tidal reef areas within the PPFHDP.

305. The rocky shores associated with the western side of the PPFHDP site and adjacent marine areas show a typical benthic habitat and flora and fauna assemblage supporting a diverse range of sessile (e.g. bivalves, gastropods) and mobile (e.g. crustaceans) invertebrates that can tolerate period of exposure and inundation of salt water. Some of the larger pools that hold water at all tide levels, such as one west of the jetty, recorded several small colonies of a number of hermatypic corals species (e.g. *Acropora sp.)* as well as soft corals. Reef associated fishes as well as juvenile stages of some butterflyfishes (*Chaetodon sp.)* and angelfishes (*Pomacanthus sp.)* were also observed during period of high water.

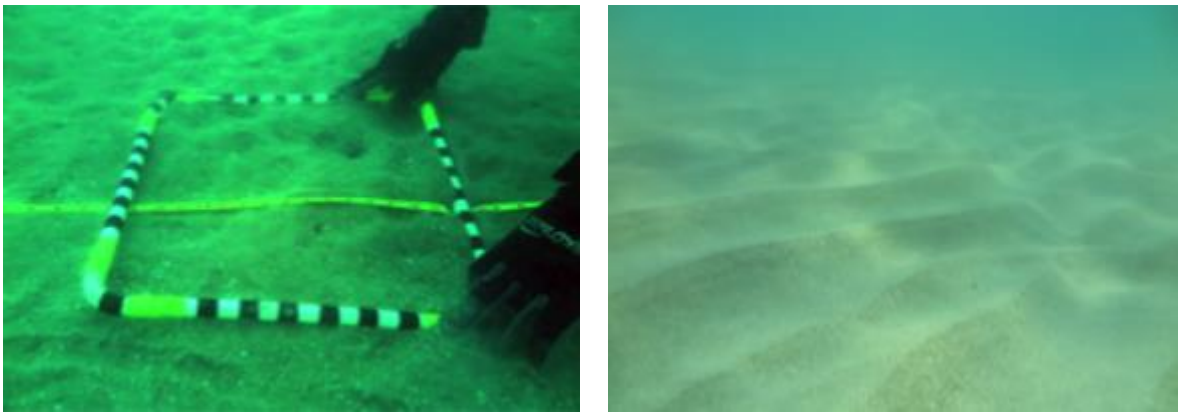
306. The inter-tidal reef flat is exposed during period of low water with a hard substrate covered with coral rock, rubble and finer reef derived sediments. The deeper areas that are not exposed during low water possess a low to medium percentage (15-35%) coverage of macro algae (**Figure 4-24**) dominated by *Padina sp*., *Caulerpa sp*., *Halimeda sp.* and *Turbinaria sp.*

Figure 4-24: Examples of macro algae located within the PPFHDP site.

307. Inter-tidal reef has a lower structural complexity and benthic flora and fauna diversity than the subtidal reef systems associated with the PPFHDP. This is reflected in the sessile invertebrate species abundance and coverage.

308. The sub-tidal reef system terminates through the reef slope onto an extensive sand substrate (**Figure 4-25)** that is almost completely devoid of hard structures (coral rocks, rubble) and extends offshore. The sandy bottom is covered with fine sand and mud on surface layers and visibility is very poor due to fine particles. The sandy bottom is devoid of any sessile benthic flora and fauna communities. Mobile invertebrates (e.g. sea cucumbers, sea urchins, crabs) were located in very low numbers throughout this area whilst fin fish schools and individuals were recorded.

Figure 4-25: The substrate found offshore from the PPFHDP site.



309. The inshore sub-tidal reef areas support commercially important finfish species, such as Jacks (Carangidae), Snappers (Lutjanidae), Groupers (Serranidae) and Sardines (Clupeidae) and the rocky reef area support a lobster (Panulirus sp.) population. Several individual giant clams (*Tridacna maxima*) and a range of gastropods were recorded along with healthy populations of the low commercial value sea cucumber *Holothuria atra*. There were no sea grass beds, marine turtles, dugong or cetaceans located during the assessment nor was there any anecdotal information provided to the assessment team that these resources reside or utilize the reef areas associated with the PPFHDP. There are no mangroves associated with the PPFHDP site nor neighbouring coastal habitats.

310. Plankton samples collected during the assessment provided evidence that a number of common marine plankton found in coastal waters around Sri Lanka are present. Large aggregations of fish or invertebrate eggs or larval stages were not recorded among samples possibly indicating that this area does not support adult invertebrate and vertebrate breeding grounds, however additional time series data would need to be collected to provide conducive evidence.

The local communities associated with the project site are heavily dependent on the local fish resources for food security, livelihood and income generation. The removal of inter-tidal and sub-tidal reef resources for the PPFHDP will have little, if any, negative impact on the local fishers, rather the increased access to fisheries harbor -based fishing infrastructure that will result from the PPFHDP will provide valuable support and assistance to the fishers.

Terrestrial Habitats, Flora and Fauna

311. Sri Lanka is characterized by a high level of plant biodiversity including 3,210 species of vascular flowering plants with a corresponding high level of plant endemism. The flowering plants belong to 1052 genera of which 916 are endemic whilst 350 species of ferns of which 50 species are reported to be endemic for Sri Lanka (IUCN, 2007 and MOE, 2012).

312. In the Jaffna Peninsula, there are no forests in and around the populated areas, except for Palmyra (*Borassus flabellifer*) plantations found as scattered patches and *Casuarina sp.* plantations established by the Forest Department along the sand dunes in Vadamarachchi area. The north-eastern part of the mainland, in Kilinochchi, Mullaithivu and Mannar District, support large areas of forests. The forests in the seasonally dry northern and eastern plains (transition between the wet and dry zones) consist of tropical semi-evergreen forests with their own characteristic species as well as some common to the adjacent zones.

313. The Jaffna Peninsula biogeographically and the PPFHDP site lies in the Low Country Dry Zone. Floristically it lies in the Coastal and Marine Belt Floristic Zone. Mangroves, Salt Marshes, Sand Dunes and Beach Vegetation are the typical natural habitats in Coastal and Marine Belt Floristic Zones. The soil and water resource of the area are both related to the limestone geology of the land. The soils are formed on the marine deposits and sediments under the influence of sea waves and winds on lime stones. Alkaline saline soil and Regasol are the dominant soil types in the area. However, the proposed project area is highly man modified.

314. Northern coastal areas from Vankalai to Kokilai, with extensive lagoons, mudflats, sand-flats, seagrass beds and shallow shores, are among the most important areas for migrating water birds in Sri Lanka. This area regularly records greater number of birds, compared with the other areas in the south-east, which also records higher number of species.

315. There are three flying routes across India and the Bay of Bengal through which migrating birds come to Sri Lanka as shown in **Figure 4-26**

316. The Western Route: from the northern and north-western parts of the world along the western coastal line of India, then towards the extreme south of India, which is common point and then fly across this coast and arrive in Sri Lanka mostly across this coastal line between Mannar and south coast;

317. The Eastern Route: migrant birds take this route initially from Europe, West Asia including western Siberia, and from the western regions of Himalaya, including Kashimir, enter the island through Jaffna Peninsula; and

318. The Andaman Islands Route: falls across the Andaman Islands in the Indian Ocean and birds enter through the North-Eastern coast of Sri Lanka.

Figure 4-26: Main Bird Migration Routes across the Sub-continent and Northern areas of Sri Lanka.

319. A detailed terrestrial baseline ecological assessment survey was undertaken for the area of influence of the PPFHDP as part of the projects environmental assessment. The full terrestrial ecological and biological assessment report is provided in **ANNEX 8** and the summary findings of the baseline ecological survey for this report are presented in **Section 4.7.4**. There is a paucity of flora and fauna coastal biological, ecological and resource baseline assessment data sets for the Northern Province, due to the social unrest of the past three decades making time series data comparisons difficult for the current study.

Terrestrial Assessment

320. A detailed rapid terrestrial flora and fauna assessment was undertaken for the PPFHDP Project Area (PA) and the Projects Influencing Area (PIA) that surrounds (500 m) the PPFHDP site during March 2018 by the projects consultants. An international standard rapid line transect method was used to assess the existing terrestrial floristic and faunal diversity with all assessment undertaken during day light hours. In addition, indirect observations of animal signs, such as scat, foot prints, and food remains were carried out to understand the different faunal species in the area and discussions with key stakeholders to confirm data.

321. This assessment is documented fully in a separate report titled: “Terrestrial, Ecological and Biological Assessment of the Point Pedro Fishery Harbor Development Site, Northern Province” (**ANNEX 08**). The information detailed by this assessment identifies key potential terrestrial environmental impacts associated with the construction and operational phases of the project, which are discussed within this report and articulated in the project’s EMP.

322. The report presents the terrestrial flora and fauna assessment in two sections which include; the PPFHDP site Project Area (PA) – which includes the area directly within the PPFHDP projects scope of works and the Projects Influencing Area (PIA), which includes an area approximately 500 m surrounding the PA. **Figure 4-27** outlines the two project areas referred to within the report.

Figure 4-27: The Project Area and Project Influencing Area associated with the PPFHDP site.

323. The PPFHDP harbor is located on the seaward margin of Jaffna Ponnalai Point Pedro road. Both the PA and PIA terrestrial environments are highly modified and, as such, natural flora and fauna associated with this urban area have been significantly altered. Thus, the typical natural vegetation formations belonging to the Coastal and Marine Belt Floristic Zones expected in these areas were not encountered.

324. The main existing terrestrial habitat types recorded within the PA include the beach and associated vegetation, home gardens and roadside vegetation, whilst the main existing terrestrial habitats associated with the PIA include beach and beach vegetation, home gardens, abandoned households and road reservations.

4.8 The Project Area (PA)

325. The terrestrial component of the proposed PPFHDP PA site is highly disturbed and modified due to human activities. The Jaffna Ponnalai Point Pedro road and the Point Pedro east coast road margins the southern boundary of the PPFHDP with the majority of the project construction associated with the inter-tidal and sub-tidal reef systems adjacent to these roads. The eastern margin of the PPFHDP site includes a small but well-established beach, which is reported to be subjected to seasonal sand accumulation cycles. The eastern margin of the PPFHDP site includes 21 small homesteads associated with the Kottady fishing community, a library building, a fisheries society building, an abandoned and damaged Natarahjar stadium and areas used for net mending and clearing. The construction of the buildings and the duration of their existence have significantly altered the natural vegetation in this location. It is anticipated that 13 of the homesteads will have some minor impact due to the PPFHDP.

326. The coastline associated with the PPFHDP receives surface water from two Point Pedro urban drainage channels and, as such, during periods of rainfall the surface water and associated land-based sediments and pollutants (e.g. plastics, garbage, petrochemical and sewage) discharge directly onto the inter-tidal reef flat within the project site. The impacts of this water and potential pollutants does not affect the terrestrial flora and fauna along the narrow coastal strip, beach nor does it appear to have any direct impacts on the inter-tidal environments directly opposite the discharge outlets. These sites are exposed during period of low water and, as such, preclude the settlement and survival and benthic

intertidal flora and fauna, whilst during periods of high water are diluted due to tide and wave action.

327. The coconut tree (*Cocos nucifera*) is the dominant tree within this area and it is estimated that the area has approximately 60 trees with a girth size between 80 – 110 cm)(**Figure 4-28)** The other significant vegetation located at this site include; *Ipomoea pes-caprae* (Mudu Bin Thamburu), *Phyla nodiflora* (Hiramanadetta), *Thespesia populnea* (Suriya), *Sesuvium portulacastrum* (Maha Sarana), *Trianthema decandra* (Maha Sarana), *Launaea sarmentosa*, *Calotropis gigantea* (Wara), *Catharanthus roceus* (Mini Mal), *Canavalia rosea* (Mudu Awara), *Cyperus arenarius*, *C. stoloniferus*, *Antigonon leptopus*, *Morinda coreia* (Ahu), *Gomphrena celosioides*, *Tridax procumbens*, *Coccinia grandis* (Kowakka), *Leucas zeylanica* (Geta Thumba), *Boerhavia diffusa* (Pita Sudu Pala), *Cynodon dactylon*, *Solanum virginianum* (Katuwel Batu), *Cassia occidentalis* (Ath Tora), *Phyllanthus sp*., *Caesalpinia bonduc* (Kalu Vavuletiya), *Azadirachta indica* (Kohomba), *Argemone Mexicana*, *Ficus benghalensis* (Maha Nuga), *Morinda coreia* (Ahu), *Passiflora foetida*, *Pisonia grandis*, *Hibiscus rosa-sinensis*, *Leucaena leucocephala*, *Citrus sp*., *Lantana camara* (Grandapana), and *Borassus flabellifer* (Tal).

328. Of the 35 species located with the PA, 24 are native to Sri Lanka, two species are classified as invasive species (*L. camara* and *A. leptopus*) and two species have a Sri Lankan conservation status of nationally Near Threatened. These two species are *Sesuvium portulacastrum* (Vankiruvilai) and *Trianthema decandra* (Mahasarana). The former is also classified as a near threatened species by the IUCN.

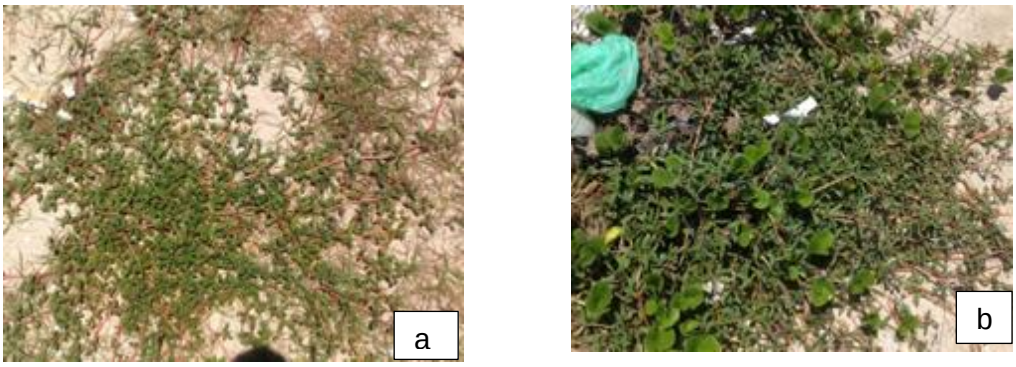
Figure 4-28: Homesteads of Kottady fishing community and dominant vegetation.

(a)

(b)

329. *S. protulacastrum* is a sprawling perennial herb that was recorded in two locations within the eastern beach area of the PPFHDP site in close proximity to the homesteads of Kottady fishing community. The first patch covers an area of approximately 5.5 m2 and is located at 9049’43”N and 80014’17”E (**Figure 4-29a**) and the second patch covered an area of 4.5 m2 and is located at 9049’44”N and 80014’16”E (**Figure 4-29 b**).

Figure 4-29: *Sesuvium protulacastrum* located in the eastern section of the PPFHDP Project Area.



330. *T. decandra* was recorded in two locations within the PPFHDP PA. The first patch was located close to the existing Point Pedro wharf behind the high sea fisheries office and covers an area of approximately 1.6 m2 and is located at 9049'41"N and 80014'09"E **(Figure 4-30a).** The second patch was recorded in the eastern beach area of the PPFHDP site in close proximity to the homesteads of Kottady fishing community. The size of the patch was approximately 1.2 m2 and is located at 9049'42"N and 80014'15"E (**Figure 4.30 b**). This patch is subjected to human interference and is located only on one side of a small pathway leading to a community dwelling.

Figure 4-30: *Trianthema decandra* located in the eastern section of the PPFHDP Project Area.

(a) **(b)**

331. Several previous studies confirmed the significant and regular existence of both these species throughout the beach and coastal environment of Jaffna, Mannar, Vavuniya, Kilinochchi and Batticaloa districts within the Northern Province (Asela et al, 2014; Joseph, 2003, Department of Wildlife Conservation, 2017; IUCN, 2012; IUCN, 2011; CEB, 2016; GOSL, 2017).

332. Home Gardens: This habitat was observed in association with the existing 21 homesteads of Kottady fishing community. Like the beach and beach vegetation, this habitat was also predominated by *Cocos nucifera* (Coconut). In addition, *Thespesia populnea* (Suriya), *Calotropis gigantea* (Wara), *Azadirachta indica* (Kohomba), *Carica papaya*, *Moringa oleifer* (Murunga), *Morinda coreia* (Ahu), *Punica granatum* (Delum), *Passiflora foetida*, *Pisonia grandis*, *Borassus flabellifer* (Tal), *Hibiscus rosa-sinensis*, *Citrus sp*. *Lecucaena leucocephala*, *Antigonon leptopus* and *Lantana camara*.

333. Of the 16 species located within the home gardens of the PA, only 6 species were native to Sri Lanka and none of the species were endemic or hold any conservation value. The two-invasive species; *A. leptopus* and *L. camara* were present.

Project Influence Area (PIA)

334. The terrestrial component of the proposed PPFHDP PIA includes a considerable proportion of the Point Pedro town ship and as such the entire area is highly disturbed urban area.

335. Point Pedro PIA includes a number of significant government/community/private sector infrastructure buildings and includes; two fish landing sites Kottady to the east and Supermadam to the west; numerous houses (some abandoned) (**Figure 4-31 a**), Hindu and Buddhist temple Periya pillayar temple, a number of schools (e.g. Sitthy Vinayaga, Hartley College, Methodist Girls' High School) (**Figure 4-31 b**), Police station, Sports complex of Hartley college, District Magistrate court complex, 551 Military Brigade and Point Pedro Urban Council buildings.

Figure 4-31: Abandoned houses and Sitthy Vinayagar School within the PIA of the PPFHDP.

(a) **(b)**

336. There will be no physical terrestrial disturbance within the PIA, however during the construction phase and to a lesser degree the operational phase of the fisheries harbor increased dust, noise and vibration due to machinery within the site and vehicle movements are expected. Impacts levels will be higher closer to the area of works and, as such, the towns' services and business directly boarding the PPFHDP will be impacted. These impacts need to be managed.

337. Terrestrial habitat types in PIA: There are four major existing terrestrial habitat types observed in the PIA which include;

- Beach and Beach Vegetation
- Home Gardens
- Abandoned Households
- Road Reservations

338. All habitat types are fully functional terrestrial ecosystems that are surviving in a highly disturbed and modified urban environment and, as such, the original native flora and associated fauna are all but non-existent.

339. Beach and Beach Vegetation: The vegetation associated with this PIA is very similar to the vegetation types recorded for the same habitat associated with the PA. However, the two near threatened species located in the PA were not present, nor were there any endemic floral species recorded.

340. Home Gardens: The household/home garden vegetation consisted either of vegetation that is used for household food and/or small-scale income generation or ornamental purposes. Food and/or income opportunity vegetation included; *Cocos nucifera*,

Borassus flabellifer, *Mangifera indica*, *Carica papaya*, *Moringa oleifer*, *Punica granatum*, *Azadirachta indica* and *Musa x paradisiaca*. The ornamental trees included; *Hibiscus rosa-sinensis*, *Plumeria obtuse*, *Bougainvillea sp*., *Nerium oleander* and the regions two invasive plant species (*A. leptopus* and *L. camara*) were recorded. There were no endemic, protected or endangered floral species recorded within the home gardens within the PIA.

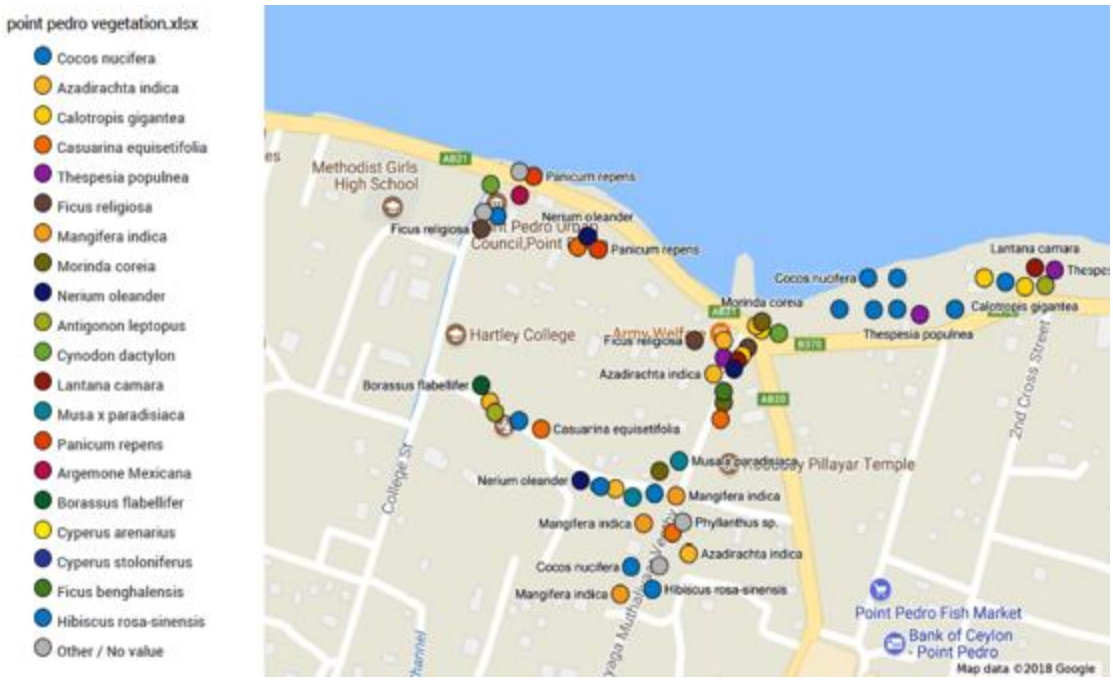
341. Abandoned Houses: Throughout Point Pedro there are a number of abandoned houses and land parcels that are in different levels of disuse with a number of land areas, which have had little human management for a considerable period of time. The major vegetation types recorded in the abandoned houses include; *Passiflora foetida, Morinda coreia, Azadirachta indica, Tribulus terrestris, Datura metel* and *Abutilon indicum*. There were no endemic, protected or endangered floral species recorded within the abandoned households within the PIA.

342. Road Reservations: These small “green areas” occur throughout the PIA and the dominant plant species include; Cynodon dactylon, Phyla nudiflora, Azadirachta indica, Thespesia populnea, Solanum virginianum, Passiflora foetida, Argemone Mexicana, Abutilon indicum and the regions two invasive species A. leptopus and L. camara. No endemic, protected or endangered floral species were recorded in the road reservations within the PIA.

343. A total of 63 floral species were recorded during the field ecological survey of the PPFHDP Project Area and surrounding Project Implementing Area (**Figure 4-32**). The species located included 26 herbaceous species, 20 trees, 9 shrubs and 8 climber or creepers. There were no endemic species located and just over half of the species located (57%) were native species whilst he remainder were exotic. Two invasive species were located throughout the PA and PIA (*A. leptopus* and *L. camara*) and these plants if required to be removed need to be disposed of to prevent further distribution.

344. Two nationally near threatened species (*Sesuvium protulacastrum* and *Trianthema decandra*) were recorded within the PA and were located in the east corner of the PA associated with the beach and shoreline habitat. These species are reported to be widely found throughout the Northern Province in similar environmental habitats, however they are restricted to this region of Sri Lanka. If these plants are required to be removed for the PPFHDP development requirements they are to be removed alive (with care) and replanted in a similar neighbouring habitat that will ensure their survival.

Figure 4-32 : Detailed map showing the location of key notable vegetation located during the field assessment associated with the PPFHDP PA and PIA.



4.8.1.1 Fauna

345. A total number of 29 faunal species within 5 different taxonomic groups were located during the faunal field assessment of the PPFHDP PA and PIA areas. This included 13 bird species, 10 butterflies, 3 dragonflies, and one species each for mammal, reptiles and land snails. There were no endemic species but all are recorded as natives to Sir Lanka.

346. One critically endangered land snail species *Trachia fallaciosa* (**Figure 4-33**) ("strawberry snail") was recorded during the field survey and was located on a fence within a homestead during the field assessment sites within the projects PIA. This species was not located within the PA of the PPFHDP site. This species is restricted to the dry northern parts of Sri Lanka and is reported to be common throughout the Jaffna peninsula, on trees and shrubs found in home gardens, roadsides and abandoned lands.

Figure 4-33: The critically endangered land snail *Trachia fallaciosa* located within the PIA of the PPFHDP site.

347. This species had been previously recorded within the PA of the PPFHDP site during the project's environmental feasibilities study in September 2016, however it was not

recorded during the present study (19.03.2018). The two assessments were undertaken during different climatic seasons. The feasibility report was undertaken during the wet seasons whilst the current study was undertaken during the dry season, the markedly different results have a direct relationship to the seasons, specifically snail populations are directly related to the presence and abundance of water.

348. Interviews undertaken by the terrestrial consultant team during the assessment with community members revealed that this species can be observed during the rainy seasons throughout Point Pedro Township in abundant numbers. According to the available information on the biology and ecology of this species and expert consultations reveals that this species aestivates to overcome the unfavourable weather conditions creating during the dry season. The specimens located during the current assessment were attached to a Palmyra fence located within a home garden within the PIA (9o 49' 41" N, 80o 14'14" E). Their abundance was low.

349. It is recommended that during the construction phase of the PPFHDP the snail if located in areas that will be impacted by the scope of works be collected by hand, kept alive and translocate to similar habitats in neighbouring locations.

350. No migratory bird species were recorded during the field ecological study, although the assessment was undertaken within the migratory bird's normal season. As the proposed project site is highly urbanized and man modified, the occurrence of migratory birds is rare. This was confirmed by the field interviews with fishermen and fisheries officers and a review of the available literature also revealed that proposed project site is not a hot spot for bird watching.

351. Feral pigeon (*Columba livia domestica*) is the common pigeon and was observed throughout the PA and PIA. The rock pigeon *Columba livia* is the wild race of the domesticated feral pigeon. Although the populations of the wild pigeons are relatively low, they were also found scattered throughout the PIA and in the Jaffna District. They are not nesting and rearing juveniles in the project area. Proposed harbor will not pose a serious threat to this species.

4.8.1.2 Threatened and Protected Species

352. The nation is reported to have over 17,000 and 450 terrestrial vertebrates and invertebrate fauna species, including 315 and 329 endemic species, respectively; over 1,700 marine and coastal animals, 3,210 flowering plants belonging to 1052 genera of which 916 are endemic and 350 species of ferns with 50 species endemic have been reported for Sri Lanka (IUCN, 2007 and MOE, 2012).

353. The International Union for Conservation of Nature & Natural Resources (IUCN) undertakes a global assessment (Red List) to classify species as to their conservation status. Classifications (from most to least concern) include critically endangered, endangered, near threatened, vulnerable, or least concern. There is also a data deficient category to denote lack of information to make a determination.

354. Information pertaining to Sri Lanka marine and terrestrial fauna and flora has been reasonably assessed, however information pertaining to all species and their threatened status is not complete. The publications IUCN, 2007 and MOE, 2012 listed in the reference provides detailed information on all flora and fauna species in Sri Lanka and their current status, these reports should be reviewed for additional information. A summary of the total number of species and their threatened status for the key taxonomic groups of Sri Lanka is reported in **Table 4-7** (IUCN, 2007 and MOE, 2016).

Table 4-7 : Total species and threatened numbers of key fauna groups of Sri Lanka.

Taxonomic Group	Total Number of Species	Number of Threatened Species (where known)
Mammals	123 (28 marine)	49 (9 Critically Endangered)
Birds	453	46 (10 Critically Endangered)
Amphibians	140	52
Reptiles	211	64
Butterflies	245	100
Echinoderms	213	
Marine Molluscs	228	
Fish		
Marine	969	52
Freshwater	93	28
Hard corals	183	

355. Threatened terrestrial species recorded for Jaffna district of the Northern Province includes one (1) freshwater fish, three (3) reptiles, one (1) amphibian, two (2) birds, two (2) mammals and seven plants as threatened. Fifteen (15) marine species of sharks, rays and skates (3 critically endangered), four (4) species of marine fish, five (5) marine turtles, over 28 marine mammals including whales and dolphins, the Dugong and the majority of hard corals are classified as threatened within the reef and marine areas of the northern district (IUCN, 2012). In addition, the whale shark (*Rhincodon typus*) and big eye tuna (*Thunnus obesus*) found in the pelagic zone are also recorded as vulnerable.

Protected Areas.

356. Officially there are 6 registered Marine Protected Areas (MPA's) within Sri Lanka (**Figure 4-34**) however the literature reports that 4 additional Terrestrial Protected Areas (TPA) within the nation include coastal and or marine ecosystems or specific habitats and as such could be included as MPA's. There are no MPA and/or TPA located in the Northern Province however the province has seven wildlife sanctuaries which include; the Madhu Road (1968), Chundikulam (1938), Giant Tank (1954), Vankalai (2008), Vavunikulam Tank (in 1963), Paraithivu (1973), and Kokkilai (1951).

357. All of which are located well outside the area of impact of the PPFHDP site and, as such, there will be no impacts on protected areas resulting from the project.

Figure 4-34: Location of the 6 MPA within Sri Lanka.

Historical Religious, Archaeological and Cultural Significant Sites

358. There are a large number of sites and associated infrastructure components within Point Pedro that have a significant historical, religious, archaeological, scientific and/or cultural importance to the communities of Point Pedro and to the wider population including interests of domestic and international tourists. There are 231 Hindu Temples, 27 Churches and a Mosque in the Vadamarachchi North DS Division. A number of the more important sites that are popular with the tourists include the; Sannathi Temple in Thondamanaru South, the Cave Mandapakkadu in Kerudavil South, the Orani Spring in Polikandy West, Therumoodimadam in Point Pedro, Light House in Point Pedro East, Vallipuram Temple at Vallipuram, Beach in Thumpalai East and Koddai, and Holy Well in Thondamanaru. These sites are outside the influence of the PPFHDP and, as such, no impacts to these areas will occur.

359. There are two and four historical facilities located within the PA and PIA, respectively for the PPFHDP (**Figure 4-35**).

Figure 4-35: A map showing the existing cultural sites within the PA and PIA of the PPFHDP.

360. The two historical facilities located within the PA includes an old 'Direction Board (**Figure 4-36a**) and the Point Pedro's existing wharf (**Figure 4-36b**).

Figure 4-36: Historical sites located within the PPFHDP PA including a direction board and existing Point Pedro Jetty.

(a) **(b)**

361. The old direction board is located next to the entrance of the existing jetty (9°49'40.97"N and 80°14'7.08"E). This structure due to its age has a local landmark value however as it is located outside of the PPFHDP scope of works the direct board will remain in its current location.

362. An Archaeological Impact Assessment (AIA) was conducted by the Archaeological Department in the proposed project area. Total of six structural remains, Old Customs Building, Old Entrance to the Jetty, Retaining wall, remains of the Ancient Fort, Old Dispensary and Old Entrance of Methodist College which have archaeological value were found from the land survey of the proposed area. All of them are colonial structures

belonging to the Portuguese, Dutch and British periods. Those are situated in the vicinity of Point Pedro jetty. The presence of concrete in some of these structures indicates that they have been used and renovated till recent past. Three barges one within the project site and the other two are out side the project area were recorded in underwater survey conducted as a part of the AIA. Old Customs Building, the Remains of the Fort, Old Dispensary, Old Entrance of Methodist Ladies' College, are categorised[8] as category B, which can be replaced in a secondary context after recording/documenting the primary context. All three Barges recorded in the underwater survey are placed in the 'D' category as a site which has no archaeological value. The AIA report is given in **Annex 9**

363. In addition, there a three religious and one cultural significant buildings that are within the PPFHDP PIA. The three religious sites include; a Buddhist temple (7 **a**) (9°49'40.70"N, 80°14'6.67"E) and a Hindu Temple (**Figure 4-37 b**) (9°49'40.00"N, 80°14'7.78"E) both located adjacent to the jetty and a Church (Error! Reference source not f ound. **a**) (9°49'41.99"N, 80°14'16.51"E) and a performing "Nadarajar stage" (Error! Reference source not found. **b**) (9°49'42.64"N, 80°14'18.68"E) located east of the PA within the PIA. This facility was constructed in 1972 to respect the former Pont Pedro Urban Council Chairman (Mr. Nadaraja) and was used to stage open air events for the local fishing communities. The facility is in a state of total disrepair. All four buildings are outside the PA and, as such, will not be impacted directly or indirectly by the PPFHDP scope works.

Figure 4-37: The Buddhist (a) and Hindu temple (b) located adjacent to the wharf within the PIA of the PPFHDP site.

(a)

(b)

[8] A - Extremely important archaeological site, cannot be destroyed, removed, replaced or even touched.
B - Important archaeological site, cannot be destroyed, but can be replaced in a secondary context after recording/documenting the primary context.
C - Has meager archaeological value, and can be removed or disregarded after a detailed recording/ documenting by archaeologists.
D - No archaeological value.

Figure 4-38: The church (a) and Nadarajar stage (b) located to the east of the PA within the PIA of the PPFHDP site.

(a)

(b)

Social and Economic Activities

4.8.1.3 Nature of households and principal economic activities

364. The proposed site and the surrounding area in Point Pedro is located in the Vadamarachchi North Divisional Secretariat (DS) Division (VNDS) in the Jaffna District along the AB 21 road. The DS Division covers an area of 54. 2 km^2 and its boundary extend along 1.6 km of lagoon and 19 km of coastline. The proposed harbor area is located in the Point Pedro Grama Niladari Division and includes the villages of Koddady, Point Pedro and Supparmadam. The details of population distribution in the area is shown in **Table 4-8**. The total population of 1,716 consists of 565 families.

Table 4-8 : Details of population distribution in the area

G.N. Division	Total Land area (km^2)	Population	Density
Point Pedro (J401)	0.74	1,716	2,318.92

Source: Divisional Secretariat, Vadamarachchi North, 2019[9]

365. The total population of Vadamarachchi North Divisional Secretariat (VNDSD) in 2018 is 45,586 and consists 22,088 males and 23,498 females. It shows the female population ratio is rather higher than the male population in the DS division. The lack of economic opportunities within the division is provided as a reason for men leaving the area in search of jobs in other areas. 62.1 percent of the population belong to the age group of 15 to 60 years.

366. The divisional data reveals that 42.10% of the population, receive a monthly income of below Rs. 5,000 with only 16.69% of the population receiving a monthly income above Rs. 25,000 (**Table 4-9**).

[9] Divisional Secretariat, Vadamarachchi North (2019), Resource Profile, Divisional Secretariat, Vadamarachchi North,2019

Table 4-9 : Percentage of Per Capita Income / Monthly

G.N Division	Monthly Income (No. of Persons)						Total
	Under 5000/=	5001/= to 10,000/=	10,001/= to 15000/=	15,001/= to 20,000/=	20,001/= to 25,000	Over 25,001	
J/401 (%)	50.31	7.06	11.66	7.82	7.52	15.64	100.00
Total (%)	42.10	17.10	8.77	6.44	8.90	16.69	100.00

Source: Divisional Secretariat, Vadamarachchi North 2019.

367. Fishing and agriculture are the dominant economic activity in the Vadamarachchi North DSD Division. The employment details in the VNDSD are given in the **Table 4-10.**

Table 4-10 : Employment details in the Vadamarachchi North DSD.

Profession	Male	Female	Total	Percentage
Agriculture	1913	366	2,279	19.86
Fishing	931	211	1,142	9.95
Govt.Sector	1348	1377	2,725	23.74
Co – operative	51	32	83	0.72
Private sector	556	185	741	6.46
Self-employment			-	-
Mason	566	0	566	4.93
Carpentry	472	0	472	4.11
Jewelling	43	0	43	0.37
Mechanic	161	0	161	1.40
Labor	3021	244	3,265	28.45
Total	**9,062.00**	**2,415.00**	**11,477.00**	**100.00**

Source: Divisional Secretariat, Vadamarachchi North 2019.

368. The Percentage of Poverty Head Count Index level in Jaffna District (7.7%) is higher than the national level (4.1%) as indicated in **Table 4-11** the poverty status in the Vadamarachchi North DS Division was 9.13% and the estimated number of poor persons was 4317 in 2012 (DCS, 2015). Thus, it is envisaged by providing improved infrastructure facilities for the fisheries sector in Point Pedro will provide opportunities to improve economic benefits to the fishing communities in the area.

Table 4-11 : Poverty Levels in Jaffna District – 2016

S. No	Sector	Poverty Head Count Index (%)	Number of Poor people	Contribution to the total population (%)
1.	Sri Lanka	4.1	843,913	100
2.	Northern Province	7.7	83,834	9.9

Source: Department of Census and Statistics -2016.

Economic Structure

369. The economic structure of VNDSD comprises agricultural, fisheries, industrial and service sectors. The agricultural sector includes cultivations of rice paddy fields, onions, tobacco, vegetables and fruits. Fisheries is the dominant sector in coastal areas of the VNDSD. The industrial sector consists of cottage (167), small/medium scale (86) and service sectors with 204 industrial establishments. Out of these, only 56.74% are functioning, which provide employment for 792 workers as indicated in **Table 4-12**. The inactive factories have the capacity to provide employment for another 335 persons. The fish processing factory in Vadamarachchi is not functioning at present due to lack of access to saleable commodities. Operations could recommence commercial production with the operation of the proposed fisheries harbor facility and improved access to fish.

Table 4-12 : Industry Structure in the Vadamarchchi North DS Division, 2018.

Industry	Functioning	Not Functioning	Total	No. of employees (in functioning industries)
Small/Medium	74	12	86	202
Cottage industry	104	63	167	380
Service industry	104	140	244	210
Total	282	215	497	792
%	56.74	43.26	100	

370. The project PPFHDP site consists mainly of fishing families. They engage in traditional coastal (demersal and pelagic) and deep-sea fishing (pelagic) activities throughout the year. Domestic and export marketing access are available to the fishermen depends on quality and quantity of catch. Crustaceans (e.g. crab and prawn) also provide a significant income to fishermen of this region. Recent increases in the skills and capacity of the fishers has dramatically improved through the use of improved modern equipment and techniques that have directly resulted in improvement in all sectors of this industry. Therefore, the proposed development of the Point Pedro harbor and associated infrastructure improvements will further develop the fishing industry in this region and will directly improve employment and income generation opportunities for these communities.

Existing Infrastructure Facilities

371. **Transport:** The major infrastructure development programs initiated by the government in the Northern Province after 2009 have improved transport, electricity and telecommunication facilities, particularly in Jaffna District. Point Pedro is linked with the main transport network of Jaffna through 'A' class roads (AB 020 Jaffna-Point Pedro Road of 33.79 km, AB 021 Jaffna Point Pedro Road of 51 km) and 'B' class Roads (B371 Point Pedro Maruthankerny Road, 13.00 km, B370 Point Pedro-East Coast Road 3.94 km). It is also linked with the transport network of the District through several 'C' class roads (Valvetti-Oorikadu- Kommanthurai Road, Police Station Road, Valvettithurai, Polikandy-

Navindil-Karanavai Road etc.) and 'D' class roads (Kumarathipulam Road, Karukampanai cemetery Road, Puttalai Temple Upayakathirkamam Road etc.).

372. **Electricity:** The entire DS Division is provided with electricity services and with a customer base of 10,369 representing (9,759) domestic services and 610 trade centers. The existing infrastructure support system at Vadamarachchi is a positive factor in promoting fisheries and related manufacturing and service sector industries.

373. **Communication:** The main mode of communication is telephone. Sri Lanka Telecom is the major service provider in the area and supports, both landlines and wireless telecommunication network facilities, are available to the public throughout the Northern Province.

374. All mobile phone service providers are extending their services to the region. The residents of the area have access to local and Indian based satellite television facilities, which bring local and foreign channels. Broadband internet was introduced in 2010 and can be accessed via SLT ADSL connection or by wireless connection using an antenna from Dialog. A number of shops provide IDD, fax and internet facilities.

375. **Schools:** There are three school that are in close proximity to the PPFHDP site, this includes the J/Methodist Girls' High School, J/Hartley College and J/Point Pedro Sithivinayagar Vidyalayam. The distances from the school boundary to the proposed fisheries harbor project boundary is given in the **Table 4-13**.

Table 4-13 : Distances from school boundary to the proposed PPFHDP site.

S.No	School	Distance (m)
1.	J/Methodist Girls' High School,	15
2.	J/Hartley College	100
3.	J/Point Pedro Sithivinayagar Vidyalayam	275

376. Due to the close proximity of the schools to the PPFHDP site additional consultations have been undertaken to ensure the schools are aware of the project and that specific environmental and social management actions will be implemented to reduce the potential physical and social impacts resulting from the construction and operational phases of the project. These have been detailed in the EMP.

377. The schools provide services to all school ages children and have a combined total number of students 3,157 with a combined teaching staff of 202 (**Table 4-14**). The J/Methodist Church also provides a play and Learn Pre -school to the community.

Table 4-14 : Details of the students and teachers in surrounding schools.

Name of School	**No. of Students and Grade**				**No. of Teachers**			
	1 – 5	6 – 11	12 – 13	Total	Graduates	Trained	Others	Total
J/Hartley College	-	879	512	1391	48	114		62
J/Methodist Girls High School	-	839	590	1429	63	15		78
J/Point Pedro Sithivinayagar Vid.	177	160	-	337	5	15		20

Source: Divisional Secretariat, Vadamarachchi North -2019

378. **Hospitals:** Manthikai base hospital is the nearest government hospital to the project area. The hospital located 6 km from the project area.

379. **Post Office:** In Vadamarachchi North area, there are 2 main post offices and 11 sub post offices. The project area does not have post office and the people in the area have access and use the Point Pedro post office.

380. **Markets:** Point Pedro fish and vegetable markets are located within the town and are approximately 450 m from the jetty of Point Pedro. The wholesale dealers operating at the fish market approach fishermen either directly at their boat or at their residence to purchase their catch and on sell the fish in the markets daily. In addition, there are a number of wholesale distributors whom purchase product from fishers within the PIA and export the fish commodities to southern markets, most entering and sold to markets in Colombo. Dry fish processing is undertaken throughout the north predominantly by women, who sell the majority of dried fish to domestic market outside of the Northern Province. Local consumption of dry fish is very low due to available of fresh fish.

Housing / sanitation, water supply agriculture.

381. Majority of the families in close proximity to the PPFHDP are living in permanent houses. The past conflict and 2004 tsunami event has caused considerable damage to the houses and local infrastructure in the Northern Province, include Jaffna and the Point Pedro area. The majority of houses that were damage due to these events have been rebuilt through self-finance and with financial support from the government and NGO community.

382. The donor funded projects that have supported the refurbishments of houses, include toilet facilities. Therefore, there has been an improvement to the poor and vulnerable families within the area as they have been provided with access to sanitary facilities at the household level. Self-financed houses have attached toilet facilities within the house. There is no central sewage system in Point Pedro and all sewer waste is stored in underground septic systems most of which include a sealed pit and rely the pits to be periodically pumped out for a nominal charge. Leach field are also included in the majority of septic systems to provide an avenue for excess fluid, if not pumped out in time. Wastewater and sewage discharged through the leach field directly impacts the freshwater lens in the region.

383. There are no rivers or permanent streams located within the vicinity of the PPFHDP area, however there are several drainage channels located in the area, two of which discharge during rainfall directly into the coastal zone within the PPFHDP site. The main source of freshwater for the communities in Point Pedro is underground water, which is accessed through household, and/or community shared wells. Well water is used for all purposes however bottled water is largely use for drinking purposes.

Fishing and Other Economic Activities

384. Fisheries is one of the key economic activities throughout the Jaffna District, including Point Pedro. During the conflict period fish production in Jaffna District was drastically reduced. However, since the end of the conflict, fisheries activities have increased considerably providing valuable opportunities to the community for food security and income generation. Fish production of the District is mainly sent to the western and southern parts of the country and some commodities are exported to foreign markets. The Vadamarachchi North DS Division, in which the proposed project site is located, is a major fish production area in the Jaffna District with many Fisheries Landing Sites. There are 19 Grama Niladhari divisions are in the coastal area and 1 jetty and 14 anchoring points are located along the coastal GNDs. The fish landing sites contributes in the order of 6,000 Metric tons (MT) of fresh fish and 369 MT of dried fish per annum as indicated in the **Table 4-15**

Table 4-15 : Profile of Fisheries Sector in Vadamarachchi North DS Division.

Type	*Year*			
	2015	***2016***	***2017***	***2018***
1. No. of fisheries family	3192	3036	3186	3041
2. No. of fishing population	14313	14146	14313	13829
3. Engine boat (in)	55	55	56	54
4. Engine boat (out)	830	855	1163	976
5. Boat (without engine)	952	916	750	271
6. No. of fisheries villages	13	13	13	13
7. No. of fisheries societies	13	13	13	15
8. Members of fisheries societies	4,923	4,719	4,818	4,798
9. Fisheries pensioners	1,050	1	-	–
10. Production of fresh fish (mt)	4,920	-	5,863	6,073
11. Fishing harbors	1	1	1	1
12. Dry fish production(mt)	365	365	368	369

Source: Department of Fisheries and Aquatic Resources, 2019.

385. As stated above, the fisheries activities in the area have been adversely affected during the conflict. However, the fisheries activities have recommenced and currently there are about 1,301 fishing vessels operating from Fisheries Landing Sites in Point Pedro area, which include 24 IMUL Boats, 26 IDAY Boats, 505 OFRP Boats, 36 MTRBs and 88 NRTBs. The key varieties of marine fish production in Point Pedro area include Trevally, Seer, Rock Fish, Cutlet Fish, Sharks, Skate/Rays, Shore Scene and Crabs. Jaffna District has the highest number of Fisheries Cooperative Societies (117) and highest number of memberships in such societies within the Northern Province.

386. **Community Based Organizations (CBO):** There is a well-established network of Community Based Organizations (CBOs) in Vadamarachchi North DS Division to strengthen the on-going development work within the Point Pedro and surrounding areas. The active presence of CBO's in the project area is very important to further enhance and facilitate improved community participation in all economic sectors associated with project development activities. The details of the community-based organizations located within the in VNDSD-2015 are detailed in **Table 4-16**.

Table 4-16 : List of Community Based Organizations in Vadamarachchi North DS Division in 2014.

Organisation Type	**Number of Organizations**
Rural Development Societies	21
Women Development Societies	38
Women Development Centers	14
Sports Clubs	40
Sports Training Centers	2
Total	115

Source: Northern Provincial Council, 2015

387. **PPFHDP Existing Beach Access:** Access to the beach directly within the PPFHDP site will be restricted and, as such, the 16 households (own and operate 30 fishing boats) located on state land in the eastern corner of the PPFHDP site will lose their current boat access directly to the beach. Shoreline access for these vessels will be moves east and will be required to use Koddady landing area and associated Munai anchorage site. This anchorage site is included in the governments' fisheries anchorage site refurbishment program and, as such, this site will be improved to ensure easy access and safety for all users. The improvement to this anchorage site is to be expedited to ensure a safe and expedient transition and as an incentive the government has indicated that for every 3-month period delay an allowance of Rs 45,000 per boat owner or 3 month average income whichever is higher will be provided and be continued to be provided until the anchorage refurbishment is complete.

5 IMPACT ASSESSMENT AND MITIGATION MEASURES

5.1 Significance of Impacts

388. The following section provides an assessment of the project's likely impacts on physical, biological, socio-economic and physical cultural resources, and also identifies mitigation measures to ensure how potential environmental impacts could be avoided or managed/reduced to acceptable levels. Where the environmental impacts are deemed to be major (or significant) or minor level impacts, mitigation measures are detailed, which are included in the project's EMP and needs to be incorporated into the project design and bidding documents.

389. The level of significance resulting from the potential impact is based on the impact screening, and includes i) No Impact, ii) Minor Impact, iii) Moderate Impact, IV) Major Impact and V) Unknown Impacts. The duration of the impacts is assessed based on the scope of work as well as the physical and biological environment in the sub-project sites. The magnitude of impact may be negligible, minor, marginal or significant if not mitigated. The determination of the scale of the impacts is based on i) spatial scale of the impacts (site, local, regional or national/international); ii) time horizon of the impact (short, medium or long term); iii) magnitude of the change in the environmental component brought about by the project activities (small, moderate, large); iv) importance to human populations; v) compliance with international, national, provincial or district environmental protection laws, standards and regulations ; and vi) compliance with guidelines, policies and regulations of the Sri Lankan Government and the ADB.

390. Direct, indirect and cumulative impacts have been assessed and where required mitigation measures proposed.

5.2 Impacts during mobilization of contractors

391. Impacts are limited to the following activities:

- Site clearance including vegetation removal during surveying and demarcation of the PPFHDP site's terrestrial boundaries.
- Land restrictions, erosion and possible archaeological findings and
- Social disruption, workers' interaction with community and establishment of existing construction sites and camp;

Physical Environment

Impacts due to Climate Change and Adaptations

392. The PPFHDP will not create any impacts on rainfall, unexpected groundwater depletion, significant changes to coastal waves and circulation patterns affecting coastal erosion or significantly increase carbon emissions, which in turn, could affect the risk of, or induce, climate change.

393. Climate change adaptation measures have been integrated in the PPFHDP design. These modifications were specially included to offset potential sea level rise and increase in intensity of natural storm events (e.g. cyclones, tsunami and droughts) that may arise in the unexpected failure of the breakwaters and associated quays and the fisheries harbor wharf itself, increased coastal erosion within the fisheries harbor and adjacent neighbouring coastal and foreshore environments. Climate change adaptation design measures included;

- Ensure climate proofing incorporated into designs to ensure coastal erosion not locally increased.
- Design modified to accommodate extreme whether events - increased storms, sea swells, cyclones, tsunami, rainfall and coastal erosion does not negatively impact the PPFHDP infrastructure.

- All facilities (land based) sealed (concrete) and waste water captured and managed to prevent land-based flooding and erosion,
- Reduction in the energy requirements of the PPFHDP through integration of alternative solar energy generation, and
- Measures to be implemented to ensure improved efficiencies and emission generation of petrochemical powered machine used within the PPFHDP and fishing vessels (maintenance and replacement of antiquated machinery improvements).
- PPFHDP staff, users and general community improved awareness of climate change and adaptation measures to reduce adverse impacts.

Biological Environment

Impacts due to vegetation removal, surveying and demarcation of PPFHDP site terrestrial boundaries.

394. The land boarding the PPFHDP site has been highly modified (cleared) previously for road and urban infrastructure development and, as such, native vegetation and associated fauna are all but absent. The eastern southern boundary of the PPFHDP site includes a small strip of land, which contains a number of homesteads and associated non-endemic vegetation (trees, shrubs) planted by the residents. This parcel of land is located in the south eastern corner of the PPFHDP site and lies outside of the project's significant infrastructure development plans.

395. The surveying and demarcation of the PPFHDP site boundaries and subsequent construction phase may include minor degradation of the local ecology through the clearance of small areas of vegetation and a number of trees (the majority are coconut trees – *Cocos nucifera*) within this area (**Figure 14** refer to figure in the terrestrial section in **ANNEX 08**. showing detailed map of existing vegetation cover)). These activities will result in insignificant impacts upon terrestrial fauna, whilst minor impacts on flora (predominately trees replanted by the communities) within the project area are expected. The final number of trees and their locations to be removed is yet to be finalized, however every effort will be undertaken to mitigate and reduce the numbers removed and impacts to the environment. Consideration for existing vegetation, including the trees to be incorporated into the PPFHDP landscaping and "green belt" development will be undertaken.

396. Two near threatened plant species (*Sesuvium portulacastrum* (Vankiruvilai) and *Trianthema decandra* (Mahasarana) were located within this area, however they will not be directly impacted by the project's scope of works. These species are reported to be reasonably abundant in similar habitats within the Jaffna area. If the individual plants are to be impacted, they will be removed and transplanted and, as such, no detrimental impacts will result. All other trees and other plant species present within this area are either introduced species or ubiquitous native species, which are highly tolerant of disturbances. There is no vegetation that has any conservation significance nor is it representative of the original vegetative cover.

397. Measures to be included in the project to ensure minimization of impacts from vegetation removal includes;

- Specification of vegetation clearance during surveying and demarcation activities,
- Under no circumstances, the contractor be permitted to fell trees or remove shrubs, not required (specified) to be removed;
- Replant minimum of 1:3 ratio for every tree removed in the area left free of any construction opposite the Methodist Girls High School within the harbor premises
- Construction workers will be informed about general environmental protection measures to be taken and the need to avoid un-necessary felling of trees wherever possible.
- Inclusion of trees and other vegetation into the project's landscaping and "green belt" along the shore line and the road.

Impacts due to Establishment of Construction Camps and Work Sites.

398. Utilizing existing and/or the establishment of new construction camp/s and work sites can create temporary impacts resulting from site clearance – flora, fauna and habitat alteration and/or removal and possible unearthing of archaeological resources (deemed to be low chance due to the highly modified urban area). Construction camps and/or project storage sites are being sited on an appropriate area, identified through consultation with village and landowners/users, as per the communications plan and permitted for this purpose. Necessary mitigation measures given in the EMP table.

Impacts due to Mobilization of the Contractor

399. The mobilization of the contractor and initial establishment of work site/s will require the presence of construction workers and subsequent interactions with the local business and residential communities. Prior to contractor mobilization to the site/s, the project's Community Development Officer (CDO) will establish the communications/protocols between the project and community as per the project's communications plan. Special reference and protocols need to be agreed upon to ensure that workers' interactions and project's impacts are managed to provide suitable mitigation process for the Methodist Girls' High school students and staff, due to its close proximity to the PPFHDP site. Due diligence and respect needs to be ensured by the contractor.

400. Contractor provide adequate space for workers accommodation including adequate ventilation, toilets and water.

401. Measures to minimize disturbance by construction workers and presence of the works site/area include:

- Community protocols discussed with workers as part of awareness and mobilization training;
- The contractor is to ensure that workers' actions outside work sites are controlled and community codes and rules of conduct are observed at all times;
- The contractor will identify one member of their staff to be the liaison between the communities and contractor, as well as between the contractor and project (PIMU);
- Adequate signage and security provided at the work camp site and prevention of unauthorized people (including children) entering the work camp site or workshop area if different;
- Provision of adequate protection to the general public in the vicinity of the work site, including advance notice of commencement of works, installing safety barriers as required by communities, and signage or marking of the work areas;
- Visual barriers need to be erected adjacent to the Methodist Girls' High school, including additional lighting and security measures;
- Provision of safe access around the works site to people, whose access are temporarily affected during road rehabilitation activities;
- To avoid, or reduce the risk of, other social impacts, construction workers should be limited to project site/s (immediate site of works and camp site), and at all times workers should respect community and land owner's boundaries and be cognizant of community rules and terms of conduct (especially addressing women and elders), and avoiding damage to property; and
- Implement HIV/AIDS/STIs awareness and prevention for the contractor's workers and adjacent communities.

5.3 Impacts during Construction period

402. All potential construction impacts and appropriate mitigations are to be managed by the contractor. Construction impacts involve the following activities:

- Operation of construction plant machinery and vehicles producing dust, noise and vibration;
- Site/location clearing, earth movements, excavations (dredging and explosive usage) and stockpiling of materials;
- Aggregate/rock metal extraction quarry/burrow sites;
- Construction waste disposal, pollution for hazardous material and waste water management;
- Stockpiling of construction material, such as sand, gravel and cement;
- Breakwater, harbor basin and fisheries harbor construction;
- Traffic disruption and land access;
- Presence of construction workers and camps;
- Transportation of construction materials;

Physical Resources

5.3.1.1 Impacts to the beach and shoreline

Erosion of adjacent beaches lands due to change of current wave height regimes attributed to the harbor structures,

403. Overall, erosional and accretion impacts due to the construction of the PPD harbor is minimal. However, highly localized effects have been noted from the numerical model results as detailed in the following sections.

404. It is noted that there is a strong current running along the outer phase of the reef, directing towards West during the Northeast monsoon under 'no harbor' scenario. This strong current has resulted in retaining only the coarse grain particles along the seaward face of the reef. With the construction of the harbor, the current along the reef tend to turn offshore at the intersection of the breakwater and the reef. This would cause localized scouring in and around the intersection point. However, the scouring would only be limited to the thickness of the sand overlay at that point, which is between 1.0-1.5m.

405. Due to the sheltering effect offered by the secondary breakwater for the waves approaching from NE direction, area immediately west of the harbor would experience an eddy formation. The suppermadam landing site, which is located west of the harbor structures would experience erosion as a result of sand moved offshore by the eddy currents. However, spatial spreading of this eddy is limited to a smaller area, the offshore movement of the sand could only be experienced in the stretch immediately west of the harbor. Further, due to the presence of the reef and hard formation underneath, the erosional effects will be limited to the moderately thin sand overlay.

406. However, there would be a reduction in the effective beach width at the landing area at Suppermadam, and this loss could be permanent. . However, in overall, there is no widespread erosional impact on either side the harbour

Erosion effects in either sides of the coastal stretch during construction period as well as in long term.

Construction Phase:

407. It is envisaged to progress the main breakwater construction substantially prior to commence the construction of the secondary breakwater. As such, erosional effects experiencing at the intersection point of harbour. main BW and shore parallel reef will be evident during construction phase as well. Further, while the main BW construction progresses during the NE monsoon period, wave diffraction from the tip of the progressing

main BW would result in moving the sand westward of the constructing BW to move eastward. However, this movement of sand would not cause any erosional threat to the Suppermadam area, as the said area further away from the main BW.

408. With the part construction of the secondary BW, the eastward movement of sand would be curtailed. That would trigger the formation of eddy, and associated shoreline changes, as explained previously.

409. During the numerical modeling of sediment transport (EML, 2018), short term possible localized morphological effects, and following were reported:

(a)the shoreline immediately east of the eastern breakwater, where any westward transport will be completely blocked by the breakwater (hereafter Zone 1), and (b) the shoreline at the divergence point west of the western breakwater (hereafter Zone 2). Volumetric considerations at these two local locations (considering that the landward toe of the reef in Zones 1 and 2 are in general about 1 m and 0.25 m below MSL, respectively) indicate that, over the first year after structures are constructed, the shoreline in Zone 1 may advance (i.e. accrete) by a maximum of about 5 m while in Zone 2 the shoreline may retreat (i.e. erode) by a maximum of about 20 m. While these are **not** very large shoreline changes in terms of coastal zone management, some expectation management of the local communities may be necessary to avoid ill-informed negative reactions.

Long Term:

410. In the long run, the sand movement towards offshore at the intersection of main breakwater- shore parallel reef would gradually diminish with the exhaust of the sand in the locality (the alongshore supply of sediment from east is marginal).

411. The local reorientation of the shoreline immediately west of the harbor would also be ceased once shoreline reorientation is completed (this could be 1-2 years) in responding to eddy formation.

Coastal erosion / accretion and bathymetric changes (on either sides of the harbor breakwaters) in the area

412. Since there is a very thin sand overlay of 1-1.5m (and underneath is hard rock), the bathymetric changes are also limited to these levels. There would not be any other bathymetric changes other than described in the previous sections.

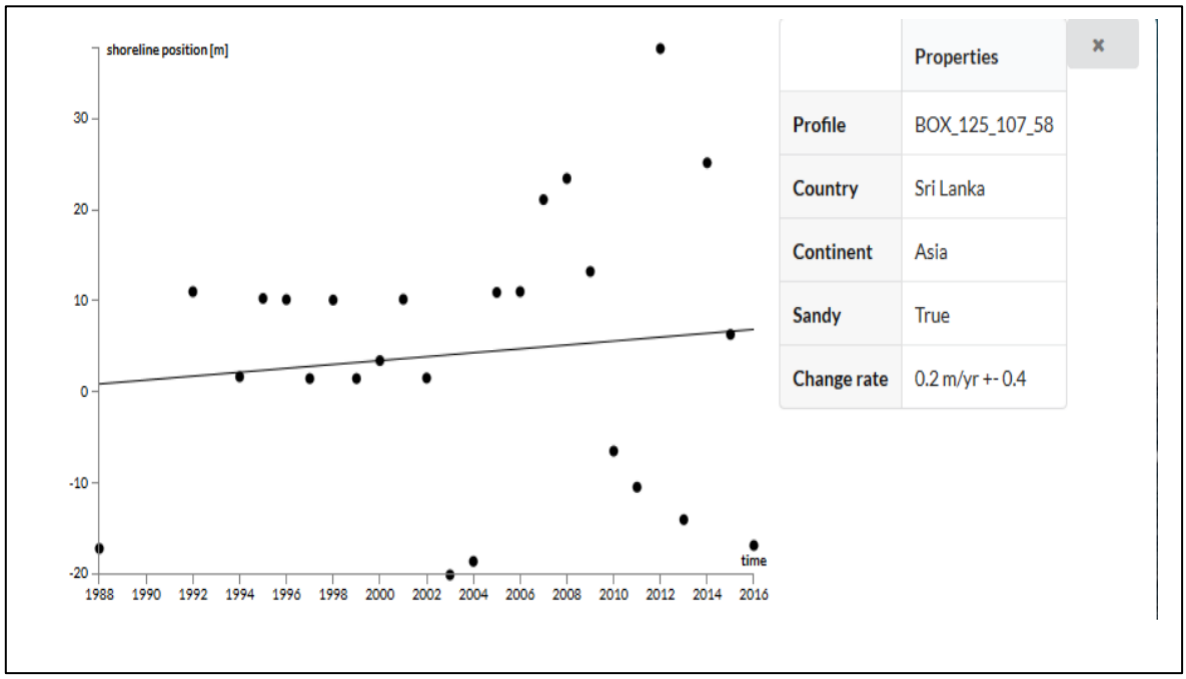
413. In order to assess the long term effects, an analysis of historical records by means of assessing satellite images has been undertaken under the Sediment Transport Study (EML, 2018).

414. Due to the very small sediment transport rates in the study area, no significant shoreline changes can be expected in the study area. This is in fact clearly shown by the satellite derived shorelines for the study area within global data base of satellite derived shorelines (SDS) recently presented by Luijendijk et al. (2018). The SDS approach provides much more reliable estimates of shoreline change than would be possible from the approach routinely adopted by consultants where only the few available cloud free satellite images are analysed with standard GIS techniques. The relative reliability of SDS estimates of shoreline change are especially high (compared to those derived from the traditional image by image GIS approach) in data poor areas, such as Sri Lanka, as the estimates are based on the automated analysis of many more images than the traditional ‘clear images only’ approach is able to use.

415. The shoreline positions (1984 – 2017) obtained from the global SDS data base for the study area are shown in **Figure 5-1** indicating an average accretionary trend of just 0.2m/yr, which according to the classification given by Luijendijk et al. (2018), represents a stable shoreline situation (i.e. insignificant amount of long term change). However, it should be noted that in some years shoreline changes that are higher than the insignificant long term trend can be seen (e.g. almost a 30m accretion from 2011-2012, and an almost 20m

erosion from 2015-2016). These singular changes that depart from the general long term trend are characteristic of the non-linear behaviour of coasts around the world.

Figure 5-1: Shoreline positions (1984-2017) immediately east of the proposed Point Pedro harbor derived from the global data base of satellite derived shorelines



Shoreline positions (1984-2017) immediately east of the proposed Point Pedro harbour derived from the global data base of satellite derived shorelines (SDS) presented by Luijendijk et al. (2018). Positive/negative indicates accretion/erosion relative to the first satellite image derived shoreline (in 1988 in this case).

Changes in drainage patterns

416. Neither the harbor construction nor resulting shoreline changes would change the natural drainage pattern that currently exists in the project area.

417. The current road drainage disposal arrangement will undergo modification as described below.

418. The shore area at the project location and its vicinity is a very narrow strip of land partly comprising of the reef. Immediately landward of the shore is Jaffna-Ponnalai Road. There is approximately 2 to 2.5m elevation difference between the road carriageway and the shore area. Presently, the road drainage (including cross roads) is discharged into the shore area via constructed culverts. The storm water finds its own drainage pathway to reach the sea. With the construction of the harbor, two such drainage culverts fall within the boundaries of the harbor; one culvert at the eastern boundary of the harbor and the other culvert is along the eastern boundary of the Methodist Girls' School. Both these culverts would be diverted to adjacent culverts outside the harbor boundary.

419. There would not be any other interference on the existing drainage discharge arrangements.

Changes in hydrological pattern such as currents and wave patterns, wave height and direction, near shore current velocity, direction and tides,

420. **Waves**: The dominance of the NE waves at the project location is evident. Hence, any impact would be with respect to these waves. The NE waves will tend to diffract around the tip of the main (eastern) BW head. Further, the eastern BW creates a sheltered area immediately west of the secondary (western) BW.

421. **Tides:** The tidal flow, while not very significant with respect to its velocity, is following the footprint of the harbor in bypassing the harbor location. No particular impact could be expected from this deviation in the flow path.

422. **Currents:** As stated earlier, significantly high flow currents along the outer face of the reef is noted in the numerical modeling. These currents dominantly moving from east to west during NE monsoon period, when intersected with the eastern breakwater will get deviated and will move towards offshore.

Changes Sediment transport patterns on both periods (short term and long term)

423. Sediment transport is dominantly from east to west during NE monsoon, and the magnitudes are very small. There is no noteworthy movement of sand during SW monsoon period (caused by very weak diffracted locally generated wind waves). Hence, there is no any significant change in the sediment patterns due to the harbor construction, except for the localized movements at the main (Eastern) BW-reef intersection and at the area immediately west of secondary (western) BW, as explained previously.

5.3.1.2 Armors (aggregate/rock) quarrying and Transportation of materials

Impacts on quarrying armors/metal

Metal Quarry

424. A large quantity (around 327,500 m^3) of armor has to be transported for the breakwater construction purpose. There are three potential metal quarries identified for the armors. All these quarries possess industrial mining licenses from GSMB and EPL from the CEA. Both licenses provide guidelines and conditions to operate the quarry without causing any environmental damages. Therefore, the construction contractor should ensure that the selected quarries possess valid GSMB and EPL for the operation. Operation of unauthorized metal quarries and borrow pits could impact the natural environment including fauna and flora, water bodies and soil in the quarrying area.

Borrow area

425. About 117,000 m^3 of filling materials is required to refill 6.3 ha of sea area. About 18,000 m^3 of dredged materials generated from the excavation of sea bed will be reused for filling purposes. The balance 99,000 m^3 will be sourced outside from the other districts as there are no suitable borrow pits located within the Jaffna district. Improper soil extraction will impact the natural resources in the area.

Impacts on roads

426. A large quantity 327,500 m^3 of armor and 99,000 m^3 of filling materials have to be transported from other districts. It is estimated that about 945 trips of vehicle movement are needed to transport the require amount of construction materials. Major portion of the transportation route of materials to the site from the quarries and borrow areas are RDA or PRDA/DRD-NP roads which are administrated by RDA. The armor and filling materials will be transported either from Mullaithivu, Vavuniya or from Anuradhapura districts using 6, 9 and 12T tracks. The existing RDA and PRDA/DRD-NP roads are capable of bearing 12T tracks. Therefore, there will not be any risk to damage the roads. However, a transport impact assessment should be carried out by the construction contractor once the borrow pits and quarry sites are finalized.

427. Most of the internal roads are either gravel or tar sealed and are maintained by the relevant local authorities in the area, which cannot bear transportation of heavy weight, and during the transportation there is a possibility to damage the roads making potholes. During the rainy season, stagnation of water in the potholes could cause inconveniences to the community that is using the roads.

Safety of Road uses.

428. It is proposed to transport the materials through Point Pedro Jaffna Road or East Coast road avoiding the school. There is a chance for accidence from the transport vehicles as these area is highly populated. The usage of Jaffna- Poonalai- Point Pedro by the school children is minimum. However, strict road safety will have to be followed to avoid unnecessary accidents and injuries. The **Figure 5-2** indicates the roads used to access the site.

Figure 5-2: Transport Rule Route

Impacts on Building from road transport

429. Rock and filling meterials transportation will be carried out on RDA and PRDA/DRD-NP roads which have adequate ROW. Therefore, the impacts to the buildings are unlikely. However, the Point Pedro -East Coast road and the Ponnalai – Jaffna roads are highly residential areas. The vibration due to transportation may cause damage to the buildings located close to the road sides.

Other impacts

430. The armor/metals will be sourced from the quarries which possess Industrial Mining Licence (IML-A) or Industrial Mining Licence -B (IML-B) category GSMB license and Environmental Protection License. Hence, these licensed quarries are bound to comply with the environmental regulations during the operation. However, loading/unloading activities during night time may create noise pollution. In addition, dust may generate during loading/unlading in improper manner.

431. Stock piling of all armors will be placed within the PPFHDP site with sediment traps used to prevent sediment discharge into the neighbouring terrestrial and marine environments. No major impacts are expected.

Proposed mitigation Measures if any new quarry sites are to be opened:

- Extraction from ecologically sensitive areas (beach, intertidal, swamps, wet lands and mangrove areas) or productive land will not be permitted.
- Sites to be identified / finalized in consultation with Geological Surveys mine Bureau GSMB/CEA/PMU and landowners and/or communities;

- PMU to agree on protocols for sourcing, transportation, haulage and storage of all materials and to ensure that procedures are followed during transportation of materials to the site.
- All transportation vehicles should be covered and secured with tarpaulin to prevent dust during the transportation.

The contractor will prepare a material and spoil management plan (MSMP) as part of the EMP. The MSMP will include at least the following:

- Identifying suitable sources and obtaining all agreements and permits as required associated with the sources;
- Required materials, potential sources and estimated quantities available (from quarries or burrow pits);
- Extraction technique and excavated material reuse and recycling methods;

Excess spoil to be disposed of as per methods approved in endorsement/permit from GSMB/CEA;

Construction materials, such as sand and aggregate needed for concrete should come from existing quarries, in compliance with GSMB/CEA guidelines;

Rock aggregate storage and stockpiles to be restricted to project site.

All rock/aggregate stockpiles need to include agreed and permitted sediment and dust management protocols including silt traps to reduce dispersion of sediment.

All material collected by sediment traps or silt nets removed daily/weekly to prevent dispersion and disposed of at dedicated dumping site locations.

Any excess spoil and construction waste material will not be dumped in;

- Wetlands, forest areas, coastal and other ecologically sensitive areas;
- Private property without written consent of the owner;
- Any water body and will not contaminate any water body.

Arranging for the safe disposal of any excess spoil including provision for stabilization, erosion control, drainage and re-vegetation provisions at the disposal site, if required.

- Ensure the armors and filling materials area utilized from licensed metal quarry
- A pre-crack survey should be conducted prior to commencement of the transport activities to make compensations any if required due to the damages of building due to project activities.
- Proper traffic management plan should be used during material transportation. Safety officers should be appointed to look after the pedestrians particularly during the school opening time and the closing time as the project area is located near the Methodist Girls High School.
- Ensure the noise levels and vibration standards prescribed in the National Environmental Act should be strictly flowed.

5.3.1.3 Impacts on sewage or wastewater, solid disposal, waste oil spills, surface runoff on coastal environmental and coastal waters,

Impacts of Sewage disposal

432. All wastewater and sewage will be managed through properly constructed septic tanks and soakage pits.as such no effluent will be released into the environment.

- Adequate toilet facilities should be provided to the labor camps

Surface runoff

433. The project will be implemented within the shore area with limited space. However, the surface runoff during the construction period may bring mud and suspended particles to the sea. Thus turbidity levels could rise due to the suspended particles and siltation could occurs in the sea bed of the project area. The contribution from surface runoff to the impacts is minimum in the harbor basin area as the basin is subject to dredging until the

completion of construction. The contractor should adhere to the following mitigation measure to avoid any impacts likely to occur.

- Provide necessary silt traps along the drainage path to minimize the entering of silt to the sea. The silt traps should be continuously cleaned to ensure the proper functioning of silt traps.

Pollution from use, storage and accidental spills of oil and hazardous substances

434. During the construction period, marine water pollution due to oil spills from heavy machinery including dredgers and at the storage facilities in the construction site could occur. Hazardous materials like paints, and other chemical related to the building construction also could spill during the transportation, storage and handling. Spills of these chemical and oils could contaminate the soil and the marine environment. Therefore, the contractor should follow the followings to minimize the environmental impacts likely occur due to oil and chemical spills.

- Prepare a detailed Emergency Response Plan – DERP (as part of the EMP) including a Hazardous Substance Management Plan (HSMP) to cover materials/oil/fuel storage, spills and accidents; The HSMP should cover at least;
    - National laws and regulations and international best practice requirements;
    - Hazardous materials inventory
    - Identification of risk associated with hazardous chemicals and materials;
    - Facility description and site plan that illustrates all buildings, roads, yards, outdoor chemical storage, sewers, wells, water bodies, and adjacent villages;
    - Facility storage map that shows the location of: all hazardous materials, all storage areas, emergency equipment and exits, evacuation points, spot where designated individual will meet emergency personnel, and all tanks/sumps/ piping;
    - Accidental exposure measures;
    - Emergency response (links with emergency response requirements set out in health and safety plan); and
    - Recording and reporting incidents.
- Locate storage areas for all petrochemical products at least 100 m from coastline.
- Chemicals including fuel to store in secured (lockable), weather proofed area including an impervious flooring and bund/containment wall to container spillage;
- All hazardous materials to be clearly labeled.
- Used oil and other toxic and hazardous materials shall be disposed of in an authorized facility off-site.
- Spill waste will be disposed at disposal sites approved by local authorities.
- Stop concreting activities during periods of heavy rainfall.
- Adequate precaution to be taken to prevent oil/lubricant/ hydrocarbon contamination of the waterways and coastal waters. Spillage, if any, will be immediately cleared with utmost caution to leave no traces.
- All spills cleaned as per emergency response plan, including spill cleanup kits and material available specifically for petrochemical and other hazardous substances;
- Ensure designated workers are trained in use of spill – clean up equipment.
- Ensure all vehicles and plant machinery are well maintained; accidents reported to police and MID within 24 hours.
- Educate all relevant staff on oil /chemical handling and management procedures and provide appropriate supervision
- Take precaution to avoid spillage or leakage of diesel, oils and lubes from construction vehicles by ensuring the lids of the fuel tanks are properly closed, the fuel tanks are properly fixed, no leakages in the tanks and no excess lubricants are used.

- Conduct maintenance of these vehicles only at designated areas and surfaces in the construction yard and not inside the water. The maintenance area should be concreted with necessary oil traps to collect and spillages. Any spillages on the maintenance floor should be cleaned immediately by using proper absorbents, such as sow dust, cotton waste etc. The used absorbents are defined as scheduled waste under the National Environmental Act, and such waste should be properly stored in steel or plastic barrels and disposed of through the licensed hazardous waste disposal facilities like Insee (former Holcim Lanka Ltd) Eco-cycle in Puttalam.
- No vehicle servicing is allowed within the project area. All vehicles should be serviced at licensed (provided with Environmental Protection License (EPL) service stations. All accidents reported to police and PMU/PIU within 24 hours.
- Ensure that explosives are not stored near the oil storage tanks

5.3.1.4 Anticipated problems related to solid waste disposal

435. Proper collection/storage and disposal methods are proposed during the construction phase. However, improper collection, storage and disposal methods could lead to environmental pollution. Washing out waste to sea, blockage of natural drainage paths and spreading of dust could happen during the construction period, if waste is not properly managed. Bad smell, spreading of wastes particularly fish offal by scavenges could occur when the solid waste is not properly managed during the operation period. Waste disposed in water courses and beaches could lead to water pollution and cause threats to marine and aquatic life. There are no impacts to the wildlife as the project area is a well built up area and no wildlife exists.

436. All construction waste should be segregated as recyclable and non-recyclable. All recyclable materials should be sold to the local recycle materials collectors in the area. The non-recyclable debris (broken tiles pieces, rubbles, broken bricks and concrete and sand mixed with cement and other materials) should be used for refilling activities and if any leftover, should be disposed at the local authority collection system/disposal sites.

- All construction wastes should be properly stored with suitable cover like polythene sheets, tarpaulin, or jute to prevent the spreading of dust.
- If possible spray water to keep the waste wet during the dry season
- No open burning of solid waste is allowed as this could cause a nuisance to the people in the area.
- The contractor should provide adequate color bins to segregate the MSW in the labour Camps. National color code for segregated waste are blue, orange, red, brown and green for Paper and card boards, Polythene and plastic, Glass and bottle, Metal and Bio degradable waste respectively. All recyclable waste should be stored separately and sold out for local recycle materials collectors in the area and all bio-degradable waste should be disposed through the Point Pedro Urban Council.

- All e-wastes bulbs such as CFL and linear fluorescent bulbs, obsolete communication equipment etc. should be collected separately to be given to the e-Waste recyclers registered with the CEA.

5.3.1.5 Impacts on Water Quality

437. Dredging and dredge spoil disposal / reclamation works are the major activities during construction that will cause increase of turbidity in and around the basin and channel area. Dispersal of sediment plume with the currents may impact further away in the sea. During the dredging process impacts may arise due to the excavation of sediments at the bed, loose material during transport to the surface, overflow from the dredger and dumping of dredge spoil at the sea.

Increasing Suspended Sediments and Turbidity levels

438. When dredging and disposing of non-contaminated sediments, the key impacts are the increase in suspended sediments and turbidity levels. Any dredging method releases suspended sediments into the water column, during the excavation itself and during the flow of sediments from hoppers and barges. Increase in suspended sediments and turbidity levels from dredging operations may under certain conditions have adverse effects on marine animals and plants by reducing light penetration into the water column and by physical disturbance. The increase is likely to last for a period of 10-15 days after the cessation of dredging activities.

439. Increased suspended sediments can affect filter feeding organisms, such as shellfish, through clogging and damaging feeding and breading process. Similarly, young fish can be affected if suspended sediments become trapped in their gills. Increased fatalities of young fish have been observed in heavily turbid water. Adult fish are likely to move away from or avoid areas of high suspended solids, such as dredging sites.

440. The increase in turbidity results in a decrease in the depth that light is able to penetrate the water column, which may affect submerged plants, by temporarily reducing productivity and growth rates. Since, the benthic fauna, such as corals, are moderately developed in the areas, impacts on this account are not expected to be significant.

Impacts on marine water quality

441. Redox potential (eH) and pH are two variables that control the characteristics of chemicals and heavy metals in water and sediment. As long as the pH remains around 8 and eH < 150 mV, most of the chemicals and metals will remain bound to the solid phase without being released into the surrounding water. Only anoxic conditions reduce the eH below this level and hence if dissolved oxygen level is within the normal range, no leaching of chemicals and heavy metals is expected to occur.

442. In a marine ecosystem, where there are no sources of pollution, dissolved oxygen levels are not reduced to anoxic conditions until and unless there is significant increase in organic pollution loading. In future, significant increase in organic pollution loading is not expected. Under these circumstances, there is no possibility of any of the chemicals or metals being leached into the water. Moreover, sediment samples collected from all the sites were uncontaminated. As such no adverse impacts due to dredging on the chemical characteristics of water or sediment are expected.

443. Water quality impact due to dredging is anticipated to be temporary and localized. Further, the following recommendations should be adopted to avoid, minimize, or control impacts from dredged material:

- Plan the dredging works taking into account tidal conditions; Limit dredging works where possible to low tide. Working at low tide will ensure fine sediments are not readily washed away;
- Clearly mark the areas for dredging;
- Install silt screens (floating type slit screen made out of blend of permeable and impermeable fabric) and of bund wall around the dredging area to confine sediments within the construction site;
    - Select most appropriate dredger type in order to minimize the impacts and follow following steps as applicable; (a) Minimize the unnecessary disturbance to the sediments by exerting care when lowering and lifting the grab; (b) Use barges that are fitted with tight fitting seals to their bottom openings to prevent leakage of material; (c) Ensure accurate barge loading to avoid splashing of dredged material to the surrounding water; (d) Do not fill the barges or hoppers to a level which will cause the overflow of materials or polluted water during loading or transportation. Adequate freeboard should be

maintained to ensure that the decks are not washed by wave action; (e) Remove large objects and debris manually prior to mechanical dredging to minimize losses from partially closed grabs.

- Increased sedimentation and turbidity due to Dredging

Select most appropriate dredger type in order to minimize the impacts and adhere to the following steps as applicable;

- Minimize the unnecessary disturbance to the sediments by exerting care when lowering and lifting the grab;
- Use barges that are fitted with tight fitting seals to their bottom openings to prevent leakage of material;
- Ensure accurate barge loading to avoid splashing of dredged material to the surrounding water;
- Do not fill the barges or hoppers to a level, which will cause the overflow of materials or polluted water during loading or transportation. Adequate freeboard should be maintained to ensure that the decks are not washed by wave action;
- Remove large objects and debris manually prior to mechanical dredging to minimize losses from partially closed grabs;
- Install siltation devices around the barge to restrict turbidity issues at all times.
- Siltation traps, socks[10] and nets (coastal) to be placed at the construction sites to regulate and manage wastewater sedimentation issues (principal turbidity from dredging and breakwater development) derived from construction activities, including specific sedimentation and pollution collection during all inter-tidal and sub-tidal construction activities (e.g. dredging, breakwater development).
- Close construction supervision to ensure the above measures is implemented.
- Plan dredging works to take in tidal and local wave conditions – preference for low tide reduced wave conditions.
- Reef reclamation to construct revetment wall first (including Geotech fabric) and backfill with dredge material (reduction in sedimentation on reef.
- Provisions of stop work during periods of heavy rainfall.
- Construction staff awareness of sedimentation management responsibilities.
- Checking of quality of sea water.

Ecological Resources (Land based and Marine)

Coastal intertidal marine habitat and resource protection Impacts.

444. Construction activities will cause considerable physical disturbance and alteration to the intertidal reef flat environment and associated marine resources within the PPFHDP. This will include: (i) reclamation of 6.4 hectares of intertidal reef, ii) the construction of two breakwaters, iii) the construction of quays, and iv) and a number of land based buildings and services. The reclamation material (sand and rock) will be sourced primarily from the onsite dredging and rock removed to create the harbor basin.

445. The proposed fisheries harbor activities will have a direct negative impact on the sessile benthic marine resources located within the intertidal and subtidal construction footprint of the PPFHDP. However, due to the paucity of sessile flora and fauna in this area, impacts to these resources in terms of population number and diversity are expected to be minor and their low biological, biodiversity and subsistence value of these resources. The removal of sediment (dredged) and base rock from the sub-tidal offshore substrate will also have no direct impacts on the resources associated with this habitat (no benthic resources located).

[10] Silt boom is used in dredging, excavation and piling operations, or when machinery operates in or around water. Silt booms trap and contain sediment and silt, preventing it from contaminating other parts of the waterway.

446. The inter-tidal and sub-tidal marine environments associated with the PPFHDP site do not possess any critical marine habitats (e.g. mangroves, sea grass), threatened or endangered marine life and as such will not impact the coastal or marine biodiversity, nor will it affect the areas ecological functions, nor the financial or cultural importance of the area.

447. The fisheries harbors proposed two breakwaters and marine infrastructure once completed will provide a suitable marine habitat for both benthic and mobile invertebrate and vertebrate flora and fauna to recolonizes, thus increasing the available habitat for these organisms. Due to the extensive nature of the fisheries harbors infrastructures developments, it is envisaged that the available benthic habitat created will provide additional marine benthic habitat than the area lost due to the project reclamation and construction phases. Thus, providing a positive net gain of potential marine habitat to the PPFHDP site.

448. Impacts are also expected to result in disturbance of resources from suspended sediments and/or rubble during the excavation and dredging activities. These impacts will be limited to the duration of these activities and can be managed through deployment of silt/sediment curtain and marine booms[11] to reduce turbidity and contain sediment and fines from dispersing too widely in the water column. As such, the impacts derived from the marine scope of works are expected to be minor, localized to the immediate footprint of the works, and easily managed through standard engineering good practice mitigation measures. There are no threats to the areas marine and coastal biodiversity associated with the project. As such, the potential impacts of the works on the marine environment are considered to be minor, temporary and overall insignificant.

449. **Mitigation measures:** The measures to address the impacts identified above include:

- Implementation of Material and spoil management plan.
- Care to be exercised during all intertidal and subtidal reef reclamation - construction activities including the sand dredging and sediment removal (blasting) of the offshore substrate to limit the physical and subsequent material placement (breakwaters) on the reef flat and offshore benthic substrate to the designated scope of works.
- Access of all construction material entering the reef to be confined to specific areas to reduce impact on sessile flora and fauna in adjacent habitat outside of the designated scope of works.
- Ensure that all equipment used for the marine construction activities (land based or barge based) are in sound and well-maintained condition, and free of any leaks of any petrochemical fluids.
- All efforts must be made to prevent petrochemical spills. Spill containment equipment is to be kept on hand.
- Activities requiring use of mechanical equipment to be coordinated and undertaken during low tide periods whenever practical.
- Activities utilizing explosive or chemical fracture to be undertaken only during day light hours, including public notification of the timing and PPE provided to all staff.
- Installation and deployment of floating silt curtains (geo-fabric), marine booms and silt traps/nets around all reclamation (e.g. dredging machinery, reef and breakwaters) areas to reduce impact on neighboring ecology.
- The deployment of silt curtains around all breakwater development sites to manage and reduce the dispersion of the benthic substrate (silt) disturbed during construction,
- The deployment of silt curtains along the entire area of the fisheries harbor reclamation areas to reduce and contain potential suspended sediments during reclamation and sediment/rock movement.

[11] A silt boom is used in dredging, excavation and piling operations, or when machinery operates in or around water/sea. Silt booms trap and contain sediment and silt, preventing it from contaminating other parts of the waterwa

- Care to be exercised when lifting and removing curtains to ensure that collected sediment does not fall off and disperse in the water column; curtains should be carefully rolled up by divers and all material collected and removed to be disposed of in an approved and designated land based receiving site location(s).
- All construction aggregate/rock material to be used within the site for construction (e.g. breakwater, fisheries harbor boundary) to be stockpiled within the PPFHDP site. Silt/sediment traps to be used at all times.
- All excavated material not being used at the site (breakwater or backfill) to be collected and removed from the marine environment and stored or disposed of in a terrestrial approval location/s. The disposal site must be at a minimum 100 meters from the foreshore.

450. Due to the nature of potential minor impacts, no specific marine monitoring program is required other than close supervision of the works to ensure that the above recommended mitigation measures are implemented and effective throughout the marine construction works.

Terrestrial habitat and resources Impacts

451. The proposed fisheries harbor activities are restricted in general to the marine environment northern wards of the Jaffna Ponnalai - Point Pedro and Point Pedro east roads. As such, potential impacts to the terrestrial environment and its associated flora and fauna resources are limited to the eastern corner of the PPFHDP site associated with the beach and associated homesteads environment. Impacts to the terrestrial flora within this area will be minimal, resulting in the removal of a number of trees (most Coconut tree) and smaller plants. Actual numbers to be removed will be finalized during the implementation phase of the project. However, it is recommended that through appropriate planning the number of trees to be removed can be minimized with the existing vegetation incorporated into the general landscape features of the fisheries harbor.

452. There were no endangered or endemic plant species recorded within the PPFHDP Project Area. Two near threatened plant species (*Sesuvium portulacastrum* and *Trianthema decandra*) were recorded within the project area in the eastern corner of the PPFHDP site. In the event that these plants are required to be removed, due diligence is to be exercised with the individual plants removed alive and transplanted to suitable neighbouring habitats, thus ensure minimal impacts to these species. These mitigation measures will ensure that there are no negative impacts to these species population structure and their ecological importance.

453. Fauna associated with the Project area is minimal and, as such, there are no expected negative impacts resulting from the PPPFHDP activities. However, it is recommended that due diligence should be undertaken prior to the construction phase of the project and a visual search be commissioned within the homesteads located in the eastern section of the PPFHDP for the critically endangered land snail *Trachia fallaciosa*. If the snail is located in areas that will be impacted by the scope of works that all individual be collected by hand, kept alive and translocate to similar habitats in neighbouring locations. These mitigation measures will ensure that there are no negative impacts to this species population structure and ecological importance.

454. Potential impacts to the environment and associated flora and fauna resources do not include any critical significant terrestrial habitats and, as such, will not impact the terrestrial biodiversity nor will it impact the areas ecological functions nor the financial or cultural importance of the area. The impacts are expected to be very minor, localized to the immediate footprint of the works, and easily managed through standard engineering good practice mitigation measures. Therefore, the potential impacts of the works on the terrestrial environment and resources are considered to be minor, temporary and overall insignificant. The near threatened plants and critically endangered snail located with the project area if managed as identified above and in the projects EMP will result in no impacts to these individual specimens.

455. **Mitigation Measures:** The measures to address the impacts identified above include:

- Educating workers, imposing sanctions regarding harm to wildlife and/or use or felling of vegetation (except trees required by the project).
- Reduce the number of trees required to be removed for project and incorporated where possible, existing flora into design landscaping.
- physical removal (live) of the near threatened plants and snails and the relocation to suitable neighboring habitats
- Excavation and construction machinery (including trucks hauling materials) to be kept in well-maintained condition.
- All efforts must be made to prevent petrochemical spills. Spill containment equipment is to be kept on hand.
- Silt and sediment traps and bunds are to be positioned around work areas from where run-off can be generated.
- All excess material and other stored or stockpiled materials to be maintained as per the provisions of the MSMP.
- Works areas and fuel/explosive storage to be on concrete pads and bunded. Wash-down areas to be connected by channels or drains to silt/grease trap. Such wash down discharge/run-off will not be disposed of in the marine environment.
- All excavated material not being used at the site to be collected and removed from the marine environment and disposed of in terrestrial approval permitted location/s. The disposal site must be at a minimum 100 m from the foreshore and not located within or close proximity to ecological important and sensitive biological areas.
- Materials to be removed from the site are to be disposed of in an approved location(s). Any disposal site must be a minimum of 100 m from the foreshore.
- Tree planting and site re-vegetation to be undertaken following completion of construction activities, if required.
- Impacts to natural shoreline and beach vegetation to be reduced where possible, maintenance of natural slope and accumulation were possible.

Impacts on protected areas and other sensitive ecosystems

456. There is no marine, coastal or terrestrial protected areas within or close to the projects area of influence and, as such, there will be no impact on the national protected area systems and the flora and fauna that resided within.

5.3.1.6 Impacts related to noise, vibration, and air pollutant generation.

Noise / Vibration

457. During the construction period, there will be elevated noise levels generated by the operation of machinery associated with the project. The noise level measures that exceeding 75 dB(A) due to construction activities may include geotechnical investigations for jetty area, construction of breakwater, jetty, quay walls, construction of foundation work, and other building construction activities the range of expected noise levels during different method of drilling operations is provided in **Table 5-1.**

Table 5-1 : Typical drilling rig noise levels (dB(A)) by Drilling Method

Distance from rig (m)	HSA Auger	Mud rotary/Core (includes Platform Rig)	ODEX with Air Compressor	Sonic
3	87-96	80-97	89-99	84-96
8	81-88	75-91	76-90	81-88
16	<75	<75	<75	<75

458. As in **Table 5-1** geotechnical investigations activities would lead to an increased noise impacts as the noise level abates at a distance of 16 m to levels less than 75 dB(A),

which is the permissible noise levels. Therefore, noise level generated due to the geological investigation will not have any major impacts on the community living near the project site.

459. Activities, such as site clearing, land preparation, construction of offices, contractor huts and other temporary buildings together with infrastructure facilities, assembly of super structure and construction of other ancillary structures, will have minor impact with related to noise pollution and vibration induced noise.

460. Equipment used in clearing the site, excavation, paving and concreting is also known to generate moderate noise levels. Most of the machinery and equipment used during construction works are known to produce moderate levels of noise levels. **Table 5-2** presents typical noise levels of some of the machinery used in construction works.

Table 5-2 : Relative range of noise levels for some common types of heavy construction machinery

Machinery	Noise levels (dB(A) at distance of 16 m
Compactors (rollers)	71-75
Front loaders	70-83
Backhoes/excavators	70-85
Tractors	78-95
Trucks	83-93
Concrete mixers	75-88
Jack hammers and drills	82-98
Crow bar	115
Compressor	109
Pile drivers (drop hammer type)	110
Pneumatic drill	85
Excavator	112
Loader	112

461. The impacts due to the construction noise may be a source of increased noise to the schools and residential houses in close proximity to the PPFHDP. However, through the mitigation measures described in below this chapter a reduction to the noise that may make nuisance to the community and workers as well will be managed and reduced as best as possible.

462. It is not possible to dictate the methods of construction to be employed by the contractor but noise control equipment could be incorporated in the tender/contract documents to specify the noise standards to be met and any noise mitigating to be corrected out by the contractor.

463. The day time (school time), and night time working will be more potential to cause annoyance since the background noise levels are lower, particularly during the school hours. Therefore, the construction activities with higher noise levels should be limited to the afterschool hours, and the night time operation also limited to low noise activities, in case if construction at night time is required.

464. The community in the surrounding area would be the likely affected group during the construction phase noise. The mitigatory measures proposed are:

- Equipment should use with adequately sized exhaust silencers and use silenced equipment wherever possible.
- Where applicable, low noise type equipment should be used such as hydraulic jacking type vibration pile and based pile system etc. and provide engines enclosures for high noisy equipment.
- Keeping equipment in good working order and maintenance and operation of equipment according to manufacturers' instructions.

- Use noisy equipment such as piling equipment's, drillers, and compressors etc. for very short periods of time.
- Use low vibratory equipment such as hydraulic jacking type vibration piles and based pile systems etc.
- where possible, keep equipment in good working order by scheduling a planned maintenance program using manufacturers operation manual. Use vibratory equipment during daytime with minimum operational time. Positioning of equipment as far as practical from vibration sensitive receivers and provide workers safety equipment.

Vibrations

Vibration due to transportation

465. According to the CEA interim standards for vibration control, the maximum allowable limit is 1 mm/sec peak particle velocity (PPV) at 1 -10 Hz, and 8.0 mm/sec PPV at over 50 Hz for type 3 building structure. The vibration from the heavy vehicles during transportation of armors could induce vibrations, which would create intermittent vibration and that could exceed the above standards. The elevated vibration could damage property and even cause discomfort to persons living in the immediate vicinity. Inconvenience for occupants in buildings is of concern, especially in residential areas (during night-time) and offices (during day-time) along the transportation routes.

466. The Interim Standard on Vibration Pollution Control for Sri Lanka provides guidelines for operation of machinery, construction activities, vehicular movements, acceptable human exposure to vibrations depending on the length of the vibration period (continuous, intermittent, and impulsive).

Noise and Vibration due to sea bed rock removal

467. There are three options proposed to remove the bedrock limestone; A). rock blasting with explosive and detonators, B). chemical blasting and C). mechanical removal using breakers.

468. The rock blasting with explosive and detonators is more noise and vibration generating activity compare to the other two. But the mechanical removal by using breakers will have continues vibrations. The chemical blasting is very expensive method when compared to the other two methods proposed.

469. The Interim Standards on Air Pressure and Ground Vibration for Blasting Activities by the CEA, the maximum allowable limit is 6.0 mm/sec PPV for ground vibration and 115 dB(L) for Air blast over pressure, for single borehole and 5 mm/sec PPV and 120 dB(L) for multi borehole with delay detonator.

470. It is estimated that 18,000 m^3 of lime stone has to be removed for the establishment of harbor basin. As the proposed project location is located in a highly residential area, the excessive vibration could exceed the above limit, causing damage to buildings near the project area. Necessary mitigations area given below to this section.

- The contractor should carry out necessary blast test through laboratories registered with the CEA (recommended GSMB) prior to commencing the blasting activity to determine, the blasting pattern and quantity of explosives to be used to minimize the vibration levels to the nearby residences and schools.
- Low vibration lime stone blasting such as chemical blasting operation shell be selected close to the vicinity of the Methodist Girls School to minimize excessive vibration generated due to the blasting activities.
- Monitoring of vibration levels in nearby building structures should be carried out whenever construction activities, such as blasting, drilling activities, are carried out and whenever complaints have been received. In this respect, special attention

should be paid to the development of Pre-cracks and crevices in nearby building structures.

- A pre-crack survey with photographic evidence should be conducted prior to the commencement of the construction activities to ensure that no property damages occurred due to the construction period.
- Observations of the RDA should be obtained to ensure the transport routes are capable of transporting rocks without excess vibration, which causes damages to the property located either side of the roads along the transport routes.
- Approval of relevant local authorities is obtained to use the internal roads.

- It is suggested to follow the control blasting methods covering the blasting surfaces with blasting mats, used tyre and sand bags to control the fly rocks during the blasting operations.

Handling of explosive

- Explosive materials are not to be placed directly against interior walls and must be stored so as not to interfere with ventilation. To prevent contact of stored explosive materials with walls, a non-sparking lattice work or other non-sparking material may be used.
- Containers of explosive materials are to be stored so that marks are visible. Stocks of explosive materials are to be stored so they can be easily counted and checked upon inspection.
- Except with respect to fiberboard or other nonmetal containers, containers of explosive materials are not to be unpacked or repacked inside and must not be unpacked or repacked close to other explosive materials.
- Tools used for opening or closing containers of explosive materials are to be of non-sparking materials, except that metal slitters may be used for opening fiberboard containers. A wood wedge and a fiber, rubber, or wooden mallet are to be used for opening or closing wood containers of explosive materials. Metal tools other than non-sparking transfer conveyors are not to be stored in any magazine containing 44 high explosives
- Explosives storages are not permitted in residential areas.

Impacts on air quality

471. The activities that may generate dust during construction phase include:

a. Geotechnical Investigations:
   Geo technical investigation (is required to the construction of jetties) has a potential to generate dust particles due to the exploration of soil and handling of materials used for loading testing etc.
b. Site Clearing and Land Preparation:
   Dust generation from on-site earth moving activities, including site clearing, land preparation etc. and pilling, would cause nuisance in and around the project site.
c. Construction of breakwater will not emit significant amounts of dust as the activities are taken place in the sea and in wet condition. However, during the initial period (the construction starts from the shore) there will be moderate level of dust could be emitted from the construction activities.
d. Dredging operations are undertaken in the sea and in wet conditions, the emission of dust to the open environment is very unlikely. All dredged materials that is to be reused on site may be stored within the development site. However, the material will be managed greatly reducing any potential dust being generated.
e. Construction activities associated with the projects infrastructure facilities (office,

contractor's huts and other temporary buildings together sanitation etc.) and vehicle movements

f. Emission of dust and cement particles may occur during the projects infrastructure construction, such as offices, contractor huts, other buildings and infrastructure facilities.
g. Transportation (materials): Major raw materials, such as rocks, metal aggregate, gravel and sand, are not available near the project site. As such, incidences of dust may occur during transportation of material (construction material, construction waste and municipal solid waste etc.), machinery, and equipment to the site and construction vehicle movements over dry and bare areas.

472. The methodologies for predicting dust impacts due to above construction activities are not straightforward and the magnitude of dust emission, deposition rates, are very much dependent on the type of activities, which include; suppression measures employed, the state of the ground, transportation type and vehicles, cleanliness of on-site haulage routes, cleanliness of vehicles and prevailing weather conditions etc.

473. At wind speeds above 3 m/s, particles of dust may become airborne and may be transported from their original place. Of the particles, which become airborne, for a typical mean wind speed of 5 m/s, particles of diameter greater than 100 µm are likely to settle out within 100 m of the source. Smaller particles, particularly those below 10 µm, are more likely to have their settling rate retarded by atmospheric turbulence, and to be transported further off-site. In high winds, some of these fine dust particles could be deposited at a distance of 500 m from the site and high winds will cause more dust to be created at source, if there are dry surfaces.

474. The gaseous pollutants emission from the exhaust of vehicles and machinery servicing the construction activities could be identified as SO_2, NOx, O_3, CO, HC etc. Geo-technical investigation equipment and servicing vehicles would contribute to increased air pollution in the form of gaseous pollutants only on a temporary basis. Gaseous pollutants emission by mechanical equipment and vehicles used for site cleaning, land preparation and construction activities would lead to slight increase in air pollution. Incidences of air pollution in terms of gaseous pollutant would occur during transportation of material, machinery and equipment to the site. Also, heavy vehicles used for the transportation of machinery to the site would lead to high emissions of air pollution in terms of unpleasant diesel smoke and gaseous pollutants, such as NOx, SO_2 and CO etc. The impacts are not significant and localized and the project will ensure all vehicles have suitable exhaust systems.

475. Dust emissions during materials transportation, landfilling, excavations to lay the foundation for buildings and other construction activities could be minimized by limiting activities that produce significant dust emissions and carefully managing by adopting followings.

- Frequent wetting or water spraying on open areas, stockpiles and deliveries of soil and similar materials. In this regard, it is recommended to use sprinklers, tankers or water bowsers, but avoiding the usage of wastewater for this purpose.
- Covering the working area with suitable materials, such as polyene, tarpaulin or jute materials.
- Provide a proper permanent/temporary parapet wall with a height of 5m from the existing road level along the Poonalai- Point Pedro Road.
- Screening of exposure areas with suitable material, compacting loosened soil and regular manual cleaning of the construction site etc.
- Ensuring that all vehicles transporting potentially dust -producing material are not overloaded, are provided with adequate tail -boards and side-boards and are adequately covered with a tarpaulin (covering the entire load and secured at the sides and tail of the vehicle) during transportation. This is especially important as the project area is located within an urban area.

– Managing the drop heights of material transfer activities, such as unloading of soil, metal, rubbles etc.
– All construction material, such as cement, sand brought to the site needs to be stockpiled carefully to avoid unnecessary dust emissions. Hence, such material needs to be adequately covered and stored in temporary sheds that are well protected against rain and wind or stockpiled in locations not subject to floods, heavy rains and winds. Sheeting of vehicles during transportation of construction materials to the site and enforcement of speed limitations to vehicles are also recommended to minimize dust emissions.
- It is recommended to use machinery that have low dust and gaseous pollutant creation where possible to minimize gaseous pollutant for site clearing and land preparation activities and they should be serviced and maintained well. All vehicles and machinery shall be fitted in full compliance with the national and local regulations (National Environmental Air Emissions, Fuel and Vehicle Importation Standards, Extraordinary Gazette No.1295/11, 01 June 2003).
- Vehicle should be regularly checked for exhaust emission and obtained emission test certificate.
- Provision of PPE equipment to workers when required.

5.3.1.7 Impacts due to changes of land use

476. Ninety percent of the land proposed for the construction of shore facilities is fishing landing site, beach and sea. Only a 10% of green area with home gardens with isolated trees will be affected. However, entire proposed project area will be developed as modern fish harbor with all necessary facility. Some existing home gardens will be lost due to the proposed project. The details are discussed in **Section 5.3.3 and provided in the resettlement plan**. More green area will be developed in the project compensating the loss. Therefore, because of the development of fishing harbor, there will be positive impacts, which will be more benefits to the community.

Socio-Economic Aspects

Impacts on Fisheries activities and Beach uses

477. There are no beach sceine in the proposed project area. There are 19 households who have been living on state land will loss beach access for continuing fishing activities. They own 22 boats and currently use the beach for landing boats within the proposed harbor area. The project already proposed a temporary breakwater structure near the proposed eastern breakwater to accommodate these 22 boats during the construction period. Separate mooring facilities have been provided to these boats within the proposed harbor. These boats could berth at this proposed site once the harbor construction is completed.

478. Therefore, the impact is minimal. However, there may be impacts on the project activities due to the community, they may be visiting the site for various purposes. Movement of several heavy vehicles and several construction activities could take place in the project site. Hence, the safety risk is very high to the person visiting the site. The unnecessary access of community to the site should be restricted. The contractor should adopt the following mitigation measures to minimize the impacts.

- Ensure the proposed temporary breakwater for 13 affected house households will be built before the commencement of construction on the proposed harbor to get access to anchor their boats.
- Alternative boat landing exit and entry points are provided to the eastern site of the PPFHDP site.
- Access to all terrestrial and marine/coastal sites, within the project site and within the greater area of influence to be restricted to only authorized personal (construction staff and associated project staff) for the duration of the project.

- Exclusion areas need to be developed and fully understood by all fishers and general community prohibiting access within the project's terrestrial and shallow water intertidal areas during construction period.
- Physical barriers, information signage and public awareness and information exchange is required on all land boundaries of the project to inform the public of restricted access areas. Exclusion areas for intertidal marine areas will require mobile signage and safety personal to ensure compliance to restricted areas.
- Intertidal reef gleaning and fishing (pole and line) from shore needs to be prohibited within the projects area of influence during the construction phase.
- Offshore reef fishing, (outside the reef) directly opposite the project's area of influence should be prohibited during the construction phase.
- Water sports e.g. snorkeling and/or scuba should be prohibited in all areas associated with the project's area of influence.
- Community and public awareness (community workshops, leaflets etc.) is required to ensure understanding of the project and compliance.
- On completion of works, all temporary obstructions to access to be cleared away and final fisheries harbor restriction in place and community made away.

Impacts to the Methodist Girls' High School

479. In the original plan, the Nadarajar Stage, which has a cultural value for the community in the area and the part of the Kottady area located eastern side of the project were included in the design. As requested by the Fishers Society of Kottady and the fishing community in Kottady area to limit the harbor boundary up to Nadarajar Stage, the design was changed avoiding the Nadarajar Stage. Because of this change, the design has to extend up to Methodist Girls' High School towards west. As the school premises located about 15 m from the boundary of the proposed site, there could be disturbances to the school by means of noise, dust and vibration during the construction period. Noise from the fishers and bad odour from the fish auction hall and market also could be disturb the school children during the school hours during the operational period.

480. In addition to the above, the school management also indicated the visual impacts of the harbour activity also will disturb the children. Considering the above facts, the project was redesigned the layout plan keeping the area Infront of the School without any development. And also, proper mitigation methods are proposed in the mitigation section (refer **section 5.5**).

481. There is adequate beach space in the Koddady area. No major impacts could be expected.

Impacts in relocation and loss of livelihood

482. About 0.2011 ha of Government land under the purview of Divisional Secretary of Point Pedro has been occupied by 13 households with renewable permits. It is evidence that the land permits of such government land have not been renewed annually for a long time due to prevailed conflict. As a result, the occupants of such state land became squatters. The original layout for the harbour land included the land belonging to these thirteen households. However, during consultations, they requested that their land be excluded. The harbor was redesigned excluding the land occupied by squatters considering the community concerns. Therefore, no impacts could be expected.

483. According to the preliminary design and the lay out of the design on ground, it has been estimated about 4.5 ha of land required to establish the onshore facilities to the proposed harbor. The land identified for the proposed harbor belongs to both private and government. This government land comes under the preview of the CCCRMD and Divisional Secretary of Vadamarachchi North. The private land lots identified within and along the boundary of the proposed harbor belong to 13 owners. Details on the impact of land acquisition and status of land ownership for onshore facilities are given in **Table 5-3**.

Table 5-3 : Details on the impact of land acquisition and status of land ownership for onshore facilities

Project Component	Ownership of the land	Type of Land	Affected Area (Ha)	No of lots	No of AHH
Onshore facilities	Private land	Land and trees	0.0552	13	13
Onshore facilities	Divisional Secretary, Point Pedro	Open waste land	0.0133	1	0
Onshore facilities	Costal Conservation Department	Vacant bare	0.4977	2	0
PPD Pier	Already in Possession	Pier for birthing	0.1148	1	0
			0.681	17	26

484. Extent of 0.0552 ha of private land will be acquired for the proposed harbor construction. As per demarcation no impacts to private properties identified, only a strip of land with trees will be affected. There is no relocation and livelihood losses during or after the construction of the harbor. Instead the proposed harbor is potential for future livelihood of the people in the area.

485. The **Table 5-4** explains the impacts to the properties falling below the proposed harbor boundary.

Table 5-4 : Impacts to the properties falling within the proposed harbor boundary.

Project Component	Land Ownership	Land Use and Assets	Affected Area (ha)	AH	APs
Onshore facilities	Private land	Vacant	0.0036	1	4
Onshore facilities	Private land	Vacant	0.0016	1	5
Onshore facilities	Private land	1 Toilet	0.0028	1	2
Onshore facilities	Private land	1 Coconut tree and 15m Fence	0.0011	1	5
Onshore facilities	Private land	15m Fence	0.0010	1	4
Onshore facilities	Private land	20m Fence	0.0007	1	4
Onshore facilities	Private land	20m Fence	0.0013	1	1
Onshore facilities	Private land	Vacant	0.0025	1	4
Onshore facilities	Private land	2 Vadi, 1 Toilet, 1 Well and 5 Coconut trees	0.0127	1	4
Onshore facilities	Private land	1 well and 2 Coconut trees	0.0076	1	5
Onshore facilities	Private land	2 Coconut trees	0.0064	1	8
Onshore facilities	Private land	Vacant	0.0106	1	2
Onshore facilities	Private land	Vacant	0.0033	1	3
Onshore	State land,	Abandoned house of non-	0.0155	1	1

facilities	Divisional Secretary, Point Pedro	titled AP with 5 Coconut trees			
Onshore facilities	Divisional Secretary, Point Pedro	Vacant	0.0133	0	0
Onshore facilities	Costal Conservation Department	Vacant	0.4977	0	0
PPD Pier	Sri Lanka Port Authority	Pier for berthing	0.1148	0	0

486. The harbour will cause unavoidable impacts on an abandoned house with one AP. Other structures to be affected include: (i) two semi-permanent fishing Vadies, (ii) 2 protected wells, (iii) 2 toilets, (iv) 70 meters (m) fences, (v) a drainage canal and (vi) an internal road. The harbour construction will also affect 10 mature coconut trees that provide supplementary income to households.

It should be ensured that necessary compensations are paid prior to commencemet of the project

Occupational (workers) Health and Safety (OH&S) Risks.

487. The workers are subject to various hazard risks during the construction stage, mainly physical hazards, due to injuries by falling from heights, spills or tripping, such as cords running across the floor or projected objects, unguarded machinery and moving machinery parts, confined working space, exposure to heavy noise and vibration, ergonomic hazards due to improper handling of weights, chemical hazards, such as exposures to chemical vapours (paint, petrochemical, paint solvents), and direct touching of chemicals. The unsafe working conditions can cause injury, illness and death. Therefore, the following mitigation measures should be followed by the contractor.

- The contractor will prepare Health and Safety Plan (HSP) as part of the CEMP. The HSP will establish: (i) activity/job safety procedures and protocols; (ii) plan for HSP training and “toolbox” sessions for workers; (iii) first aid facilities (in works area and in vehicles), PPE, and medical evacuations; (iv) routine safety and accident prevention measures; (v) emergency response and preparedness; (vi) accidental environmental instance (e.g. spill) procedures highlighting the sizes and types of impacts that may occur, and the resources (onsite and/or offsite) that will be required to handle and treat the spill; and (vii) accident, near-miss and emergency registry, monitoring and reporting.
  - The HSP will cover both workers OH&S and community health and safety. The HSP will be appropriate to the nature and scope of activities and meet the requirements of good engineering practice, national laws, regulations and the EHSG.
  - Before construction commences the contractor/s will conduct training for all workers on environmental safety and environmental hygiene. The contractor will instruct workers in health and safety matters as required by the HSP,
  - The contractor will designate one full-time staff as HSO to implement the HSP and to work closely with the EMO...
  - All workers shall be provided with appropriate personal protective equipment, (PPE) such as safety shoes, hard hats, safety glasses, earplugs, gloves, etc. including use of Personal Protective Equipment (PPE).
  - Install channeling devices (e.g., traffic cones and barrels) and/or fence to delineate the work zone, an exclusion (physical and visual) boundary fence (including visual material is to be installed within the project area).
  - Workers shall be provided with potable water supply and portable toilet facilities where relevant.

- Provision of distinguishing clothing or reflective devices or otherwise conspicuously visible material to workers on site that are to be worn at all times.
- Monitoring and control of the working environment and planning of safety and health precautions should be performed as prescribed by national laws and regulations. This includes;
- Workers who have received appropriate training in accordance with national laws and regulations shall operate construction equipment.
- The drivers and operators of vehicles and materials handling equipment shall be medically fit, trained and tested and of a prescribed minimum age as required by the government rules and regulation.
- Safety provisions shall be brought to the notice of all concerned by displaying on notice board at a prominent place at the work locations.
- The contractor shall be responsible for observance, by his sub-contractors, of all health and safety provisions.
- The contractor should take adequate measures for the control of dengue fever and other mosquito vector diseases.
- All vehicles used in the construction yard should have reverse horns.
- There should be proper demarcation of work areas with signage boards showing the work areas. The signboards should be in Tamil, Sinhala and English.
- Suitable warning should be displayed at all places where contact with or proximity to electrical equipment can cause danger.
- Persons having to operate electrical equipment should be fully instructed as to any possible danger of the equipment concerned. All the electrical equipment should be inspected before it is taken into use to ensure that it is suitable for its purpose.
- Water transport tanks, storage tanks and dispensing container should be designed, used, cleaned and disinfected at suitable intervals in a manner approved by the competent authority.
- Water that is unfit to drink should be conspicuously indicated by notices prohibiting workers from drinking it.
- Secure storage areas should be provided for flammable liquids, solids and gases such as liquefied petroleum gas cylinder, paints and other such materials in order to deter trespassers.
- Smoking should be strictly prohibited and “no smoking” notices be predominantly displayed in all places containing readily combustible or flammable materials.
- Only suitably protected electrical installations and equipment, including portable lamps, should be used.
- Oil rags, waste and clothes or other substances liable to spontaneous ignition should be removed without delay to a safe place.
- Fire-extinguishing equipment should be provided at construction camps, storage areas for combustible materials and other areas where fire hazards are found. Such equipment shall be properly maintained and inspected at suitable intervals.

1.1.1 Impacts on Movement of Project Vehicle and Traffic Management

488. Large number of vehicle movements could be expected during the construction period.. The following mitigation measures proposed to follow the contractor to minimise the risks.

- Traffic management plan to be prepared by Contractor, predominately used for vehicles transporting material in and out of site associated with the neighboring communities and material sourcing;
- Inform nearby community about the duration of the traffic disruptions, describe operations and how it will be managed;
- Consultation required with community to minimize disruption to access and install temporary access to affected properties where required;
- Vehicle haulage routes and timing identified through consultation;
- Signage used in vicinity of works for direction of traffic associated with the project.

- Ensure public safety is enacted and public not allowed to enter the PFHDP areas.
- Roads to be kept free of material and rubbish at all times.

1.1.2 Impacts on Presence of Construction workers

489. The construction workers may be coming from various places with various cultures. Due to different culture and habits, there could be various social impacts including: Social disruption; Possibility of conflict or antagonism between community and workers; Spread of communicable diseases including STIs & HIV/AIDS; Children are potentially exposed to exploitation; Impacts on general health and safety of community. Considering the potential social disruption due the workers presence, the following mitigation measures are proposed;

- The contractor's HSP will address community impacts and management measures in addition to worker health and safety.
- The HSP will include agreement on consultation requirements, establishment and monitoring of acceptable practices to protect community safety, links to the complaints management system for duration of the works (in accordance to the grievance redress mechanism – GRM) and system for reporting of accidents and incidents. The PMU/PIU and SC to ensure these actions are enforced.
- Before construction commences the contractor/s will conduct training for all workers on their requirements to engage the local community and ensure national laws are respected, special consideration and respect for women, elderly and children are to be strictly followed.
- Community protocols discussed and worker awareness as part of mobilization process;
- Contractor to ensure workers' actions and work site/camp are controlled and community rules and code of conduct is observed;
- Signage and security i.e. prohibition on unauthorized people (especially children) entering site office, construction areas, works yard and camp all in Tamil, Sinhala and English;
- Workers to respect landowner (business/resident) boundaries;
- STIs and HIV/AIDS awareness program through approved service provider for workers and communities (refer projects social safeguard documents);
- A communications and complaints plan will be used for liaison and correction among stakeholders;
- Contractor to appoint ESO;
- No damage to property and resources;
- Sri Lankan minimum wage requirements to be observed.
- Child and/or trafficked labor will be strictly prohibited for any activities associated with the project.
- Children will be prohibited from entering the worker's camps, accommodation, works area/construction zone and prohibited from playing on any equipment or machinery associated with the project
- The contractor will implement the traffic management plan, which will include traffic control and pedestrian safety measures.
- Protection for the public in vicinity of work sites and safe access across work sites provided for the public;
- In consultation with PMU/PIU, the contractor will clearly fence off 'no go areas' within the construction zone and erect boundary fences to prevent the public from entering and visually seeing the construction during the construction period (or specific construction activities).
- Electronic security and additional lighting is to be included along the sites landside outer perimeter.

5.3.1.8 Impacts on Archaeological Cultural Resources

490. Archaeological Impact Assessment conducted for the project by the Archaeological Department in the proposed project area recorded six structural remains. All of them are colonial structures belonging to the Portuguese, Dutch and British periods. Those are situated in the vicinity of Point Pedro jetty. There are three underwater Barges also observed. Old Customs Building, the Remains of the Fort, Old Dispensary, Old Entrance of Methodist Ladies' College, are categorised as category B, which can be replaced in a secondary context after recording/documenting the primary context. All three Barges recorded in the underwater survey are placed in the 'D' category as a site which has no archaeological value. The AIA report is given in **Annex 9**,

491. The proposed project could have impacts by damaging and disappearing the identified archaeological structures. Therefore, it is proposed to implement the recommendations given in the AIA.

492. Cultural resources, such as damaged Nadarajor Stage, small Church, Hindu temple and a Buddhist temple are located within 50 m from the boundary of the project. The Church is located within 20m from the eastern boundary. The construction activities could disturb the day today prayers and festival happenings of these temples. The PIU and contractor will ensure the places of worship are informed in advance of any major activity (such as blasting, etc,) that may inconvenience the worshipers and identify suitable timings, if there is a need to shift the times of any operations.

493. The J/Methodist Girls' High School and J/Hartley College, two older and more than 180 years of functioning missionary schools in Sri Lanka, are situated within 200m radius of the project boundary. Adequate precautionary measures have been proposed to avoid disturbances to the function of the schools. The concerns of the school community also incorporated in to the design to avoid disturbances to the learning environment.

5.3.1.9 Any other impacts not listed here but may be significant.

Safety of Community

Impacts to the school

494. Except the construction of western breakwater, the other activities are limited to outside the boundary of the Infront of J/Methodist Girls' High School premises. The proposed site and the location of the school is given in the **Figure 5-3**

Figure 5-3: Map of project site in relation to JMGS

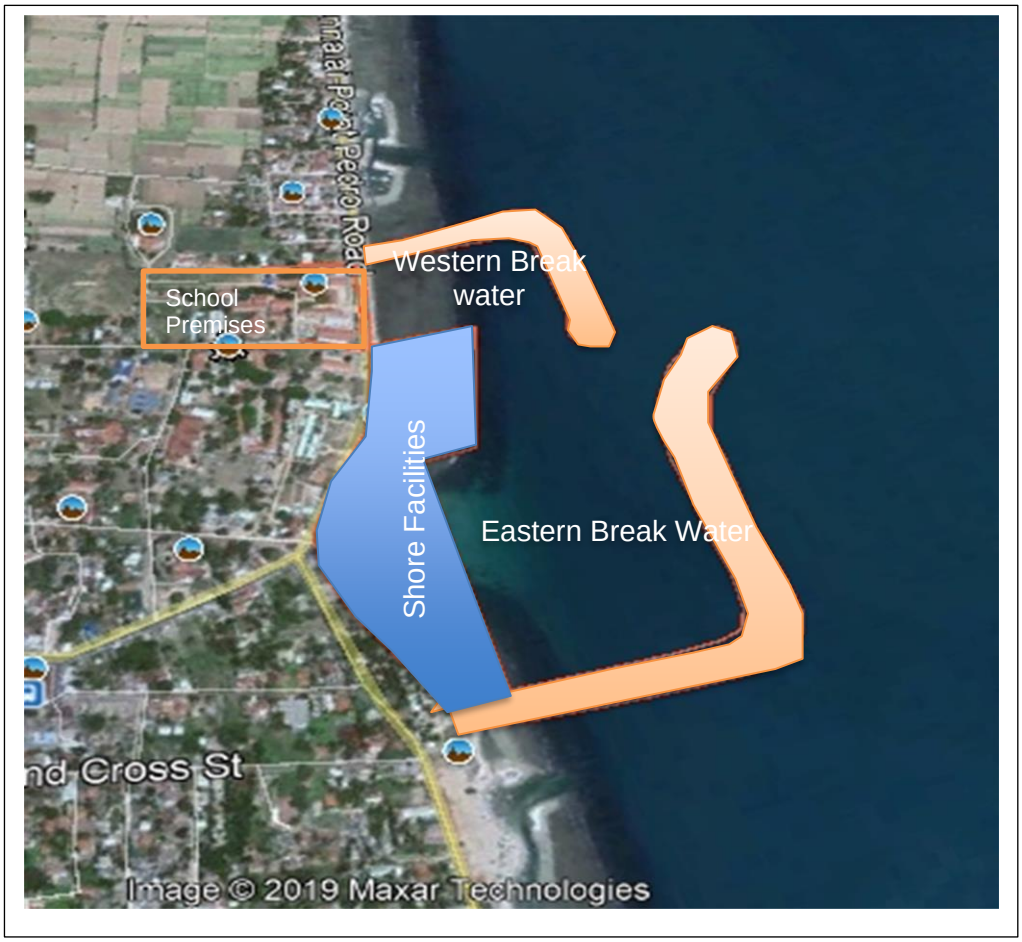


Figure 5-4: Location of the School

495. Considering the scale of construction activities and the operational activities, the school management expressed their concerns that the construction activities and the operational activity may disturb the day today school activities.

496. In this regard proper mitigation measures are proposed in the relevant section.

Visual Impacts

497. The Methodist Girls' High school also indicated the concerns on the obstruction of sea due to the construction of fisheries harbor buildings. The EIA team identify that there is no major objection to the visual of the sea as there are no fisheries facilities will be located Infront of the school premises. Further, the orientation of the major school buildings is towards western and eastern direction, but the building will be located in the northern direction. Therefore, the visual impact is not significant.

Figure 5-5: Orientation of the school building

498. The school management also expressed concerns on the misbehaviour/shouting by fishermen, which may impact the school children's day- to-day study. These impacts are unlikely as there are project activities proposed in front of the School premises. However, the project will install security cameras within the project area and also along the roads near the school. Impacts due to operations are discussed in the preceding section.

Possibility of encountering Improvised Explosive Device (IED) and Unexploded Ordnance (UOX)

499. Since this area was affected by the conflict, even though sites have been cleared of mines, there is always the possibility of chance encounter. For this, at the initial stage of the project, the contractor should organize awareness programs about IED & UXO with the help of local police or bomb disposal or Explosive Ordnance Disposal (EOD) professionals with proper briefing and training on safety precautions.

500. If any suspected IED or UXO item is found within the site or outside the project area (construction area, road side environment, mettle quarry, temporary use labor camps,

burrow pits, disposal site etc.) it shouldn't be touched, disturbed or tampered with any other items. The contractor should inform it to the Police immediately through the Engineer or directly. Once informed, the police will arrange suitable measures to dispose those items through military experts. In the meantime, removal of workforce from the location immediately, marking the location with barricading tapes to identified location easily with a way to the suspicions item (if possible) and preventing entry of any person to the suspected area will reduce the risks. Further project activities should be carried out according to the instruction given by military experts at the particular locations

5.4 Operational Impacts

501. Ceylon Fisheries Harbor Cooperation will manage the proposed fishery harbor. Necessary infrastructure facilitates will be provided under this project. A harbor manager and a Deputy Harbor Manager will be stationed.

Physical Resources

Impacts of Sewage disposal

502. About 61.8 m^3 /day of wastewater will be generated during the operational period and it will be treated before discharge into the environment. Wastewater Discharge into Marine Coastal Area will conform to the National Discharges Standard which is in parallel with the World Bank's Environmental Health Standard (EHS) guidelines. A pipeline will be provided through the eastern side break water about 100 m away from the shore area to get adequate dilution. Therefore, no major impacts are anticipated

503. However, malfunction or improper maintenance will create pollution in the wastewater treatment plant area and the wastewater disposal area.

- The auction hall, sales center and the processing center should be regularly washed and kept clean to avoid the accumulation and stagnation of wastewater, which could emit bad odor. The harbor will be managed by the CHFC. The CFHC will recruit necessary labors for maintain the harbor including cleaning of auction all, market and processing center.
- All wastewater generated from the operation of the fishery harbor will be treated up to the CEA accepted national discharge standards prior to discharge.
- Proper function of the treatment plant should be ensured through periodic monitoring of waste water discharges.
- Quality of sea water should be checked regularly at least once in three months to ensure, there is no pollution due to the discharge
- Regular sediment analysis should be conducted at least once in a year to ensure that there is no contamination in the sediment due to waste water discharge.

Waste oil spills

504. It is estimated that around 225 boats will be operating by 2022, the used oil from boats are currently in demand since many recyclers are buying such waste oil. However, with increased boat numbers and movements the potential of accidental spills will increase. Such potential pollution may get aggravated since water circulation is limited after constructions are completed. This may result in stagnation of oil inside the harbor.

505. The Harbor Management should follow the followings to minimize the environmental impacts likely occur.

- Educate all relevant staff on oil /chemical handling and management procedures and provide appropriate supervision
- Take precaution to avoid spillage or leakage of diesel, oils and lubes from construction vehicles by ensuring the lids of the fuel tanks are properly closed, the fuel tanks are properly fixed, no leakages in the tanks and no excess lubricants are used.
- Conduct maintenance of these vehicles only at designated areas and surfaces in the construction yard and not inside the water. The maintenance area should be concreted with necessary oil traps to collect and spillages. Any spillages on the maintenance floor should be cleaned immediately by using proper absorbents such as sow dust, cotton waste etc. The used absorbents are defined as schedule waste under the National Environmental Act, and such waste should be properly stored in steel or plastic barrels and disposed through the licensed hazardous waste disposal facilities like Insee Cement, (former Holcim Cement Ltd) Puttalam.

- At present hazardous waste site is not in operation. Therefore, the hazardous waste should be stored in plastic barrels until such time, the hazardous water site is established.
-
- No vehicle serving is allowed within the project area. All vehicle should be serviced at licensed (provided with Environmental Protection License (EPL) service stations

Solid waste disposal

506. Proper collection, waste segregation, storage in allocated areas disposal through Local Authorities. Storage and disposal methods are proposed during the operational phase. However, improper collection, storage and disposal method could lead to environmental pollution. Washing out waste to sea, blockage of natural drainage paths and spreading of dust could happened during the construction period if waste not properly maintained. Bad odour, spreading of wastes particularly fish offal by scavenges could occur when the solid wastes are not properly managed during the operation period. Please ref. **Annex 4** for Waste Management Plan

- All solid waste should be collected in containers with proper lid to avoid spreading by scavengers..
- Regular disposal of solid waste should be ensured with Point Pedro Urban council.
- Fish waste should be properly collected and removed on daily basis to avoid the emission of bad odor.
- The harbor management should ensure no waste are disposed in the sea or coastal area

Air emission

507. Only possible dust emission during the operation period will be movement of vehicle for the loading of fish.

Air emission from vehicles and the operation of the stand by generator are the major sources for the air emission. The dust emission and the air emission are considerable low during the operational period. Presently about 10 fishing vehicles come to the Jetty to purchase fish and it is expected to increase by 5 fold, and there could be some impact due to increased traffic. The baseline assessment conducted for the EnA reveals that the ambient air quality is well below the CEA recommended levels. Therefore, the emission of No_2, So2, CO_2 and particulate matter from the vehicle and boats may not be a significant impacts.

Smell from the operation of the fishery harbor

508. The proposed fishery harbor includes a fish auction hall, a sales outlet and a processing center. In all three places, cutting and cleaning of fish will be carried out. These activities will generate considerable quantity of solid waste and wastewater. The improper discharge of waste water particularly stagnation of wastewater in the open areas may emit foul odour in the vicinity. In the meantime, spreading of solid waste by scavengers and improper handling will emit bad smell and causes nuisance to the people living near the fish harbor. The auction hall, sales outlets and the processing centres are located about 200 m away from the school premises, the impact of bad smell is minimal. However, proper mitigation measures are required to ensure that there will be no nuisance to the community due to the operation of the fishery harbour.

- All solid waste should be collected in containers with proper lid to avoid spreading by scavengers..
- Regular disposal of solid waste should be ensured with Point Pedro Urban council.
- Fish waste should be properly collected and removed on daily basis to avoid the emission of bad odor.

- The harbor management should ensure no waste are disposed in the sea or coastal area
- Drains from the auction hall and fish market should be keep clean and ensure there is no waste water stagnation

509. **Noise:** The major noise generating sources are movement of vehicles, shouting of venders, operation of fishing boats and operation of Standby Generator.

- **Movement of vehicles:** There will be large no of vehicle that will enter to the harbor and exists continually. As the entrance are located towards eastern side, and just opposition to the Jaffna Road, the disturbances to the school is minimum.
- **Shouting of venders:** The noise due to the venders will be very minimum and further, it will be preventing from the parapet wall proposed to be constructed along the Punnalai-Point Pedro road. The distance to the auction hall is about 200m away from the school. Therefore, the noise from the venders will not be a significant impact.
- **Noise from fishing boats:** There will be continuous noise from the operation of boats, which could make nuisance to the people living in the close vicinity. The impacts may be moderate in long term and need mitigation measures.
- **Operation of standby Generators:** The operation of the standby generator particularly in the night time may causes nuisance to the community in the vicinity. This could be control by proper mitigation measures.

510. The above noise generation is occurred inside the fishery harbor. Therefore, no major impacts could be expected.

- The noise level at the boundary of the premises should maintained below 50dB(A) and 45 d(B) during night time. By maintaining green vegetation along the boundary operating the machinery in low noise status.
- Standby generator should be instated well away from the residential area. Continuous maintenance is required to reduce the excessive noise generation.

511. **Health and Safety during operations:** The fish boat operation involved in boat anchoring, unloading, fish, transfer to the auction hall, cutting and cleaning of fish and vehicles and pedestrians could be observed. Further, handling fish, knife and fish blood will possess high risk to the people working and using the harbor. Therefore, the following mitigation measures are proposed.

- Inclusion of OH&S requirements in fisheries harbor operations manual including:
- Allocation of responsibility for safety inspections to staff and awareness to fishers;
- Training staff on safety precautions and for implementing emergency procedures;
- Provision of PPE clothing and equipment to workers as appropriate;
- Ensuring that vehicle and equipment operators are properly licensed and trained;
- Arranging for provision of first aid facilities;
- Emergency response and evacuation procedures for manmade and natural disasters (e.g. Oil spill, cyclones, tsunamis);
- Provision for regular safety checks of vehicles and material;
- Provision of hazard warning signs at the all construction sites.
- Recommendation for the fisheries harbors administration to maintain a register of accidents detailing date, circumstances, severity, action taken and outcomes.
- Ensure correct OH&S procedures developed and implemented during the operational phase, specifically, including the maintenance and future repair activities of the fisheries harbors equipment and infrastructures.

Maintenance schedule is defined and costed to adequately cover the cost of maintenance is secured prior to the operation phase. Maintenance schedule should at least cover the operation life of the equipment.

Disaster/Emergency Response Measures

512. The project site and the surrounding areas were affected by the tsunami in 2004. , which caused several deaths and damages to the houses in the vicinity of the project site. As presented in Section B.1, the reef in the area has also been damaged by the cyclone 'Nisha' in 2008 and the scattering of broken reef and silting in the basin area have also caused difficulties in access and mooring of boats. No other major natural disasters have affected the project site or the surrounding areas in the recent past. Although not frequent, the project site, being located next to the coast, is potentially exposed to cyclones/storm surges. No flooding has been reported in the project site and the surrounding areas.

513. In accordance with the National Policy on Disaster Management, it has been identified that the environmental assessments need to cover relevant issues on disaster risk management and mitigation pertaining to the project. Apart from environmental impacts, disaster risk reduction and minimizing the impacts of disasters is a fundamental feature of the design process. Any such incident can seriously affect smooth operation, cause loss of life and damage to ecosystems and critical infrastructure. Therefore the designs need to include comprehensive state of the art methods to identify, assess and minimize the impacts arising from such events.

514. The potential disasters relevant to the site during construction and operation phases include:

- Cyclones
- Tsunamis
- Fires
- (Transport and stockpiling of construction material (Construction Phase))

515. The potential impacts arising from these hazards can be mitigated by planning and design and the adoption of best practices.

516. The region, in which the project site is located, is potentially exposed to both cyclones and tsunamis although the frequency of occurrence of a mega tsunami such as the Indian Ocean Tsunami in 2004 is very low. A two pronged approach is recommended for the mitigation of impacts of these hazards. In the case of structural design, due attention needs to be focused on design measures to minimize the impacts against cyclones and tsunamis. Given the frequency of occurrence of extreme hazard events, which is not very high, it is not economical to adopt disaster proof design. However, sufficient structural engineering measures need to be incorporated to develop hazard resilient infrastructure, thereby minimizing potential impacts.

517. In the case of both cyclones and tsunamis, the Disaster Management Centre (DMC) and the Meteorological Department provide warnings well in advance of the events. For tsunamis arising from earthquakes in the Sunda Arc, the warning time exceeds 90 minutes which provides sufficient time for evacuation to a safe location. Cyclone warnings can also be issued well in advance. The design of buildings in accordance with the required standards and the availability of a trained firefighting unit with modern equipment would mitigate potential impacts arising from fire hazards.

Cumulative Impacts and Mitigation Measures

518. The preliminary assessment of the cumulative environmental impacts resulting from the scope of works associated with the PPFHDP in general are minor with no long term expected impacts if the environmental impact mitigation measures identified in the projects EMP are implemented. Potential cumulative impacts include:

Cumulative impacts and mitigation measures

519. **Physical impacts:** Natural daily tidal currents, oceanic water circulation and wave systems associated with the reef and shoreline to the east and west of the exiting PPFHDP site have been significantly altered due to the previous construction of the coastal road and associated shoreline revetment walls, fish anchorages (reef channel alterations) and landing sites, coastal reclamation areas, sand removal and the past physical alteration (e.g. dredging) of the existing wharf infrastructure.

520. These structures have altered the natural movement of water throughout this reef area, especially the intertidal reef flat for many decades. The project's breakwater and associated intertidal infrastructural components will further change the water circulation dynamics of this reef system; however, the net flow (east to west) of water circulation and wave action will remain the same.

521. Sediment deposition along the shoreline to the east of the PPFHDP breakwater will be altered while the natural system adjusts to the project infrastructure. Preliminary sediment transportation studies undertaken at the project site have indicated that, over time, sand accumulation and accretion patterns will occur due to the breakwater, with some accumulation to the east of the breakwater. This accumulation will replace the original sand beaches in this area of the coastline. These studies have also indicated little change in the beach and costal foreshore areas associated within the harbor basin and to the west of the western breakwater.

522. The existing coastal system is highly dynamic; sand and rubble is constantly moving driven by the prevailing waves and tides at any given time. Water exchange along the shoreline throughout the intertidal reef flat is a daily/tidal process and this exchange will continue unaltered.

523. **Ecological impacts:** The coastal disturbance associated with the project includes the reclamation of the inter-tidal reef platform through dredged sand and rock material from the sub-tidal reef system directly adjacent to the PPFHDP site and the construction of two breakwaters and associated quay within the fisheries harbors harbor basin.

524. The overall footprint of the project in terms of loss of inter-tidal reef flat and marine resources is small and localized and the project will not create adverse cumulative ecological impacts. The implementation of the mitigation measures defined in the EMP will ensure potential impacts are managed. The creation of the fisheries harbor, reclaimed from the inter-tidal reef platform and the construction of the two breakwaters and other harbor basin in water structures provides additional inter-tidal and sub-tidal protected reef habitat available for sessile (e.g. hard corals) and mobile marine resources to recolonize. In effect increasing the complexity of the existing reef system and ecosystem resulting in maintaining and/or possibly increasing this reef's marine biodiversity. Natural settlement of sessile benthic resources (e.g. hard corals) is expected to occur within on the breakwaters and other harbor basin structures once construction activities have finished.

525. There is neither perceived increase nor cumulative impacts associated with the wastewater, fish wastes, petrochemical spillage and sewage associated with the PPFHDP. Rather improvements in provisions of suitable practical and environmental designed equipment, containment and management of these items will improve current levels of potential land and water contamination. Thus, as a result of the projects interventions, a net positive outcome will be attained.

Socio-economic impacts:

526. At an individual, family and community level the project will not create landlessness, displacement, or loss of livelihood or income sources. Minor restrictions on access to construction zone inter-tidal reef areas will be mitigated by provision of alternative fishing boat landing areas to the east and west through the redevelopment of existing neighbouring fish landing and small boat anchorage site (parallel project undertaken by MFAR).

527. There will be no adverse impacts on cultural or heritage resources. The project will not require acquisition of private or customary owned land. There are no adverse cumulative social impacts arising from the project.

6 ENVIRONMENTAL MANAGEMENT PLAN (EMP)

528. This section identifies mitigation and management measures to avoid, reduce, mitigate or compensate for adverse environmental impacts that are anticipated as a result of the projects scope of works that have been identified in the previous section of this report. The EMP is a management tool and the issues are accordingly addressed with regard to the sequence of operations, i.e., those activities that apply to: pre-construction, construction and operation. A summary of the EMP is in **Table 7-1**

529. This EMP covers the environmental impacts envisage to take place while constructing the proposed new fisheries harbor at Point Pedro and associated coastal infrastructure components. It is site specific based on the scope work required for the PPFHDP and any activities likely to cause impact on the environment (refer Section 3.1-Project Details)

6.1 Institutional Arrangements

Sri Lankan Government

530. The MFAR will be the projects Executive Agency (EA) and has the overall responsibility for all project related activities including inter-ministry coordination. MFARD will exercise its functions through its Project Management Unit (PMU), which will undertake the day to day management of the harbor construction and procurement. The PMU will be supported by a PIU based in Jaffna to support this output as well as other outputs under the project. The PIU includes a safeguards Manager, who is supported by three environmental officers, to supervise the entire project of which the harbor construction is one. The PIMU will be assisted by consultancy team that provides support for the construction supervision management and administration for harbors, anchorages and landing package, which includes a full time Environmental Specialist (ES) to supervise and monitor all day to day construction works. The ES will monitor the implementation of the environmental management plan and support the PMU in the preparation and submit semi-annual environmental monitoring reports to ADB and government.

531. MFAR with assistance from the PMU will be responsible to acquire the necessary governmental Development Consent (DC) clearances required under the Coast Conservation and Coastal Resources Management Act, through the Ministry of Mahaweli Development and Environment (MMDE) prior to awarding of contract.

532. The project's EMP will be included in the bidding documents and form part of the contract documents. All bid documents will include a requirement to incorporate necessary resources into the contractor's bid to implement mitigation measures specified in the EMP. Where unanticipated environmental impacts become apparent during project implementation, the IEE including EMP will be updated by the environment specialists. Any updates to the IEE or EMP will be submitted to ADB for review.

533. The EA, through the PMU and PIU, with the support of the environmental specialists and environmental safeguards officers attached to the PMU, will be responsible to:

i) Provide oversight on environmental management aspects of the project and ensure that the EMP is implemented by the contractors:
ii) Facilitate and ensure contractors comply with all government rules and regulations and obtain any relevant approvals required for works;
iii) Supervise and guide contractors on implementation of the EMP;
iv) Review, monitor and evaluate the effectiveness with which the EMP is implemented, and recommend necessary corrective actions to be taken as necessary;
v) Submit semi-annual monitoring reports to ADB and government approval authorities;
vi) Ensure timely disclosure of the IEE in locations and forms accessible to the public;
vii) Take corrective actions when necessary when unforeseen negative environmental impacts occur;

viii) Conduct ongoing consultation with the community during implementation of the project; and
ix) Establish a Grievance Redress Mechanism (GRM) and ensure it is operated satisfactorily.

534. PMU and PIU will be responsible for ensuring that the contractor does not start construction activities until all requisite approvals have been received from MMDE and other government agencies.

535. Quarterly Progress Reports will be issued by the Supervision consultant to government and ADB. These will report on all aspects of the project, including those documented in the Contractor's monthly reports and environmental monitoring reports prepared by the DSC and Contractor. In addition, the ADB will review progress of implementation of the EMP during regular review missions and review periodic monitoring reports and officially disclose the IEE and monitoring reports on ADB's website.

536. After the completion of construction, MFARD will be responsible for operations and ongoing maintenance of all assets.

Contractor

537. The civil works Contractor will be responsible for interpreting the EMP in preparing a Construction Environmental Management Plan (CEMP), after the award of the contract. Where changes or additional engineering information is available, these shall be taken into account in the CEMP. The DSC (as the Supervising Engineer) will approve the CEMP, upon advice from the EO within the PMU and ADB, before any physical works are undertaken. The CEMP should include the following

The CEMP will provide the following:

i. Contractor's organizational structure showing the implementation, supervision and reporting and responsibilities of key personnel

ii. The project program and work activities

iii. The Contractor's specific plans as follows

1. Utilities re-positioning if required (to minimize/avoid disruption of services, such as power, water supply, etc.)

2.Facilities Management Plan (detailed designs, methodologies and installation locations of all construction-related facilities, such as access roads, workers' camps, storage areas, equipment maintenance areas etc., as well as pollution control facilities, such as drainage channel, settling tank/ponds, septic tanks, temporary noise barrier, etc.,) to manage impacts due to operation of various facilities.

3. Air Pollution (dust and gaseous emissions) Control Plan

4. Noise and Vibration Control Plan

5. Waste Management Plan (solid, liquid, hazardous)

6. Spoil Disposal Plan

7. Drainage Management Plan

8. Erosion and Sedimentation Control Plan

9. Traffic Management Plan

10. Chemicals and Hazardous Materials Management Plan

11. Workers and Public Safety Plan

12. Emergency Response Plan

13. Quarry extraction and rehabilitation plan

v. The approach and program for implementing various mitigation measures specified in the Project EMP

v. Plan for self-monitoring and reporting to ensure compliance with EMP/CEMP provisions

538. The Contractor will be required to assign an Environmental Safety Officer (ESO) whose responsibilities for the contractor will include:

- Coordinating with PMU and PIU, the EO and/or DSC for updating the CEMP when required;
- Ensuring that the contractor engages a suitable organization to undertake STI/HIV/AIDS briefings and awareness raising amongst the Contractor's employees.
- Ensuring that the Contractor complies with the clauses in the contract and bidding documents in respect of the environment and OH&S issues;
- Coordinating with MFARD and/or PMU/PIU in respect of continued community consultation;
- Participating in monitoring and coordinating with PIMU and the DSC to ensure that environmental management activities are reported as required;
- Ensuring that the Contractor does not commence construction activities until all requisite approvals have been received from MMDE and other government agencies; and
- Maintaining a log of all grievances received and action taken to address these grievances.

539. Coordinating and communicating with the Contractor's Community Liaison Officer (CLO), as required, to facilitate consultation with the affected communities, various stakeholders (public, private and government), and ensuring smooth implementation of the individual subproject.

540. As identified in the EMP, the Contractor and MFARD and/or the PMU/PIU, may be responsible for the execution of various aspects of the project's environmental monitoring during the construction phases of project. MFAR, through the PMU will also be responsible for verifying the monitoring undertaken by the DSC, through audits and on site monthly spot checks.

541. The outcomes of the monitoring will be included in the monthly and quarterly progress reports to be submitted by the DSC to MFAR and ADB. This information will also be consolidated and submitted to ADB for review on a six monthly basis.

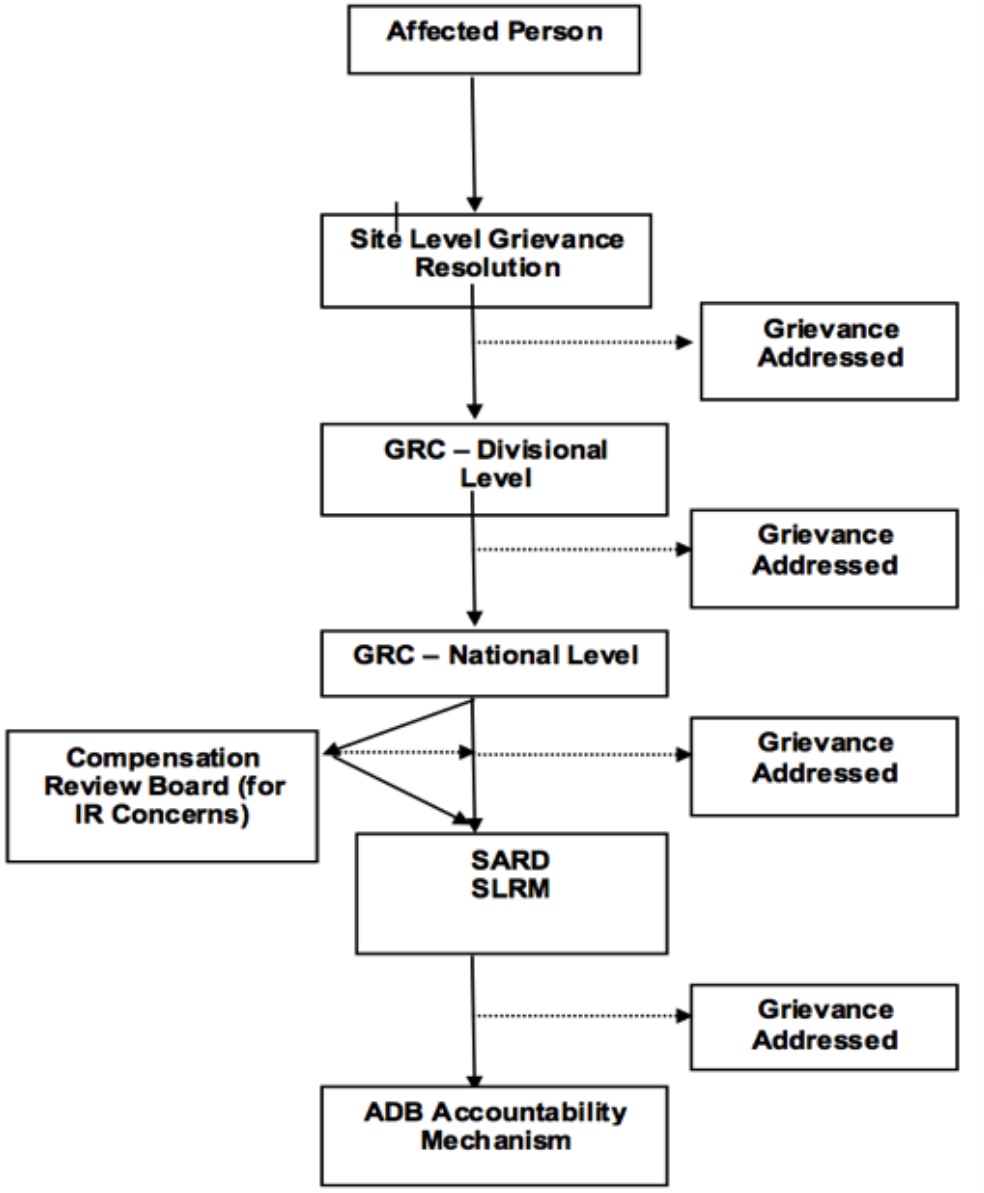
Grievances Redress Mechanism

542. During the course of the project, it is possible that people may have concerns with the environmental management, including the implementation of the EMP. Issues may occur during construction and again during operation. Any concerns will need to be addressed quickly and transparently, and without retribution to the Affected Person (AP).

543. A Grievance Redress Mechanism (GRM), therefore, has been established to resolve disputes and grievance relating to environmental concerns and complaints associated with the PPFHDP. It is based on a multi-tiered approach as outlined below, with each tier possessing a time bound schedule with the responsible persons identified to address the grievance and consult appropriate persons at each stage as required. The objective of the GRM is to support genuine claimants (AP) to resolve their problems through mutual understanding and consensus building process with relevant parties. This is in addition to the available legal institutions for resolving issues. APs using the project GRM can choose to use legal systems at any point in the project GRM process. During detailed design stage a grievance redress committee was established at the first tier and continues to function and membership will be expanded as described below during implementation.

The following process is to be used as described in **Figure 6-1.**

Figure 6-1: Grievance Redress Mechanism



544. The first step is to attempt to sort out the problem directly at the local and/or project site level Grievance Redress Committee (GRC) by the AP directly contacting the projects site engineers and/or the DSC site representative, if the AP believes the issue has not been addressed properly. The project staff is to explain to AP the steps taken to assist and solve the grievances within 7 days. If unresolved, the AP can approach the Local or Divisional level GRC. The local/Divisional GRC will reply within 2 weeks. If the complaint is within the mandate of the GRC, GRC will examine it and submit the findings to appropriate forum for necessary action. If the AP is not satisfied with the findings and action of the second tier GRC, the AP then appeals to the National level GRC for resolution. If the AP is still not satisfied and believes that harm has resulted due to non-compliance with ADB policy, and all good-faith efforts have been made to solve the problem by working with the Project team, a complaint may be submitted to ADB's Office of the Special Project Facilitator or Office of Compliance Review in accordance with ADB's Accountability Mechanism. The last resort left for the AP is the Sri Lanka Court of Law, if it is still felt that none of the above procedures has delivered justice. The decision of the court would be

final, since at this level, the problem has been adjudicated by a competent, knowledgeable legal body. **Table 6-1** provides a list of individuals and agencies that can be involved in the different levels of the GRM.

Table 6-1 : Individual persons and agencies that can be contacted by the AP for assistance with a grievance.

Grievance Level		Persons- Agency
Tier 1	Project/Site Level	PIMU site engineer; Contractor's site representative(DSC); Supervision consultant's representative.
Tier 2	Divisional Level GRC	Divisional Secretary of the area (Chairperson); Representative of the PIMU (secretary); Representative of provincial ministry of education; Assistant Director/Fisheries inspector (Department of Fisheries); Grama Niladhari; Representative of Supervision Consultant; Representative of contractor; Representative of Fishermen's Cooperative Society; Representative of Women's Rural Development Society; Representative of the Methodist Girls School; and Representative of Affected person/affected entity member (non -voting member).
Tier 3	National level GRC	Secretary, MFAR; Project Director; Representative of the MPRRRHRA; Representative of the National Fisheries Federation; Representative from the affected party/affected entity (non-voting member); and Any other representative as deemed necessary based on the issue at hand

Consultation and Disclosure

Consultation process

545. Continuous consultations with relevant stakeholder were conducted during the PPTA and the detailed design stages. Consultations will continue during implementation as well. The details are as follows:

PPTA

546. Consultation activities conducted during the PPTA are: meetings with relevant government authorities for specific issues, concerns, and information collection; public meetings with a wide range of participants for the proposed project

Meetings with government authorities

Table 6-2 : provides a summary of the main meetings and consultations with relevant government authorities.

Table 6-2 : Meetings with government authorities

Government Authority	Consultation date
Northern Provincial Council Chief Secretary's Secretariat, Jaffna	01 August 2016
District Secretariat, Jaffna District	01 August 2016
District Secretariat, Kilinochchi District	02 August 2016
CCD and MMDE, Colombo	02 August 2016
Climate Change Secretariat, Colombo	02 August 2016
Central Environmental Authority, Colombo	02 August 2016
Disaster Management Centre, Colombo	02 August 2016
District Secretariat, Mullaitivu District	03 August 2016
District Secretariat, Mannar District	04 August 2016
Ceylon Fisheries Harbor Corporation, Colombo	08 August 2016
CCD, Jaffna	31 October 2016
Divisional Secretariat and District Secretariat, Mannar	30 November 2016
NARA, Colombo	14 December 2016
DWC, Colombo	14 December 2016
Climate Change Secretariat, Colombo	14 December 2016
MFARD, Colombo	16 December 2016

Source: PPTA Consultants

547. A public consultation at Point Pedro was held, chaired by the District Secretary of the Vadamarachchi North DS, as well as several consultations with the land owners and fishers.

Table 6-3 : Consultations for Proposed Fishery Harbors

Subproject	Consultation location	Consultation date
Point Pedro Fishery Harbor	Suppaamadam Community Hall	29 November 2016
Point Pedro Fishery Harbor	Kottady Beach	28 December 2016
Point Pedro Fishery Harbor	Divisional Secretariat, Point Pedro	30 March 2017

Source: PPTA Consultants

548. Prior to the meetings, the PPTA consultants distributed a leaflet, in Tamil, containing brief description of the proposed investment. At the beginning of each consultative meeting, an overall brief of the project was provided to the participants. The PPTA consultants described technical aspects of the proposed investment and highlighted social, environmental, and resettlement aspects.

549. Impacts, both negative and positive, that are common with any infrastructure development project, were discussed with the stakeholders. People interacted with interest to learn about the project and shared their views and potential concerns. Discussions were conducted in Tamil language and translations from English to Tamil language were made whenever necessary. After the meetings, the participants were invited to a site visit.

550. Key concerns raised or suggestions made, and proposed solutions are presented in the **Table 6-4** below.

Table 6-4 : Concerns and Responses - Fishery Harbors Consultations

Key concerns or suggestions	Response
(Point Pedro) Participants indicated that the site is vulnerable to erosion as the coastline doesn't have any reef for wave protection	The PPTA consultants confirmed that the proposed design considered all aspects and further studies will be done during the detailed design stage. The representative of DCC also confirmed that adequate measures will be proposed to prevent erosion when the project comes to approval stage.
The fishers, who engage in fishing with small boats, raised concern that they may not be able to anchor small boats in the proposed harbors, and hence they fear of potential livelihood loss.	The PPTA consultants informed that the proposed investment includes anchorages and landing sites to cater the requirement of small boat owners to continue fishing.
Concerns were raised over the usage and sharing of the harbor with fishers from other parts of the island that could lead in conflicts with local people.	CFHC will act as the regulatory body in place to control the activities of the fishers and avoid conflicts. It was emphasized that fishery harbors are national assets and the license holder has rights to use services of any fishery harbors of the Island.
The fishers of Koddadi village requested to allocate a separate strip within the proposed Point Pedro Fishery Harbor to anchor their one-day boats.	Adequate space is available in the Kottady
The fishers raised concern about livelihood loss if the fishing activities will be limited during construction of the harbors.	No impacts to the livelihood as the fishers can continue the activities in the Kottady area
Many participants expressed desire to observe operation of modern harbors.	It was discussed to potentially arrange an exposure visit to modern fishery harbors in the country during the detailed design stage as the suggestion of GM, CFHC. Dick-owita Harbor was identified as the best example. Operation procedures could be explained during the visit.
Fishers appreciated the livelihood development proposals and also requested loan facilities to purchase multi-day boats.	This should be further discussed during the detailed design stage.

Source: PPTA Consultants

Detail Design period

551. The meetings were conducted using different tools. At the initial stage of the designing period, most of the meetings were conducted using the draft layout plan to explain the location of each activity in the proposed site. Secondly, meetings were conducted using 3D conceptual model to understand the clear picture of the proposed project and then stakeholder meetings were conducted with power point presentation with details of the project activities. One consultation meeting was held with the Chief Minister Northern Province where detailed power point presentation was done with the major anticipating impacts and the proposed mitigation measures. All the meetings were either conducted in Tamil language or provided with the translation. As the domestic Environmental Specialist and the Social and Resettlement Specialists are Tamil speaking consultants, which added positive value to the consultation process. Generally, in the consultation the consultants described technical aspects of the proposed investment and highlighted social, environmental, and resettlement aspects as much as possible.

Table 6-5 : Stakeholder consultation

No.	Subject	Venue	Date
1	ADB- Divisional Level Meeting	Progress Briefing	02.11.2018
2.	Discussion on Methodist Girls High School concerns	Methodist Girls High School	11.12.2017
3.	Stakeholder meeting with Ministry of Education including Principal of Methodist School	Northern Province Education Ministry	24.11.2018
4.	Jaffna Government Agent and Planning officials updated on district Progress and issues	Government Agent Office-Jaffna	6.03.2018
5.	Chief Minister and key stockholders including Methodist Girls High School-Awareness	Chief Ministers office- Northern Province	7.03.2018

552. In addition to the above, the consultants had several field visits and one is to one discussion with the community in the area.

553. Key concerns raised or suggestions made, and proposed solutions are presented in the **Table 6-6** below.

Table 6-6 : Responses to the community consultation

Key concerns or suggestions	Response
The fisherman society of Kottady and the fishing community in Kottadi requested consider to limit the harbor boundary up to Nadarajar Stage during the design	The design was shifted towards western side
J/Methodist Girls High School has indicated that noise, dust and vibration during the construction period and the odour and the misbehaviour of the fishers will disturb their day today school activities.	Design layout was modified so that most of the project activities are located away from the school premises towards eastern boundary. Proper mitigation measures are proposed to reduce the nuisance due to the construction activities and operational activities
The school requested to shift the present quarters location to the east	The Bachelor quarter is relocated to the western site
The school requested that a promise be given that no future development will take place in the future - through MOU and to allow them to participate from time to time in the Harbor Management committee meeting.	There is no legal provision to have the MOU, with School management. School included in the project grievance redress committee
The principal requested assistance to construct a school building by purchasing a private land adjoin to the school	There is no provision to purchase private property, however, project willing to consider any urgent development required within the school property.

Principal requested a Copy of the environment assessment report	A copy of the report will be made available once finalized.
Kottady and Suppermadam fishers indicated their concern over the beach erosion and accretion	The sand movement modelling study conducted for the proposed fisheries harbour, indicates no major erosion or accretion in both sides of the harbour. Therefore, no impacts could be expected.

Two Consultation meetings were conducted with the fisher community and the government official separately on the findings of the EnA on 21.11.2019 at the Divisional Secretariat Office, Vadamarachchi North. The concerns raised by the fisher community and the Government officers are given in the **Table 6-7**

Table 6-7 : Responses to the concerns raised by the fisher community

Key concerns or suggestions	Response
Increased wave action will cause higher erosion along the western coastline (Suppermadan area), as a result fishing activity will become a challenge to the fishermen and safe docking of one day OFRP boats will not be possible.	The sediment transportation study shows the impact is not significant.
Koddadi women help to arrange the hooks for long line fishing in boxes and earn around Rs1,500 per day. Because of the proposed intervention, women will permanently lose their livelihood and become vulnerable.	There are no impacts to the present livelihood activities as the construction activities are limited only to the project site.
Koddadi Fishermen Society requested a navigation access through the eastern edge of the breakwater.	Provision of navigation channel through the break water is technically not feasible, but a separate access with gate will be provided at the inception of the eastern breakwater to easy access to the OFPR boat owners.
The participant requested a meeting with the Governor Northern Province or higher officers.	The project will arrange such meetings.

Table 6-8 : Responses to the concerns raised by the Government Officials

Key concerns or suggestions	Response
The roads may get damaged due to transportation of construction materials and PS has no funds for rehabilitation. This will create community issues against the intervention. Further, the width of the road is also not adequate for heavy vehicle movement and may cause accidents. Mainly schoolchildren use these roads to	Transportation of construction materials will be carried out only through the RDA and PRDA/DRD-NP roads. Therefore, no impacts to the rural roads are expected. Further, the construction contractor should identity suitable quarry sites, borrow areas and disposal sites and conduct Transport Impact Assessment prior to the commencement of the construction in order to ensure the safety of the community and

access schools and church.	the properties.
Allocating adequate space for storage of boulders is not available within the PS area because the volume is massive. Therefore, measures should be taken for offshore storage.	The armors will be temporarily stored in the reclaimed area for the shore facilities.
At present the PS manages the solid waste disposal with lot of difficulties with minimal machineries. During the construction period and the operation period of the harbor, solid waste generation would be higher and PS will find it difficult to manage the situation in addition to household collection. Therefore, the project should provide assistance to the PS to continue the service without interruption and without management issues.	The Pradeshiya sabha has already given the concerns to collect waste during the operation phase. The Harbor management will make payment as requested by the PS for the disposal of their wastes.
Since shallow water fishing is a common phenomenon in the region as a result wastewater disposal is crucial during the construction period and the operation period of the harbor. Therefore, wastewater treatment plant should be in place for treatment prior to discharge into the sea to avoid public protest among fishing community and the environmentalists.	There is no discharge of wastewater during the construction period to the sea as the wastewater from the labor camps will be either discharged into properly constructed septic tank/soakage pit or sealed septic tanks. However, during the operational stage the wastewater will be treated to the CEA standards and discharged into the sea about 100m away from the beach.
Upgrade Munai offshore facilities prior to Point Pedro harbor to cater the operation of about 22 OFRP boats. Obtaining concurrence from Munai fishermen to accommodate Koddadi boats until the completion of proposed harbor. This official arrangement will minimize the issues between the two societies.	A temporary break water will be constructed to facilitate the berthing of 22 Koddadi OFRP boats. Therefore, no need of using Munai facilities by the Koddadi fishers
The Chairman and the Grama Niladhari of Koddadi expressed that fishermen in Koddadi have traditionally been engaging long line fishing. Therefore, they will have space for continuing this without disturbing their livelihood including women.	No disturbances to the Koddadi people as the construction activities are limited to the foot print of the project area.

The minutes of the meetings are given in Appendix 02 of ANNEX 10.

7 Information disclosure.

554. Several consultations were undertaken during feasibility and detailed design stage.

555. Further consultation and disclosure has been done through:

- The project's Communications Plan;
- Disclosure of a summary of the project documents, including the preparation and dissemination of a brochure in English and local language, explaining the project, works, impacts and anticipated timing of the works; and
- Setting up a formal grievance redress committee with a representation from the affected people.

556. Disclosure will conform to the SPS and Public Communications Policy of the ADB: Disclosure and Exchange of Information which requires that environmental assessment reports for ADB projects be accessible to interested parties and the general public. The project's environmental assessment report as part of ADB project documents will be uploaded onto the ADB website while the report will be made available to the public upon request.

557. MFAR will also submit the report to any member of the public upon request.

7.1 Environmental Monitoring and Reporting

558. Environmental monitoring is integral component of an environmental impact assessment to ensure i) combat uncertainties pertaining to unanticipated impacts, ii) ensure mitigation measures are working and iii) reassure public on the progress of the development. Progressive monitoring must accompany various stages of the subproject activities (pre-construction, construction and operational phase). The project Environmental Monitoring Plan is based on the potential impacts, significance of the impacts and mitigation approaches identified during the environmental assessment study. It comprises parameters to be monitored, frequency of monitoring, responsible authorities and cost estimates. The contractor will be required to prepare a detailed Environmental Monitoring Plan based on the EMP and as set out in the contract documents. A review committee that is to include staff members of the MFAR/PIMU and MMDE are responsible for monitoring compliance, review of contractors' monthly monitoring report and suggest ways to improve or strengthen mitigation approaches.

559. The MFAR/PIMU and MMDE are required to:

- Review contractors' monitoring plan based on contract documents and grant a certificate of approval when requirements are met;
- Co-ordinate compliance monitoring programs and submit quarterly monitoring reports;
- Review contractor's monthly monitoring report and suggest ways to strengthen mitigation approaches; and
- Include the likely mitigation cost incurred by the contractor for implementing the mitigation approaches and recruitment of ES in the as items in the bill of quantities.

560. The contractor is required to:

- Produce a detail monitoring plan and submit to MFAR/PMU/PIU and MMDE for review;
- Execute all mitigation approaches required under the contract document and CEMP;
- Produce a monthly environment monitoring report to MFAR/PIMU and MMDE; and
- Recruit an Environment Safety Officer (ESO) to manage EMP implementation.

Table 7-1 : Environmental Management and Monitoring Plan (EMP)

IMPACT MITIGATION			IMPACT MONITORING			
Environmental Impacts	**Mitigation Measures**	**Mitigation Responsibility**	**Mitigation costs ($US)**	**Parameter to be monitored**	**Frequency & means of Verification**	**Monitoring Responsibility**
PRE-CONSTRUION PHASE						
General						
Delay in obtaining Environmental Clearance of project, scope of work permits will negatively impacts the project implementation	- Consult with Marine environment Protection Authority (MEPA) and other relevant agencies, finalize and submit environment assessment for review and GoSL clearance of project. - Ensure updated EMP and any conditions of environmental clearance are included in tender/bid and contract documents including requirement for contractor to prepare a CEMP (based on EMP) for approval before commencement of construction activities. The CEMP will demonstrate the manner (location, responsibilities, schedule/ timeframe, budget, etc.) in which the contractor will undertake the works and implement required mitigation measures. - Disclose project documents including environment assessment, consultation and communications plan and establishment of the GRM. - Engage and inform community stakeholders of project.	Contractor	Include in contract.	Clearance/s Issued; Tender/bid documents and contract contain all relevant items. Project document is disclosed.	Once at start of contract proceedings. ADB approval.	MFAR-PMU
Non Environmental responsible procurement will negative impacts impact the implementation of the project	Updated EMP (based on detailed design) included in bid documents to ensure that mitigation measures are budgeted and to prepare the contractor for environmental responsibilities. Specify in tender/bid and contract document (incl. BOQ) that contractor required to recruit EMO and HSO to prepare the CEMP, implement, manage, and monitor environmental and safety issues of the project. Contractor to submit site-specific CEMP based on updated EMP in tender/bid documents and contract detailing approach to construction and environmental impact mitigation.	MFAR-PIU/PMU & ADB	Include in contract.	Specification in tender/bid and contract documents, BOQ indicated elements of CEMP to be costed.	Once at start of contract proceedings. ADB approval	MFAR-PIU/PMU MEPA
Occupational Health and Safety	Contractor prepares Health and safety Plan (H&SP) including workers camps as part of the CEMP covering all items specified in outline EMP.	MFAR-PMU & ADB	Include in contract.	Specification in tender/bid and contract documents.	Once at start of contract proceedings. ADB approval.	MFAR PIU/MU

IMPACT MITIGATION				IMPACT MONITORING			
Environmental Impacts		**Mitigation Measures**	**Mitigation Responsibility**	**Mitigation costs ($US)**	**Parameter to be monitored**	**Frequency & means of Verification**	**Monitoring Responsibility**
Potential risks due to public not well informed about project and/or GRM		Key community stakeholder meeting held prior to commencement of works. Information disclosure procedures on GRM and how it is accessed and used. Consultation and communications plan updated and disclosed. Construction schedule disclosed.	MFAR-PIU/PMU & ADB	Include in contract.	Specification in tender/bid and contract documents.	Once at start of contract proceedings. ADB approval.	MFAR-PIU/PMU
Prepare Management and risks of impacts associated with construction activities	Suitable contractor environmental compliance	Contractor prepares CEMP and submits for approval by MFAR/PMU and MEPA the CEMP. CEMP to include site plans, construction methodology for specific elements (dredging, fill placement, breakwater and wharf construction) and workers requirements.	Contractor	Construction Cost.	CEMP approved and includes all sub-plans as required.	Once at start of contract proceedings. ADB approval.	MFARD&REA-PIU/PMU MEPA & MSDW
Physical Environment							
Climate Change Adaptation	If design not including Climate Change/adaptation could result in; 1), Unexpected failure of breakwater and port; 2), Increased coastal erosion; 3), Facilities capable of accommodating increase storm risk and sea level changes.	Ensure climate proofing incorporated into design to ensure coastal erosion not locally increased. Design modified to accommodate extreme whether events - increased storms, sea swells, cyclones, tsunami, rainfall and coastal erosion.	MFAR&REA Contractor	Construction Cost.	Strom frequency, wave and swell heights, localized flooding & frequency, Localized coastal erosional issues.	At start of project; Visual, Local – regional weather data.	MFAR&REA-PMU

IMPACT MITIGATION				IMPACT MONITORING			
Environmental Impacts		**Mitigation Measures**	**Mitigation Responsibility**	**Mitigation costs ($US)**	**Parameter to be monitored**	**Frequency & means of Verification**	**Monitoring Responsibility**
		Vegetation clearance during surveying and demarcation activities, especially of trees along to minimized; Under no circumstances is the contractor permitted to fell trees or remove scrubs not required (specified) to be removed; Construction workers will be informed about general environmental protection and the need to avoid un-necessary felling of trees wherever possible. Inclusion of trees and other vegetation into the projects landscaping and "green belt" areas where possible. Replant minimum of 1:3 ratio for every tree removed in the area left free of any construction opposite the Methodist Girls High School					
Social Impact							
Project site clearance, reclamation and excavations (dredging)	Accidental discovery of archeological assets, sites or resources.	Cease activities immediately if archeological site etc located; - Inform Department of Archaeology, PMU – MFAR&REA and - Undertake all actions required by law.	Contractor	Construction costs.	Site and/or resource (artifact) discovered and protected.	Literature and stakeholder discussions, During all work activities – stop work order given if located until site/resource dealt with appropriately.	,PMU, Archeology department.
	Restriction of use of land and coastal waters.	- Consultation with owners/users including local communities if required; - Compensation for vegetation.	Contractor	Construction Cost.	Grievances received from community & MOU signed.	Before and after work.	PMU/PIU
	Erosion & contamination of adjacent coastal waters due to site preparation, rock storage	Ensure implementation of all measures detailed in Impact section of report.	Contractor	Construction Cost.	Visual review of project area scope of work – usage of mitigation	Before and after work.	PIU/PMU

IMPACT MITIGATION				IMPACT MONITORING			
Environmental Impacts		**Mitigation Measures**	**Mitigation Responsibility**	**Mitigation costs ($US)**	**Parameter to be monitored**	**Frequency & means of Verification**	**Monitoring Responsibility**
	and/or excavation works (reclamation, dredging & breakwater).				fixtures (silt traps), waste water management.		
Mobilization of contractor, presence of construction workers interaction with local people.	Social disruption**.**	Community protocols discussed & workers awareness provided; Contractor to ensure workers actions outside work hours (e.g. camp) are controlled and local and national codes of conduct observed; Signage and security at work site and camp – i.e. prohibition on unauthorized people (especially children) entering worksite and camps.	Contractor Ministry of Health &/or district office, PIU/PMU and community sector.	Construction cost.	GRM protocols; Understood by community, register of complaints between community and worker. Number of children entering camps. Signage usage and awareness programs.	Before construction: visual check of contractor (monitoring) records – consultations with workers & civil society (CBO, NGO).	PMU/PIU
	Spread of Communicable STI's & HIV Aids.	Implementation of awareness & prevention program – Contractor. Implementation of HIV/AIDS awareness and prevention program – Community. Approved service provider to delivery awareness prior to construction activities.	Contractor Ministry of Health &/or district office, PIU/PMU and community sector.	Construction cost.	STI-HIV – AIDs prevalence, increase awareness – transmission and prevention.	Before construction: visual check of contractor (monitoring) records – consultations with workers & civil society (CBO, NGO).	

IMPACT MITIGATION				IMPACT MONITORING			
Environmental Impacts		**Mitigation Measures**	**Mitigation Responsibility**	**Mitigation costs ($US)**	**Parameter to be monitored**	**Frequency & means of Verification**	**Monitoring Responsibility**
Impacts due to Establishment of Workers camps.	Potential minor loss of vegetation; Restriction on use and access of land; Waste and water management (delivery, use and disposal); Accidental discovery of archaeological assets, sites or resources.	- Minimize vegetation removal to immediate corridor of works (camp). - Consultations with land owners/users; - Compensation for vegetation/building cleared/removed, if required - Provide waste and water management plan for the site and seek approval (PMU – MFARD&REA & MEPA. - Establish site office, workers yard, accommodation and security in consultation with relevant landowners and government agencies. - Cease activities immediately if archeological site etc. located; - Inform Department of Archaeology, PIU/PMU – MFARD&REA and - Undertake all actions required by above.	Contractor PIU/PMU Health department, Government and Civil society groups (CBO, NGO), Archeology department.	Construction cost.	Land use agreements, Updated consultation and communication plans disclosed; Agreed social conduct protocols disclosed; CLO staff on board, Workshop & consultation minutes and attendance records reviewed.	Following contractor mobilization	PMU/PIU
Environmental capacity building.	To support the staff capacity and skills to effectively manage the environmental monitoring and compliance associated with the project.	- MFARD&REA commit sufficient resources for PIU/PMU operations (staffing, resources, equipment etc.) for project duration. - MEPA/CCCRMD provide time for staff to participate in environmental management training and capacity building to be provided by the MFAR/PMU. - MFAR/PMU allocation of funds for general training and awareness of safeguards requirements (e.g. workshops and on-the-job training). -	MFARD&REA – PIU/PMU and MEPA	Construction cost.	Budget with sufficient allocation of funds; Number of workshops, training courses and on site training delivered. Review of workshop reports,	During project -prior to start of construction Phase and continue as required.	

IMPACT MITIGATION				IMPACT MONITORING			
Environmental Impacts		**Mitigation Measures**	**Mitigation Responsibility**	**Mitigation costs ($US)**	**Parameter to be monitored**	**Frequency & means of Verification**	**Monitoring Responsibility**
					minutes.		
Construction Phase							
Physical Impacts							
	Impacts to the beach and shoreline						
Impacts due to sourcing, excavation and/or transportation of construction materials (incl. fill placement, dredge spoil management and disposal).	Extraction from quarries or borrow pits results in unusable land, reduction in biodiversity, exposed water table, attracts rubbish dumping and reduces visual values.	Extraction from ecologically sensitive areas (beach, intertidal, swamp, wet lands, mangrove areas) or productive land not permitted. Sites to be identified / finalize in consultation with GSMB/CEA/PMU and landowners and/or communities; PMU to agree protocols for sourcing, transportation, haulage and storage for all materials and ensure procedures are followed during transportation of materials to the site. Conduct a Transport Impact Assessment prior to commencement of the construction once the quarry sites and borrow sites are finalized. All transportation vehicle should be covered and secured with tarpaulin to prevent dust during the transportation. The contractor will prepare a material and spoil management plan (MSMP) as part of the CEMP. The MSMP will include at least the following: - Identifying suitable sources and obtaining all agreements and permits as required associated with the sources; - Required materials, potential sources and estimated quantities available (from quarries or burrow pits); - Extraction technique and excavated material reuse and recycling methods; Excess spoil to be disposed of as per methods approved in endorsement/permit from GSMB/CEA; Construction materials, such as sand and aggregate	Contractor	Construction Costs	Material obtained only from approved designated sites, extraction permit requirements are followed and compliance is attained, Spoil managed in accordance with EMP including use of sediment management systems and dredging requirements. Rehabilitati	Monthly visual inspection at all sites, Review of extraction, dredging waste management plans. Review complaints record.	PIU/PMU

IMPACT MITIGATION				IMPACT MONITORING			
Environmental Impacts		**Mitigation Measures**	**Mitigation Responsibility**	**Mitigation costs ($US)**	**Parameter to be monitored**	**Frequency & means of Verification**	**Monitoring Responsibility**
		needed for concrete should come from existing quarries, in compliance with GSMB/CEA guidelines; Rock aggregate storage and stockpile to be restricted to project site. All rock/aggregate stockpile needs to include agreed and permitted sediment and dust management protocols including silt traps to reduce dispersion of sediment. All material collected by sediment traps or silt nets removed daily/weekly to prevent dispersion and disposed of at dedicated dumping site locations. Any excess spoil and construction waste material will not be dumped in; - Wetlands, forest areas, coastal and other ecologically sensitive areas; - Private property without written consent of the owner; - Any water body and will not contaminate any water body. Arranging for the safe disposal of any excess spoil including provision for stabilization, erosion control, drainage and re-vegetation provisions at the disposal site, if required. ➢ Ensure the armors and filling materials area utilized from licensed metal quarry ➢ A pre-crack survey should be conducted prior to commencement of the transport activities to make compensations any if required due to the damages of building due to project activities. ➢ Proper traffic management plan should be used during the martials transportation. Safety officers should be appointed to look after the pedestrians particularly during the school opening time and the closing time. ➢ Ensure the noise levels and vibration standards prescribed in the National Environmental Act should be strictly flowed. Follow recommendation given in the AIA			on of site is conducted as extraction plan requirements.		

IMPACT MITIGATION				IMPACT MONITORING			
Environmental Impacts		**Mitigation Measures**	**Mitigation Responsibility**	**Mitigation costs ($US)**	**Parameter to be monitored**	**Frequency & means of Verification**	**Monitoring Responsibility**
Impacts of Sewage disposal		- Adequate toilet facilities with septic tanks and soakage pits should be provided to the labor camps -	Contractor		Sea, beach and project site Sea water quality,	Water quality, once in three months, Water quality report, visual inspection.	PIU/PMU
Impacts Due to Surface Run off		- Provide necessary silt traps along the drainage path to minimize the entering of silt to the sea. The silt traps should be continuously cleaned to ensure the proper functioning of silt traps.	Contractor		Sea, beach and project site Sea water quality,	Water quality, once in three months, Water quality report, visual inspection	PIU/PMU
Pollution from use, storage and accidental spills of hazardous substances & need for emergency response.	Petrochemical (oil, fuel) and other hazardous chemicals are spilled into the environment (marine and terrestrial) from the fisheries harbor and breakwater construction and/or associated facilities (camps, transport) resulting in pollution & environmental damage;	- Detailed Emergency Response Plan – DERP (as part of the EMP) including a Hazardous Substance Management Plan (HSMP) is to be prepared by Contractor to cover materials/oil/fuel storage, spills and accidents; The HSMP to cover at least; ➢ National laws and regulations and international best practice requirements; ➢ Hazardous materials inventory ➢ Identification of risk associated with hazardous chemicals and materials; ➢ Facility description and site plan that illustrates all buildings, roads, yards, outdoor chemical storage, sewers, wells, water bodies, and adjacent villages; ➢ Facility storage map that shows the location of: all hazardous materials, all storage areas, emergency equipment and exits, evacuation points, spot where designated individual will meet emergency personnel, and all tanks/sumps/ piping; ➢ Accidental exposure measures;	Contractor	Construction Costs	Review and monitor DERP and HSMP EMP and emergency response plan, ensure storage sites are using concrete base and covered (including explosion storage in separate secure facility), Spill areas	Monthly or after event or as required-review and approval emergency plan. Regular visual inspection of storage facilities.	PIU/PMU

IMPACT MITIGATION				IMPACT MONITORING			
Environmental Impacts		**Mitigation Measures**	**Mitigation Responsibility**	**Mitigation costs ($US)**	**Parameter to be monitored**	**Frequency & means of Verification**	**Monitoring Responsibility**
	Accidents placing people at risk.	➢ Emergency response (links with emergency response requirements set out in health and safety plan); and ➢ Recording and reporting incidents. - Locate storage areas for all petrochemical products at least 100 m from coastline. - Chemicals including fuel to store in secured (lockable), weather proofed area including an impervious flooring and bund/containment wall to container spillage; - All hazardous materials to be clearly labeled. - Used oil and other toxic and hazardous materials shall be disposed of in an authorized facility off-site. - Spill waste will be disposed at disposal sites approved by local authorities. - Stop concreting activities during periods of heavy rainfall. - Adequate precaution to be taken to prevent oil/lubricant/ hydrocarbon contamination of the waterways and coastal waters. Spillage, if any, will be immediately cleared with utmost caution to leave no traces. - All spills cleaned as per emergency response plan, including spill cleanup kits and material available specifically for petrochemical and other hazardous substances; - Ensure designated workers are trained in use of spill – clan up equipment. - Ensure all vehicles and plant machinery are well maintained; accidents reported to police and MID within 24 hours. - Educate all relevant staff on oil /chemical handling and management procedures and provide appropriate supervision - Take precaution to avoid spillage or leakage of diesel, oils and lubes from construction vehicles by ensuring the lids of the fuel tanks are properly			cleaned and rehabilitated. Receive record f compliance and accidents.		

IMPACT MITIGATION				IMPACT MONITORING			
Environmental Impacts		**Mitigation Measures**	**Mitigation Responsibility**	**Mitigation costs ($US)**	**Parameter to be monitored**	**Frequency & means of Verification**	**Monitoring Responsibility**
		closed, the fuel tanks are properly fixed, no leakages in the tanks and no excess lubricants are used. - Conduct maintenance of these vehicles only at designated areas and surfaces in the construction yard and not inside the water. The maintenance area should be concreted with necessary oil traps to collect and spillages. Any spillages on the maintenance floor should be cleaned immediately by using proper absorbents such as sow dust, cotton waste etc,. The used absorbents are defined as schedule waste under the National Environmental Act, and such waste should be properly stored in steel or plastic barrels and disposed through the licensed hazardous waste disposal facilities like Insee Cement, Puttalam. - No vehicle serving is allowed within the project area. All vehicle should be serviced at lincenced (provided with Environmental protection Licence (EPL) service stations. -					
Anticipated problems related to solid waste disposal		- All construction waste should be segregated as recyclable and non-recyclable. All recyclable materials should be sold to the local recycle materials collectors in the area. The non-recyclable debris should be used for refilling activities and if any leftover, should be disposed at the local authority collection system/disposal sites. - All construction wastes should be properly stored with suitable cover like polythene sheets, tarpaulin, or jute to prevent the spreading of dust. - If possible spray water to keep the waste wet during the dry season - No open burning of solid waste is allowed as this	Contractor		Available storage facility, clean environment, Presence of waste in the environment	Daily Random check	PIU/PMU

IMPACT MITIGATION				IMPACT MONITORING			
Environmental Impacts		**Mitigation Measures**	**Mitigation Responsibility**	**Mitigation costs ($US)**	**Parameter to be monitored**	**Frequency & means of Verification**	**Monitoring Responsibility**
		could cause a nuisance to the people in the area. - The contractor should provide adequate color bins to segregate the MSW in the labour Camps. National color code for segregated waste are blue, orange, red, brown and green for Paper and card boards, Polythene and plastic, Glass and bottle, Metal and Bio degradable waste respectively. All recyclable waste should be stored separately and sold out for local recycle materials collectors in the area and all bio-degradable waste should be disposed through the Point Pedro Urban Council. - All e-wastes bulbs such as CFL and linear fluorescent bulbs, obsolete communication equipment etc.,, should be collected separately be given to the e-Waste recyclers registered with the CEA[12]. -					
Water quality affected by works in marine environment and on land (run-off).	Construction material and sediment washed into coastal waters; Increased turbidity detrimental to coastal fringing coral reef systems; Soil and marine environment	- Preparation and implementation of Waste Management Plan before start of work. - Implementation of good construction practice and accepted methods. - Minimizing the vegetation clearance where possible. - Cover/stabilize all exposed surfaces and excavated materials during construction. - Implementing effective construction site drainage such that runoff is directed to sediment traps before discharge to the environment and/or into the coastal marine ecosystem. - All wastewater should not be directed nor spilled onto the coastal foreshore strip. No wastewater to be dumped within project site foreshore or intertidal marine sites. Run-off prevented as best as possible from entering the	Contractor	Construction Costs	Implementation of wastewater management plan, number of trees removed, no wastewater entering marine environment – siltation traps and other	Monthly visual inspection at all sites, and spot checks and if complaints recorded. Review of extraction, dredging waste management plans. Review complaints	PIU/PMU

[12] http://www.cea.lk/web/images/pdf/whats/Licensed_Collectors_of_Electronic_Waste_Management_in_Sri_Lanka_WEB.pdf

IMPACT MITIGATION				IMPACT MONITORING			
Environmental Impacts		**Mitigation Measures**	**Mitigation Responsibility**	**Mitigation costs ($US)**	**Parameter to be monitored**	**Frequency & means of Verification**	**Monitoring Responsibility**
	contamination from petrochemicals (fuels, oils).	adjacent terrestrial and coastal marine waters. Siltation traps, socks and nets (coastal) to be placed at the construction sites to regulate and manage wastewater sedimentation issues derived from construction activities, including specific sedimentation and pollution collection during all intertidal and subtidal construction activities (e.g. dredging, breakwater development) Siltation traps, curtains, nets and covers (tarpaulins) to be used (mandatory) on all construction waste to prevent dispersion of waste due to rain events. Close construction supervision to ensure the above measures is implemented. Provisions of stop work during periods of heavy rainfall. Construction camps supplied with sanitary latrines - no direct discharge. Monitoring of water quality of the sea water			management measures in use and working throughout site (breakwater, dredging, reef reclamation). Workers actions and camp compliant to EMP, review compliance record.	record.	
	Increased sedimentation and turbidity due to Dredging	Select most appropriate dredger type in order to minimize the impacts and follow following steps as applicable; ➢ Minimize the unnecessary disturbance to the sediments by exerting care when lowering and lifting the grab; ➢ Use barges that are fitted with tight fitting seals to their bottom openings to prevent leakage of material; ➢ Ensure accurate barge loading to avoid splashing of dredged material to the surrounding water; ➢ Do not fill the barges or hoppers to a level, which will cause the overflow of materials or polluted water during loading or transportation. Adequate freeboard should be maintained to ensure that the decks are not	Contractor	Construction Costs	Waste management plan in use, silt curtain/s in use for all dredging activities and working, Workers following EMP requirements and no sediment	Weekly visual inspection of dredging operations when in use – include delivery and decommissioning of machinery, spot checks if complaints recorded. Review of extraction, dredging	PIU/PMU

IMPACT MITIGATION				IMPACT MONITORING			
Environmental Impacts		**Mitigation Measures**	**Mitigation Responsibility**	**Mitigation costs ($US)**	**Parameter to be monitored**	**Frequency & means of Verification**	**Monitoring Responsibility**
		washed by wave action; ➢ Remove large objects and debris manually prior to mechanical dredging to minimize losses from partially closed grabs; Install siltation devices around the barge to restrict turbidity issues at all times. Siltation traps, socks and nets (coastal) to be placed at the construction sites to regulate and manage wastewater sedimentation issues (principal turbidity from dredging and breakwater development) derived from construction activities, including specific sedimentation and pollution collection during all intertidal and subtidal construction activities (e.g. dredging, breakwater development) Close construction supervision to ensure the above measures is implemented. Plan dredging works to take in tidal and local wave conditions – preference for low tide reduced wave conditions. Reef reclamation to construct revetment wall first (including Geotech fabric) and backfill with dredge material (reduction in sedimentation on reef. Provisions of stop work during periods of heavy rainfall. Construction staff awareness of sedimentation management responsibilities. Checking of quality of sea water			waste water entering the marine environment form dredging operations. Review compliance record.	waste management plans. Review complaints record.	
Ecological Impacts							
Impacts on intertidal and subtidal reef marine habitats and resources (Flora and fauna) during construction activities.	Impacts on marine flora and fauna marine resources and habitats; Fragmentation of marine habitats. Endemic or Conservation	- Implementation of MSMP. - Care to be exercised during all intertidal and subtidal reef reclamation - construction activities including the sand dredging and sediment removal (blasting) of the offshore substrate to limit the physical and subsequent material placement (breakwaters) on the reef flat and offshore benthic substrate to the designated scope of works. - Access of all construction material entering the reef to be confined to specific areas to reduce impact on sessile flora and fauna in adjacent habitat outside of the designated scope of works. - Ensure that all equipment used for the marine	Contractor	Construction Costs	MSMP measures implemented by contractor. Care exercised to limit impacts to areas outside of project area.	Weekly or as required-regular daily spot checks during all construction by contractor to be undertaken to ensure EMP compliance – specifically important for	PIU/PMU

IMPACT MITIGATION				IMPACT MONITORING			
Environmental Impacts		**Mitigation Measures**	**Mitigation Responsibility**	**Mitigation costs ($US)**	**Parameter to be monitored**	**Frequency & means of Verification**	**Monitoring Responsibility**
	status species affected; Workers impacting flora and fauna; Marine protected areas or species affected. Loss of structural coastline – protection from erosion.	construction activities (land based or barge based) are in sound and well-maintained condition, and free of any leaks of any petrochemical fluids. - All efforts must be made to prevent petrochemical spills. Spill containment equipment is to be kept on hand. - Activities requiring use of mechanical equipment to be coordinated and undertaken during low tide periods whenever practical. - Activities utilizing explosive or chemical fracture to be undertaken only during day light hours, including public notification of the timing and PPE provided to all staff. - Installation and deployment of floating silt curtains (geo-fabric), marine booms and silt traps/nets around all reclamation (e.g. dredging machinery, reef and breakwaters) areas to reduce impact on neighboring ecology. - Care to be exercised when lifting and removing curtains to ensure that collected sediment does not fall off and disperse in the water column; curtains should be carefully rolled up by divers and all material collected and removed to be disposed of in an approved and designated land based receiving site location(s). - All construction aggregate/rock material to be used within the site for construction (e.g. breakwater, fisheries harbor boundary) to be stockpiled within the PPFHDP site. Silt/sediment traps to be used at all times. - All excavated material not being used at the site (breakwater or backfill) to be collected and removed from the marine environment and stored or disposed of in a terrestrial approval location/s. The disposal site must be at a minimum 100 meters from the foreshore**.**			Restrict all equipment on reef to designated areas (reducing impact) and ensure machinery well maintained to reduce petrochemical spillage. Ensure use of sediment controlling equipment in use at all times. Review compliance record.	sedimentation management associated with dredging and breakwater development.	

IMPACT MITIGATION				IMPACT MONITORING			
Environmental Impacts		**Mitigation Measures**	**Mitigation Responsibility**	**Mitigation costs ($US)**	**Parameter to be monitored**	**Frequency & means of Verification**	**Monitoring Responsibility**
Impacts on terrestrial habitats and flora and fauna resources during construction activities.	Impacts on flora and fauna (terrestrial, beach and homestead habitats); Fragmentation of terrestrial habitats; Endemic or Conservation status species affected; Workers impacting flora and fauna; Terrestrial protected areas or species affected.	- Contractor responsible for educating workers, imposing sanctions regarding harm to wildlife and/or use or felling of vegetation (except trees required by the project). - Reduce the number of trees required to be removed for project and incorporated where possible, existing flora into design landscaping. - Excavation and construction machinery (including trucks hauling materials) to be kept in well-maintained condition. - All efforts must be made to prevent petrochemical spills. Spill containment equipment is to be kept on hand. - Silt and sediment traps and bunds are to be positioned around work areas from where run-off can be generated. - All excess material and other stored or stockpiled materials to be maintained as per the provisions of the MSMP. - Works areas and fuel/explosive storage to be on concrete pads and bunded. Wash-down areas to be connected by channels or drains to silt/grease trap. Such wash down discharge/run-off will not be disposed of in the marine environment. - All excavated material not being used at the site to be collected and removed from the marine environment and disposed of in terrestrial approval permitted location/s. The disposal site must be at a minimum 100 m from the foreshore and not located within or close proximity to ecological important and sensitive biological areas. - Materials to be removed from the site are to be disposed of in an approved location(s). Any disposal site must be a minimum of 100 m from the foreshore. - Tree planting and site re-vegetation to be undertaken following completion of construction activities, if required. - Impacts to natural shoreline and beach vegetation to be reduced where possible, maintenance of natural	Contractor	Construction Costs	MSMP measures implemented by contractor. Care exercised to limit impacts to areas outside of project area. Ensure machinery well maintained to reduce petrochemical spillage. Ensure use of sediment controlling equipment in use at all times. Review compliance record.	Monthly or after event or as required. Review machinery is well maintained and sedimentation management system used and working. Number of trees removed and Review complaints record.	PIU/PMU

IMPACT MITIGATION				IMPACT MONITORING			
Environmental Impacts		**Mitigation Measures**	**Mitigation Responsibility**	**Mitigation costs ($US)**	**Parameter to be monitored**	**Frequency & means of Verification**	**Monitoring Responsibility**
		slope and accumulation were possible.					
Impacts related to noise, vibration, and air pollutant generation	Noise and vibration in community (residential and commercial); Impacts on construction workers.	– Equipment should use with adequately sized exhaust silencers and use silenced equipment wherever possible. – Where applicable, low noise type equipment should be used such as hydraulic jacking type vibration pile and based pile system etc. and provide engines enclosures for high noisy equipment. – Keeping equipment in good working order and maintenance and operation of equipment according to manufacturers instructions. – Use noisy equipment such as piling equipment's, drillers, and compressors etc. for very short periods of time. – Use low vibratory equipment such as hydraulic jacking type vibration piles and based pile systems etc. – where possible, keep equipment in good working order by scheduling a planned maintenance program using manufacturers operation manual. Use vibratory equipment during daytime with minimum operational time. Positioning of equipment as far as practical from vibration sensitive receivers and provide workers safety equipment.	Contractor	Construction Costs	Adherence to agreed EMP time schedule of activities, visual inspection (weekly) Review record of Complaints, PPE equipment supplied and used by workers Noise level dB(A). during day and Night	Weekly visual inspections or after complaint – ensure EMP vehicle and machinery compliance. Noise measurement one in three months or when complains received	PIU/PMU
	Vibration due blasting operation for the dredging transportation of materials	- The contractor should carry out necessary blast test through laboratories registered with the CEA (recommended GSMB) prior to commencing the blasting activity to determine the blasting pattern and quantity of explosives to be used to minimize the vibration levels to the nearby residences and	Contractor		Pre-crack survey houses in the close proximity.	Crack survey before commencing construction once, if	PIU/PMU

IMPACT MITIGATION				IMPACT MONITORING			
Environmental Impacts		**Mitigation Measures**	**Mitigation Responsibility**	**Mitigation costs ($US)**	**Parameter to be monitored**	**Frequency & means of Verification**	**Monitoring Responsibility**
	and construction activities such pilling could damage the community property in the vicinity**.**	schools. - Proper low vibration lime stone blasting operation shell be selected to minimize excessive the vibration generated due to the blasting activities. - Monitoring of vibration levels in nearby building structures should be carried out whenever construction activities such as blasting, drilling activities are carried out and whenever complaints have been received. In this respect special attention should be paid to the development of Pre-cracks and crevices in nearby building structures. - A pre-crack survey with photographic evidence should be conducted prior to the commencement of the construction activities to ensure that no property damages occurred due to the construction period. - Observations of the RDA should be obtained to ensure the transport routes are capable of transporting rocks without excess vibration which causes damages to the property located either sides of the roads along the transport routes. - Approval of relevant local authorities are obtained to use the internal roads.			License from GSB/CEA and other agencies, Vibration levels, Peak particle velocity,	complains, receives. Blasting lest prior to commence the blasting operation. Vibration test once in three months	
Impacts on air quality	The operation of vehicle, clearing of lands, transportation of materials and construction of shore facilities will generate excessive dust and air pollutants which could	- Frequent wetting or water spraying on open areas, stockpiles and deliveries of soil and similar materials. In this regard, it is recommended to use sprinklers, tankers or water bowsers but avoiding the usage of wastewater for this purpose. - Covering the working area with suitable materials such as polyene, tarpaulin or jute materials - Provide a proper permanent/temporary parapet wall with a height of 5m from the existing road level along the Poonalai Point Pedro Road. - Screening of exposure areas with suitable material, compacting loosened soil and regular manual cleaning of the construction site etc. - Ensuring that all vehicles transporting potentially	Contractor		Visual observation of spreading of dust during wind season, Air quality monitoring, once in a month during dry season as	Visual inspection daily, Fugitive dust emission once in a month and ambient air quality once in three months Checking of	/PIU/PMU

IMPACT MITIGATION				IMPACT MONITORING			
Environmental Impacts		**Mitigation Measures**	**Mitigation Responsibility**	**Mitigation costs ($US)**	**Parameter to be monitored**	**Frequency & means of Verification**	**Monitoring Responsibility**
	causes health effects to the community and the workers exposed to such air pollutants	dust -producing material are not overloaded, are provided with adequate tail -boards and side-boards and are adequately covered with a tarpaulin (covering the entire load and secured at the sides and tail of the vehicle) during transportation. This is especially important as the project area is located within the urban areas of Honiaira and there are a number of villages along the road where trucks transporting machinery and road material will pass – carefully managing the drop heights of material transfer activities such as unloading of soil, metal, rubbles etc. – All construction material such as cement, sand brought to the site needs to be stockpiled carefully to avoid unnecessary dust emissions. Hence such material needs to be adequately covered and stored in temporary sheds that are well protected against rain and wind or stockpiled in locations not subject to floods, heavy rains and winds. Sheeting of vehicles during transportation of construction materials to the site and enforcement of speed limitations to vehicles are also recommended to minimize dust emissions. - It is recommended to use machineries that have low dust and gaseous pollutant creation where possible to minimize gaseous pollutant for site clearing and land preparation activities and they should be serviced and maintained well. All vehicles and machineries shall be fitted in full compliance with the national and local regulations (National Environmental Air Emissions, Fuel and Vehicle Importation Standards, Extraordinary Gazette No.1295/11, 01 June 2003). - Vehicle should be regularly checked for exhaust emission and obtained emission test certificate. - Provision of PPE equipment to workers when required.			in National Environmental ACT	vehicle smoke test reports	

IMPACT MITIGATION				IMPACT MONITORING			
Environmental Impacts		**Mitigation Measures**	**Mitigation Responsibility**	**Mitigation costs ($US)**	**Parameter to be monitored**	**Frequency & means of Verification**	**Monitoring Responsibility**
SOCIO-ECONOMICAL IMPACTS							
Impacts on Fisheries activities an beach uses	Loss of beach access boat landings. Loss of livelihood. Safety concerns**.**	- Ensure the affected house households will get access to anchor there boats in the adjacent Kottady area. - Alternative boat landing exit and entry points are provided to the eastern site of the PPFHDP site. - Access to all terrestrial and marine/coastal sites, within the project site and within the greater area of influence to be restricted to only authorized personal (construction staff and associated project staff) for the duration of the project. - Exclusion areas need to be developed and fully understood by all fishers and general community prohibiting access within the project's terrestrial and shallow water intertidal areas during construction period. - Physical barriers, information signage and public awareness and information exchange is required on all land boundaries of the project to inform the public of restricted access areas. Exclusion areas for intertidal marine areas will require mobile signage and safety personal to ensure compliance to restricted areas. - Intertidal reef gleaning and fishing (pole and line) from shore needs to be prohibited within the projects area of influence during the construction phase. - Offshore reef fishing, (outside the reef) directly opposite the project's area of influence should be prohibited during the construction phase. - Water sports e.g. snorkeling and/or scuba should be prohibited in all areas associated with the project's area of influence. - Community and public awareness (community workshops, leaflets etc.) is required to ensure understanding of the project and compliance. - On completion of works, all temporary obstructions to access to be cleared away and final port restriction in place and community made away.	Contractor and Department o of Fisheries	Construction Costs	Community awareness (face to face and information pamphlets) to gain understanding of exclusion areas, signage used and barriers erected to identified areas. GRM process understood and obligations with communities implemented when required.	During all project activities – regular (weekly) visual inspections and spot checks, review record books and complaints.	PIU/PMU
Construction activities	Interference and/or damage	-Consult infrastructure and services providers (e.g. s, water, power, telecommunication,) and private/business	Contractor		Services	Visual inspections	PIMU

IMPACT MITIGATION				IMPACT MONITORING			
Environmental Impacts		**Mitigation Measures**	**Mitigation Responsibility**	**Mitigation costs ($US)**	**Parameter to be monitored**	**Frequency & means of Verification**	**Monitoring Responsibility**
causing accidental damage to existing services and/ or accidental damage to property.	to existing infrastructure services and/or property. Potential contamination of coastal and marine systems. Potential safety issues to community.	stakeholder in close proximity to the PPFHDP site before construction to minimize physical impacts to services and property during works; - Any services likely to be impacts need to have mitigation actions in place to prevent disruption, all services or properties impacted must be rehabilitated;			damaged-disrupted have been repaired – service reinstalled, Property damaged repaired and rehabilitated to pre-existing state. Review record of complaints.	as required, consultation with service providers and property owners.	

IMPACT MITIGATION			IMPACT MONITORING			
Environmental Impacts	**Mitigation Measures**	**Mitigation Responsibility**	**Mitigation costs ($US)**	**Parameter to be monitored**	**Frequency & means of Verification**	**Monitoring Responsibility**
Occupational (workers) Health and Safety (OH&S) Risks.	- The HSP will cover both workers OH&S and community health and safety. The HSP will be appropriate to the nature and scope of activities and meet the requirements of good engineering practice, national laws, regulations and the EHSG. - Before construction commences the contractor/s will conduct training for all workers on environmental safety and environmental hygiene. The contractor will instruct workers in health and safety matters as required by the HSP, - The contractor will designate one full-time staff as HSO to implement the HSP and to work closely with the EMO.. - All workers shall be provided with appropriate personal protective equipment (PPE) such as safety shoes, hard hats, safety glasses, earplugs, gloves, etc. including use of Personal Protective Equipment (PPE). - Install channeling devices (e.g., traffic cones and barrels) and/or fence to delineate the work zone, an exclusion (physical and visual) boundary fence (including visual material is to be installed within the project area). - Workers shall be provided with potable water supply and portable toilet facilities where relevant. - Provision of distinguishing clothing or reflective devices or otherwise conspicuously visible material to workers on site that are to be worn at all times. - Monitoring and control of the working environment and planning of safety and health precautions should be performed as prescribed by national laws and regulations. This includes; - Workers who have received appropriate training in accordance with national laws and regulations shall operate construction equipment. - The drivers and operators of vehicles and materials handling equipment shall be medically fit, trained and tested and of a prescribed minimum age as required by the government rules and regulation. - Safety provisions shall be brought to the notice of all	Contractor		Inclusion of OH&SP in the HSP plan	Daily Provision of PPE, No. of accidents,	PIU/PMU

IMPACT MITIGATION			IMPACT MONITORING			
Environmental Impacts	**Mitigation Measures**	**Mitigation Responsibility**	**Mitigation costs ($US)**	**Parameter to be monitored**	**Frequency & means of Verification**	**Monitoring Responsibility**
	concerned by displaying on notice board at a prominent place at the work locations. - The contractor shall be responsible for observance, by his sub-contractors, of all health and safety provisions. - The contractor should take adequate measures for the control of dengue fever and other mosquito vector diseases. - All vehicles used in the construction yard should have reverse horns. - There should be proper demarcation of work areas with signage boards showing the work areas. The signboards should be in Tamil, Sinhala and English. - Suitable warning should be displayed at all places where contact with or proximity to electrical equipment can cause danger. - Persons having to operate electrical equipment should be fully instructed as to any possible danger of the equipment concerned. All the electrical equipment should be inspected before it is taken into use to ensure that it is suitable for its purpose. - Water transport tanks, storage tanks and dispensing container should be designed, used, cleaned and disinfected at suitable intervals in a manner approved by the competent authority. - Water that is unfit to drink should be conspicuously indicated by notices prohibiting workers from drinking it. - Secure storage areas should be provided for flammable liquids, solids and gases such as liquefied petroleum gas cylinder, paints and other such materials in order to deter trespassers. - Smoking should be strictly prohibited and no smoking notices be predominantly displayed in all places containing readily combustible or flammable materials. - Only suitably protected electrical installations and equipment, including portable lamps, should be used. - Oil rags, waste and clothes or other substances liable to spontaneous ignition should be removed without delay to a safe place.					

IMPACT MITIGATION				IMPACT MONITORING			
Environmental Impacts		**Mitigation Measures**	**Mitigation Responsibility**	**Mitigation costs ($US)**	**Parameter to be monitored**	**Frequency & means of Verification**	**Monitoring Responsibility**
		- Fire-extinguishing equipment should be provided at construction camps, storage areas for combustible materials and other areas where fire hazards are found. Such equipment shall be properly maintained and inspected at suitable intervals. -					
Impacts due movement of project vehicle and traffic management plan	Traffic and access disrupted during construction; Traffic safety affected**.**	• Traffic management plan to be prepared by Contractor; • Inform nearby business/residents/school about the duration of the traffic disruptions, describe operations and how it will be managed; • Consultation required with business/residents/school to minimize disruption to access and install temporary access to affected properties where required; • Vehicle haulage routes and timing identified through consultation; • Signage used in vicinity of works and to include "flag persons" to regulate traffic flow and ensure traffic safety to workers, pedestrians and general public; • Ensure public safety across all work sites are maintained including i) barriers to prevent entry in high risk areas (e.g. excavation sites, area with heavy machinery being used) and ensure safety passage are erected through work sites if needed; • Roads to be kept free of material and rubbish at all times.	Contractor	Construction Costs	Traffic management plan prepared. Number of accidents or events, Maintenance access for community and residence (school, signage present and useful, road free f construction debris.	Visual inspection (weekly) throughout project, consultation with communities, review record of compliance and actions undertaken, review traffic management plan.	PIU/PMU
Presence of Construction workers - Community health and safety.	Various social impacts including**:** Social disruption; - Possibility of conflict or antagonism	- The contractor's HSP will address community impacts and management measures in addition to worker health and safety. - The HSP will include agreement on consultation requirements, establishment and monitoring of acceptable practices to protect community safety, links to the complaints management system for duration of the works (in accordance to the grievance redress mechanism – GRM) and system for reporting of accidents and incidents. The PIU/PMU and DSC to	Contractor	Construction Costs	Training awareness provided to all workers on HASP and HIV/SIT and required behavioral	During all project activities – visual inspections and spot checks (weekly at least) at work site and	PIU/PMU

IMPACT MITIGATION				IMPACT MONITORING			
Environmental Impacts		**Mitigation Measures**	**Mitigation Responsibility**	**Mitigation costs ($US)**	**Parameter to be monitored**	**Frequency & means of Verification**	**Monitoring Responsibility**
	between business/residents and workers; - Spread of communicable diseases including STIs & HIV/AIDS; - Children are potentially exposed to exploitation; - Impacts on general health and safety of community.	ensure these actions are enforced. - Before construction commences the contractor/s will conduct training for all workers on their requirements to engage the local community and ensure national laws are respected, special consideration and respect for women, elderly and children (including the school) are to be strictly followed. - Community (business/resident) protocols discussed and worker awareness as part of mobilization process; - Contractor to ensure workers' actions and work site/camp are controlled and community rules and code of conduct is observed; - Signage and security i.e. prohibition on unauthorized people (especially children) entering site office, construction areas, works yard and camp all in Tamil, Sinhala and English; - Workers to respect landowner (business/resident) boundaries; - STIs and HIV/AIDS awareness program through approved service provider for workers and communities (refer projects social safeguard documents); - A communications and complaints plan will be used for liaison and correction among stakeholders; - Contractor to appoint ESO; - No damage to property and resources; - Sri Lankan minimum wage requirements to be observed. - Child and/or trafficked labor will be strictly prohibited for any activities associated with the project. - Children will be prohibited from entering the worker's camps, accommodation, works area/construction zone and prohibited from playing on any equipment or machinery associated with the project - The contractor will implement the traffic management plan that will include traffic control and pedestrian safety measures. - Protection for the public in vicinity of work sites and safe access across work sites provided for the public;			protocols at work site and workers camps and compliance enforced, Signage and safety systems installed and useful. GRM process understood and obligations with communities implemented when required.	camp/s record books and complaints.	

IMPACT MITIGATION				IMPACT MONITORING			
Environmental Impacts		**Mitigation Measures**	**Mitigation Responsibility**	**Mitigation costs ($US)**	**Parameter to be monitored**	**Frequency & means of Verification**	**Monitoring Responsibility**
		- In consultation with PIU/PMU, the contractor will clearly fence off 'no go areas' within the construction zone and erect boundary fences to prevent the public from entering and visually seeing the construction during the construction period (or specific construction activities). - Electronic security and additional lighting is to be included along the sites landside outer perimeter.					
Archaeological Impacts	Damages and Loss of archaeological important structures	- Implement the recommendation given in the AIA -	Contractor		Damages to the structures	Daily during dredging and site clearance	PIU/PMU ADB
Operational period							
Pollution, contamination and waste accumulation in and around fisheries harbor (marine and terrestrial environment).	Discharge of wastewater Degradation of environment. Impacts on fishers productive and livelihoods.	- The auction hall, sales center and the processing center should be regularly washed and kept clean to avoid the accumulation and stagnation of wastewater which could emit bad odor. - All wastewater generated from the operation of the fishery harbor will be treated upto the CEA accepted national discharge standards prior to discharge. - Proper function of the treatment plant should be ensured. - Quality of sea water should be checked regularly at least once in three months to ensure, there is no pollution due to the discharge - Regular sediment analysis should be conducted at least once in a year to ensure that there is no contamination in the sediment due to waste water discharge.	Harbor Management, fishers and maintenance contractor. ADB (post evaluation period).	Internal fisheries harbors operational and maintenance costs.	fisheries harbors operational manual, level of rubbish visually witnessed in the harbor, foreshore areas and land sites, Maintenance schedule disclosed and adhered to. Provision of waste receptacles and general waste management	Daily activity	PIU/PMU ADB

IMPACT MITIGATION				IMPACT MONITORING			
Environmental Impacts		Mitigation Measures	Mitigation Responsibility	Mitigation costs ($US)	Parameter to be monitored	Frequency & means of Verification	Monitoring Responsibility
	Oil disposal	- Educate all relevant staff on oil /chemical handling and management procedures and provide appropriate supervision - Take precaution to avoid spillage or leakage of diesel, oils and lubes from construction vehicles by ensuring the lids of the fuel tanks are properly closed, the fuel tanks are properly fixed, no leakages in the tanks and no excess lubricants are used. - Conduct maintenance of these vehicles only at designated areas and surfaces in the construction yard and not inside the water. The maintenance area should be concreted with necessary oil traps to collect and spillages. Any spillages on the maintenance floor should be cleaned immediately by using proper absorbents such as sow dust, cotton waste etc,. The used absorbents are defined as schedule waste under the National Environmental Act, and such waste should be properly stored in steel or plastic barrels and disposed through the licensed hazardous waste disposal facilities like Insee Cement, Puttalam. - No vehicle serving is allowed within the project area. All vehicle should be serviced at licensed (provided with Environmental protection License (EPL) service stations -					

IMPACT MITIGATION				IMPACT MONITORING			
Environmental Impacts		**Mitigation Measures**	**Mitigation Responsibility**	**Mitigation costs ($US)**	**Parameter to be monitored**	**Frequency & means of Verification**	**Monitoring Responsibility**
	Disposal of solid waste	- All solid waste should be collected in containers with proper lid to avoid spreading by the scavenges. - Regular disposal of solid waste should be ensured with Point Pedro Urban council. - Fish waste should be properly collected and removed on daily basis to avoid the emission of bad odor. - The harbor management should ensure no waste are disposed in the sea or coastal area					
Biological (flora and fauna) marine resource assessments and impacts associated with the fisheries harbors fishing operations.	Degradation of environment, resulting in reduction in natural recruitment of sessile flora and fauna on new fisheries harbor structures leading to reduced biodiversity. Impacts on fishers productive and livelihoods.	- Undertake annual marine benthic flora and fauna assessment of the environment associated with the fisheries harbor and adjacent biological communities to document time series data on the status of the marine environment associated with the fisheries harbor. Specific information pertaining to recovery, recolonization of key coral reef benthic habitats and species. - - Undertake periodic in water inspections of the fisheries harbor facilities for invasive and alien species and instigate a proactive management and eradication program, if located. - Implement a waste management plan to reduce pollution entering the marine environment. - Implement safety protocols to avoid or minimize risk of vessels grounding or colliding and subsequent petrochemical spills within the fisheries harbor. - Continue fisheries harbor users (fishers) awareness and education to improve environmental conditions of the fisheries harbor above and below water.	fisheries harbor operator, marine scientist and/or maintenance contractor.	Internal fisheries harbors operational and maintenance costs.	Benthic assessments produced and compared to time series of data. fisheries harbors operations manual; Invasive and alien species identified and eradicated if required. Catch and income data reviewed.	Annual investigation	CFHC
		-					
Biological	Degradation of	- The restoration and replanting of native trees and	fisheries harbor	Interna	Trees and	When	CFHC

IMPACT MITIGATION				IMPACT MONITORING			
Environmental Impacts		**Mitigation Measures**	**Mitigation Responsibility**	**Mitigation costs ($US)**	**Parameter to be monitored**	**Frequency & means of Verification**	**Monitoring Responsibility**
terrestrial resource impacts associated with the fisheries harbor operations.	environment and loss of natural biodiversity.	other vegetation where appropriate to increase foreshore natural beach soil protection and the aesthetic of the fisheries harbor facility providing habitat shelter for terrestrial fauna, potentially roosting sites for sea and shore birds.	operator, fishers and/or maintenance contractor.	l fisheries harbors operational and maintenance costs	vegetation replanted where required.	required	
Management of fisheries harbor's operational dust and noise.	Impact on air quality. Emissions of exhaust from boats, vehicles and machinery detrimental effects to the fisheries harbors environment.	Implement good house-keeping measures as part of fisheries harbor operational management plan, including provision of: ➢ awareness to all users on noise and dust management and prevention; ➢ PPE supplied to all staff, especially noise reducing equipment; ➢ Consideration of wetting of roads and port surfaces during period of high dust production to reduce suspension; ➢ Ensure maintenance programs for all fisheries harbor vehicles and machinery are undertaken ensure noise reducing requirements are regular maintained; and ➢ Encourage through awareness and support fishers to improve their environmental footprint in terms of waste production and its sustainable management.	fisheries harbor operator, and fishers	Internal fisheries harbors operational and maintenance costs.	fisheries harbors operations manual; Levels of dust throughout site and noise levels – self compliance of fisheries harbor users to noise requirements.	When required – compliance should reduce potential issues.	CFHC
Community perception.	Support and compliance of all users of the fisheries harbor and surround community**.**	➢ Provide continued awareness and information exchange with the public on all aspects of the fisheries harbor and ensure all management activities undertaken to preserve and enhance the marine and terrestrial environment and resources are fully disclosed and acknowledge by the community.	fisheries harbor Operators and fishers. ADB (post evaluation period).	Construction costs.	Compliance register	Post Construction completion report.	PIU/PMU ADB
Harbor OH&S.	Safety at work for all workers	- Inclusion of OH&S requirements in fisheries harbor operations manual including:	fisheries harbor Operators,	Construction	fisheries harbor	Post Construction	PIU/PMU ADB

IMPACT MITIGATION				IMPACT MONITORING			
Environmental Impacts		**Mitigation Measures**	**Mitigation Responsibility**	**Mitigation costs ($US)**	**Parameter to be monitored**	**Frequency & means of Verification**	**Monitoring Responsibility**
	and associated with operation	- Allocation of responsibility for safety inspections to staff and awareness to fishers; - Training staff on safety precautions and for implementing emergency procedures; - Provision of PPE clothing and equipment to workers as appropriate; - Ensuring that vehicle and equipment operators are properly licensed and trained; - Arranging for provision of first aid facilities; - Emergency response and evacuation procedures for manmade and natural disasters (e.g. Oil spill, cyclones, tsunamis); - Provision for regular safety checks of vehicles and material; - Provision of hazard warning signs at the all construction sites. - Recommendation for the fisheries harbors administration to maintain a register of accidents detailing date, circumstances, severity, action taken and outcomes. - Ensure correct OH&S procedures developed and implemented during the operational phase, specifically including the maintenance and future repair activities of the fisheries harbors equipment and infrastructures. - Maintenance schedule is defined and costed to adequately cover the cost of maintenance is secured prior to the operation phase. Maintenance schedule should at least cover the operation life of the equipment.	fishers compliance ADB (post evaluation period).	cost.	operation manual including OH&S. PPE provided and used by staff. Training sessions documented.	Completion report - once only.	

Note: CEA – Central Environmental Authority, CEMP- Construction Environmental Management Plan,EMP- Environmental Management Plan, EMO- Environmental Monitoring officer, HSMP- Health and Safety management Plan, HSO- Health and Safety officer, OH&S – Occupational Hygiene and Safety, IEE – Initial Environmental Examination Report, MEPA- Marine Environmental Pollution Prevention Authority, MFAR – Ministry of Fisheries and Aquatic Resources NWS&DB – National water Supply and Drainage Board, PMU – Project Management Unit, PIU- Project Implementation Unit, HSP – Health and Safety Plan, GRM – Grievances Redress Mechanism, BOQ- Bill of Quantity, PFHDP- Pesalai Fisheries Harbor Development

Table 7-2 : Environmental Monitoring Plan

Pre-construction & Construction Stage - Output 1: Point Pedro Fishery harbor

Environmental Aspect	Monitoring Parameter	Applicable Standard	Monitoring Method	Monitoring Locations	Monitoring Frequency	Monitoring Responsibility	Cost (Rs)
Marine Water quality	All parameter as in the **Table 7-6**	Proposed ambient water quality (Marine waters)	Sample collected and analyzed by approved laboratory	Sampling location WS4 and WS5 – **Figure 7-1**	Once before the commencement of construction	PIU	30,000 x 5 =130,000
	Basic Parameters pH, Turbidity, DO, salinity, TDS, TSS,	Proposed ambient water quality (Marine waters)	Sample collected and analyzed by approved laboratory or trained Environmental officer	All location indicated in the **Figure 7-1**	Monthly during construction- Using portable water quality testing meter	PIU	250,000[13],
	All parameters as in the **Table 7-6**	Proposed ambient water quality (Marine waters)	Sample collected and analyzed by approved laboratory	All locations as in **Figure 7-1**	Once in six months	PIU	30,000X8X5= 1,200,000

[13] Cost of portable meter

Environmental Aspect	Monitoring Parameter	Applicable Standard	Monitoring Method	Monitoring Locations	Monitoring Frequency	Monitoring Responsibility	Cost (Rs)
Quality of harbor basin sediments	Particle size, pH, color, smell, oil and grease, organic materials, organic Nitrogen, Phosphorus, Sulphide, heavy metals, pesticides and toxic components etc.	-	Sample collected and analyzed by approved laboratory	3 locations at the harbor basin	Once before construction	CC	50,000X3= 150,000
Inland surface and groundwater quality	pH, Temp, Conductivity, DO, BOD, Ammonia, Nitrates, Iron, PO4, TSS, Fecal Coliform, Total Coliform;	Proposed ambient water quality (surface water); Drinking water quality	Sample collected and analyzed by approved laboratory	5 locations (surface water and wells) as given in the **Figure 7-2**	Quarterly to cover dry and wet seasons	CC	30,000X5 X16=2,400,000
Air quality (Dust)	Fugitive dust6.	Fugitive Dust Emission standards	Gravimetric Method	5 locations as in the **Figure 7-3**	Once a month	CC	20,000 x 5 x 48 =4,800,000
Ambient Air quality	PM10, PM2.5, NO_2, SO_2, O_3 and CO	The National Environmental (Ambient Air Quality) Regulations	Sampled and analyzed by approved laboratory	5 Locations as in the **Figure 7-3**	Quarterly	CC	25,000 x5 x16 = 2,000,000
Noise	Day and night time ambient noise dB(A) LAeq	The National Environmental (Noise Control) Regulations No.1 1996	Portable noise meter (range 0-120 dB(A))	4 locations as in the **Figure 7-4**	Quarterly	CC	25,000 x 4x 16 = 1,600,000

Environmental Aspect	Monitoring Parameter	Applicable Standard	Monitoring Method	Monitoring Locations	Monitoring Frequency	Monitoring Responsibility	Cost (Rs)
Vibration	Vibration levels	Proposed Air-Blast Over Pressure and Ground Vibration Standards for Sri Lanka published by CEA	Portable vibration meter. 4 hour recording period at each site	4 locations as in the **Figure 7-4**	Baseline survey pre-construction;	CC	25,000x4 = 100,000
		Proposed Air-Blast Over Pressure and Ground Vibration Standards for Sri Lanka published by CEA	Portable vibration meter. 4 hour recording period at each site	4 locations as in the **Figure 7-4**	Quarterly;	CC	25,000 x 4 x16= 16,000,000
		Blast Over Pressure and Ground Vibration Standards for Sri Lanka published by CEA	Portable vibration meter.	4 locations as in the **Figure 7-4**	Once as blast test (rock blasting) to determine the Blasting pattern	CC	25,000 x4 =100,000
		Blast Over Pressure and Ground Vibration Standards for Sri Lanka published by CEA	Portable vibration meter.	4 locations as in the **Figure 7-4**	During the blasting operation. Once in three months	CC	25,000 x4X4[14] = 400,000
Crack survey	Cracks and other structural weakness	Any changes causing	Take measurements	At-risk buildings and structures as	Baseline survey pre-construction	CC	200,000

[14] Considering that the blasting operation will exist one year only.

Environmental Aspect	Monitoring Parameter	Applicable Standard	Monitoring Method	Monitoring Locations	Monitoring Frequency	Monitoring Responsibility	Cost (Rs)
	of at risk buildings	structural weakness or risk since baseline pre-construction records	and photographic records. Number all defects	identified from field observations; and any locations from which there are complaints;	During / after construction on complaints	CC	

CC = Construction Contractor.

Table 7-3 : EMP Operation Stage - Output 1: Point Pedro Fishery harbor

Environmental Aspect	Monitoring Parameter	Applicable Standard	Monitoring Method	Monitoring Locations	Monitoring Frequency	Monitoring Responsibility	Cost (Rs.)
Marine Water quality	pH, Turbidity, DO, salinity, TDS, TSS, oil & grease, Total Organic Carbon, `nutrients, heavy metals, pesticides, coliform etc	Proposed ambient water quality (Marine waters)	Sample collected and analyzed by approved laboratory	08 at harbor basin (04 at site; 02 at 25 m from site; 02 at 100 m from site)	Twice; During maintenance dredging	CFHC	30,000 x 4 x= 240,000
Quality of harbor basin sediments	Particle size, pH, color, smell, oil and grease, organic materials, organic Nitrogen, Phosphorus, Sulphide, heavy metals, pesticides and toxic components etc.	-	Sample collected and analyzed by approved laboratory	4 locations At the harbor basin	Before maintenance dredging	CFHC	50,000 x4= 200,000
Air quality	NO_2, SO_2, O_3 and CO;	Natural baseline levels recorded before construction	Sampled and analyzed by approved laboratory	4 Locations as in annex 4	Once a year	CFHC	4 x 25,000 =100,000

Environmental Aspect	Monitoring Parameter	Applicable Standard	Monitoring Method	Monitoring Locations	Monitoring Frequency	Monitoring Responsibility	Cost (Rs.)
		begins and The National Environmental (Ambient Air Quality) Regulations					
Noise	Day and night time ambient noise dB(A) LAeq	The National Environmental (Noise Control) Regulations No.1 1996	Portable noise meter (range 0-120 dB(A))	5 locations - 02 access road, 03 nearby residencies	Once a year	CFHC	25,000x 5 =125,000

Table 7-4 : Cost the Environmental Monitoring

Pre-construction and Construction Stage

S.No	Test	No of tests	Total No. of tests	Rate	Total
1	Sea water Analysis all parameters	5	5	30,000	150,000
2	Sea water Analysis Basic parameters	1	1	250,000	250,000
3	Sea water Analysis all parameters	8X5	40	30,000	1,200,000
4	Quality of harbor basin sediments	3	3	50,000	150,000
5	Inland surface and groundwater quality	5X16	80	30,000	2,400,000
6	Air quality (Dust)	5X48	240	20,000	4,800,000
7	Ambient Air quality	5X16	80	25,000	2,000,000
8	Noise	4X16	64	25,000	1,600,000
9	Vibration (baseline survey pre construction)	4	4	25,000	100,000
10	Vibration (Quarterly)	4X16	64	25,000	1,600,000
11	Vibration (rock Blasting)	4	4	25,000	100,000
12	Vibration (during blasting operation)	4X42	168	25,000	4,200,000
13	Crack Survey		1	200,000	200,000
	Total				**18,750,000**
Operation Stage					
1	Marine Water quality	4X2	8	30,000	240,000
2	Quality of harbor basin sediments	4	4	50,000	200,000
3	Air quality	4	4	25,000	100,000
4	Noise	5	5	25,000	125,000
	Total				**665,000**
Total cost for Construction and operation stage					**19,415,000**

Table 7-5 : Parameters to be tested for sea water

No.	Parameters		Unit
1	Color (Spectral Absorption coefficient)	Yellow ($36 nm)	m^{-1}
		Red (525 nm)	m^{-1}
		Blue (620 nm)	m^{-1}
2	pH Value at 30^0C		-
3	Temperature		^0C
4	Total Kjedhal Nitrogen (as N)		mg/1
5	Ammonical Nitrogen (as N)		mg/1
6	Chemical Oxygen Demand (COD)		mg/1
7	Biological Oxygen Demand (BOD) @ 20^0C		mg/1
8	Total Suspended solids (TSS)		mg/1
9	Sulphide (as S)		mg/1
10	Fluoride (as F)		mg/1
11	Total residual Chlorine		mg/1
12	Oil and Grease		mg/1
13	Dissolved Phosphate (as P)		mg/1
14	Arsenic (as A)		mg/1
15	Copper (as Cu)		mg/1
16	Iron (as Fe)		mg/1
17	Nickel (as Ni)		mg/1
18	Cadmium (as Cd)		mg/1
19	Total Chromium (as Cr)		mg/1
20	Lead (as Pb)		mg/1
21	Mercury (as Hg)		mg/1
22	Zinc (as Zn)		mg/1
23	Selenium (as Se)		mg/1
24	Cyanide (as CN)		mg/1
25	Hexavalent Chromium (as Cr^{6+})		mg/1

Figure 7-1: Sampling Locations for Sea water analysis

Figure 7-2: Well water sampling Locations

Figure 7-3: Sampling Locations for ambient air quality

Figure 7-4: Sampling Location for Noise Measurements

8 CONCLUSIONS

561. **Project benefits.** The proposed development of the PPFHDP through the scope of works will result in the construction of a safe and fully functioning marine fisheries boat harbor for the inshore and offshore fishers utilizing the waters in the north of Sri Lanka. This development will substantially increase the safety, efficiency and economic productive of these fishers by providing a safe and fully functional harbor that includes needed fishery land-based infrastructure amenities. It demonstrates suitable and appropriate infrastructure directly to the fishers, communities and business operators whilst ensuring the regions infrastructure is enhanced. The new infrastructure will be designed to be climate resilient and includes climate change adaptation features that contribute to the sustainability of the project. The adaptation measures will also be climate proofed by increasing the design heights of the breakwater, wharf, and foreshore fisheries harbor buildings to accommodate the projected rise in sea levels and increasing severity and frequency of waves.

562. **Findings.** In summary, the IEE concludes that there are no identifiable significant environmental impacts, no critically sensitive marine or terrestrial environmental habitats or species nor is the project deemed environmentally sensitive. The works will have a limited and distinct footprint and is an enlargement of an existing fisheries harbor and harbor complex. When completed the project will result in an improved environment associated with the fisheries harbor (significant improvements to the current land-based infrastructure and machinery), significantly improve safety and boat operational requirements and a marked improvement in the efficiencies of the local and national fishers working in the northern waters of the nation. The key findings include:

- The project is located in an area that has had a fisheries jetty and has operated as a landings site for well over a century and, as such, the terrestrial and shallow marine areas have been highly modified (cleared, filled, built on) and does not support any terrestrial ecological or biological (flora or fauna), endemic, endangered or significant biodiversity.
- The fisheries harbor landward site does not have any freshwater (rivers, streams), forests or agriculture.
- The project includes the coastal foreshore, inter-tidal reef flat and sub-tidal reef systems. The coastal foreshore and inter-tidal reef flat areas have been highly modified (dredged, built on, rock walls) whilst the sub-tidal shallow water reef areas have been impacted by fishing activities resulting in the degradation of benthic habitat and the removal of sessile benthic marine resources.
- The inter-tidal reef flat ecosystem associated with the project does not support any marine shallow water ecological or biological (flora or fauna) endemic, endangered or significant biodiversity. Hard-coral abundance is very low and, as such, the proposed reclamation program and adjacent area of influence to the west and east have negligible impact on marine benthic resources.
- The subtidal reef edge and slope ecosystem associated with the project does not support any marine shallow water ecological or biological (flora or fauna) endemic, endangered or significant biodiversity. Hard-coral coverage and biodiversity in the region also shows very low levels of coverage and species diversity.
- The hard reef terminates between 6-8 meter water depth at the base of the reef slope where the substrate is exclusively dominated by surface layers of sand (between 1- 2.5 m thick), which rest on a hard-coralline base layer of rock. This area is almost devoid of sessile marine organisms, therefore, this area does not support any marine shallow

water ecological or biological (flora or fauna) endemic, endangered or significant biodiversity.

- The proposed site includes a small area of land that is dominated by foreshore sand beach and remnant beach sand dunes that supports a low terrestrial footprint of vegetation. All vegetation located in this area is non-endemic is approximately 50 % native species and the dominate tree species is the coconut tree. A number of coconut trees may be required to be removed for the projects land-based infrastructure improvements. However, a reduction in the trees to be removed is expected during the construction phases when the decision on the areas landscape, including trees is finalized.
- Two near threatened plant species (*Sesuvium portulacastrum* (Vankiruvilai) and *Trianthema decandra* (Mahasarana) were located within the Project Area, however they will not be directly impacted by the projects scope of works. These species are reported to be reasonably abundant in similar habitats within the Jaffna area. If the individual plants are to be impacted they will be removed alive and transplanted and, as such, no detrimental impacts will result.
- Terrestrial fauna recorded within the Project Area was all but absent. Therefore, no endemic, endangered or significant biodiversity recorded.
- The critically endangered land snail, *Trachia fallaciosa,* was recorded within the projects influenced area and, as such, will not be impacted by the projects scope of works. This species population numbers varies considerably annually, with high numbers recorded throughout Point Pedro and the Northern Province during the wet season.
- Impacts on the terrestrial and shallow water marine ecosystems and their environments resulting from the projects construction activities are expected to be minor and manageable.
- Impacts on the environment associated with the construction of the projects two breakwaters and sub-tidal sand dredging and associated subsurface rock reclamation will be relatively short lived. Sedimentation resulting from these activities will have a low impact on the marine fauna and flora due to the scarcity of resources located within and adjacent to the projects the area of influence, the inclusion of sedimentation mitigation measures and the constant movement of sea water throughout the area (tidal currents and oceanic waves).
- The project site does not impact any terrestrial or marine conservation and/or protected area/s, sites of cultural, customary or heritage significance nor any national or international endangered or protected species.
- Due diligence and proactive management of all pre-construction, construction and operational activities will ensure limited disturbance to the daily business activities undertaken within the fisheries harbor and surrounding business and community activities.
- Sri Lankan laws and regulations associated with labor, employment, OH&S will be complied with throughout pre-construction and construction and monitored by the PIMU.

563. **Conclusions.** The IEE concludes that there were no identifiable significant environmental impacts, no critical important terrestrial or marine habitats impacts. All impacts are site specific, irreversible and can be minimized through appropriate mitigation measures. Impacts arising from the projects construction phase, including the two breakwaters and reclamation of the shallow water reef flat and subsequent adjacent substrate dredging program (deepens the harbor and uses the material for project fill), and associated machinery and operational phases of the project are minor, localized, and acceptable, provided the mitigations

measures set out in the outline EMP are further elaborated by the contractor and implemented, and monitored properly.

564. The pre-construction, construction and operational EMP identifies potential environmental impacts arising from the project along with a corresponding schedule and monitoring of mitigation measures to ensure potential impacts are maintained at insignificant levels. It also includes the institutional arrangements for implementing and monitoring the EMP to ensure its effectiveness.

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