Terms of Reference (TOR) of Environmental Impact Assessment (EIA) study for the Global Oil Terminal in Lauhata, Liquica with the Capacity of 10,000 m^3.

Prepared by PEC – Consulting, LDA

For Global Oil Terminal, LDA

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1. Introduction

The purpose of this Terms of Reference (ToR) is to define the scope of the Environmental Impact Assessment (EIA) for the fuel storage terminal, which will be constructed in Lauhata area, Liquica, Timor Leste. Per the approved Project Document (PD) by the National Petroleum and Mineral Authority (ANPM – Portuguese acronym), this proposed development is a Category A project, meaning that the project has a potential to generate significant impacts to the environment.

As such, a full scale EIA would be required to properly assess major impacts during the pre-construction, construction, operation and maintenance as well as decommissioning stages of the development. The EIA will incorporate the establishment of the baseline environmental parameters which will become a base for the analysis of impacts. The EIA process will result in the formulation of the Environmental Impact Statement (EIS) and the Environmental Management Plan (EMP) for the purpose avoiding, mitigating or offsetting potential environmental impacts identified during the EIA.

2. Background Information

The proposed development project is a private investment from the Global Oil Company (Project Proponent) to seize business opportunity in fuel importing, storing, and distribution in the growing or emerging economy of Timor Leste. The Project Proponent has been in operation in Timor Leste since 2014, therefore, is very familiar with business opportunities and challenges in the sector. According to its business plan, demand for fuel in the near future will grow proportionally to the economic growth of the country, which is estimated at 3.9 % in 2019 (World Bank Report, as of April 2019- Timor –Leste Economic Report).

The objective of the project, is to construct the fuel storage yard in the designated area in Liquica, that will be fed by fuel tanker, that come every twice a month. Oil from the tanker will be fed into the storage via existing jetty. Compared to similar projects already in the operation, for example tank farm owned by Esperanca Timor Oan (ETO) in Hera and tank farm owned Pertamina International Timor, S.A (PITSA), in Pantai Kelapa in Dili, the proposed scale of the development would be considered large or may be largest scale of the fuel storage in term of the capacity of the fuel storage tank, at total cumulative volume of 10,000 KL. With this large scale of the fuel that will be handled by this proposed facility, the environmental, health, and safety impacts generated by this project, particularly during the operation of the facility would be significant.

Table 2.1 Comparison of Similar Project Scale in Timor - Leste

Company	Total Volume of Storage, KL
ETO	6,600
PERTAMINA International Timor, SA (PITSA)	5,200
This Project – Global Fuel	10,000

Timor Leste is currently developing rapidly as the Government is investing heavily in the infrastructure sector to realize the country's vision of joining the ranks of upper middle income country by 2030. Infrastructure development is also driving demand for fuel for use in the heavy machinery. Additionally, the company is also catering to fuel stations throughout the country. The proposed development project is the type of productive investment from the private sector; that the government of Timor Leste should support in creating the support facility for Timor Leste economy to continue growing. In terms of economy, the country is heavily dependent on revenue from the oil and gas sectors which may present a problem in the future, as the oil and gas resources are non-renewable resources. Moreover, above 90% of the real expenditure in Timor Leste has come from Government general budget, as the private sectors investment is still limited compared to the government. Timor – Leste needs private sector participation in the development of a sustainable economy to invest in a more productive economy by taking advantage of the basic infrastructure that government has been focusing on. Moreover, Timor – Leste is also facing unemployment issues from the higher percentage of youth that every year graduates from the universities and other training school. This project will create direct employment to the young people to work as part of operators of the facility. Indirect positive impacts of the project to the Timor – Leste economy will also be significant, as the presence of the project will create other economic opportunities in local community as well as the national level.

However, the presence of this type of large scale project is subject to higher risk in terms of environmental, health, and social aspects that should be managed well in order to realize the objective of the project in achieving sustainable operation, which means also cost-savings and healthy profit margin. Therefore, proper assessment of risks and impacts must be conducted by project proponent at an early stage of project development prior to the construction of the project. When risks and impacts have been assessed and proper management/mitigation plans proposed, operation costs shall be able to be maintained at reasonable level. Moreover, the Government of Timor – Leste, through the Decree Law 5/2011, has made it mandatory for every major project to have environmental license prior to the commencement of project. By having proper risk and impact assessment as part of the environmental impact assessment, it shall also be easier for Government agencies, as regulatory body to monitor project implementation and ensure that the project brings more benefit than risks to the society, local community, and the national government.

The environmental impact assessment will be conducted throughout project implementation cycle from design and construction to operation and maintenance, which covers the entire component of the projects. A major component of the project is the construction of large scale fuel storage in the designated area in Liquica. This storage will be fed by fuel tanker that will come twice a month. Transfer of fuel from the tanker to the storage will be done via pipeline supported by an existing jetty located approximately 300m west from the project. Planned total capacity of the storage complex will be 10,000 KL.

Besides the storage tank, there are various supporting facilities that need to be constructed as an integral part of the project to support sustainable operation and maintenance of the project for longer time. These supporting facility include:

- River crossing bridge
- Office spaces
- Loading bay

- Backup power system
- Fire safety management system
- Emergency response system or equipment
- Piping system from Jetty to the storage tanks and from storage tanks to the loading bay for uploading into the tanker trucks
- Water supply for office and firefighting purposes
- Pump room
- Other small items such as security port, parking space

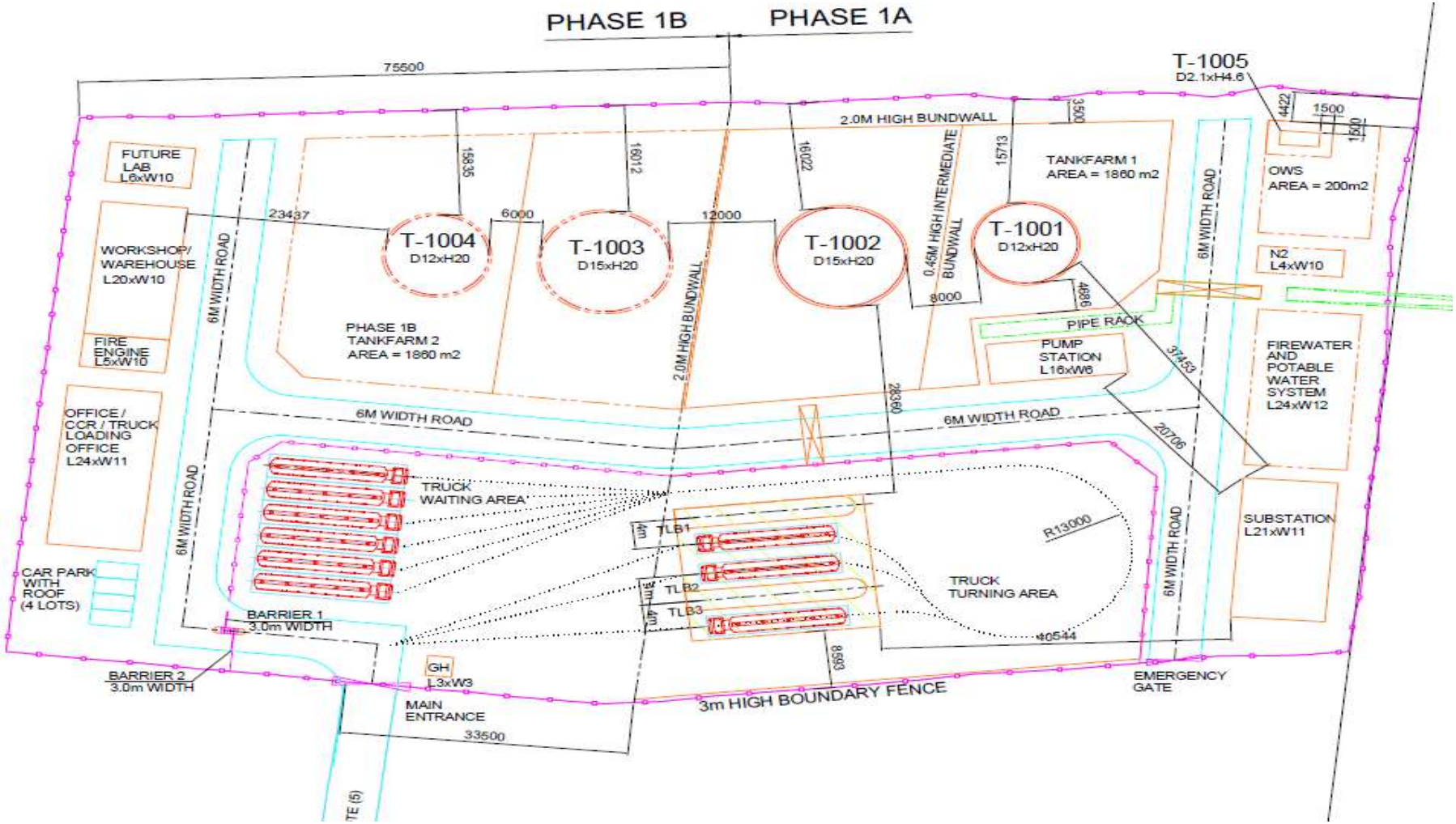
Other essential facility, the oil tanker, shall feed the fuel storage terminal, which the Jetty with the maximum capacity of 20,000 DWT (Dead Weight Tonnage), the project owner will utilized the existing one, which has already constructed by Timor Cement, SA. The internal arrangement between Global Fuel Terminal LDA and Timor Cement has already negotiated regarding the condition including the rental fee of the jetty. The following figure presents the concept layout on the major components of the project (Figure 2.1).

In addition to the fuel storage and supporting facilities, the proposed development project will also consider other requirement facilities to support the operation in meeting the requirements for environmental, health and safety. These facilities include:

- Drainage system to convey storm water runoff within the facility to the oil-water separator
- Oil-water separator to separate the oil and water from the runoff
- Drainage outlet to discharge the runoff (after oil has been separated)

Further detail in each major component of the project is presented in Section 7.1.

Figure 2.1 Site Lay Out



3. Detail of Project Proponent

Global Oil Storage Oil Terminal, Lda is a Timor Leste registered company. It is a part of the Global Group with operations in Singapore, Greater China, Indonesia, and Myanmar. They are involved in the oil and gas industry as well as in infrastructure development.

In Timor Leste, the group (Petroleum Division) is involved in downstream petroleum business that imports and provides wholesale fuel supplies to construction companies and petrol stations. The company owns downstream supply chain from cargo procurement, quality control and logistic deployment.

Since 2014 until today, Global Group has hired and trained local labors into qualified officers in the business of petroleum trading. Since then, several have risen through the ranks to become trusted partners of its operation in Timor Leste.

3.1 Contact Information

The project is proposed by Global Oil Storage Terminal, Lda. The company's contact detail is provided as follows:

Mr Kelvin Lim Project Manager
Tel: +670 7706 0008 Email:
Kelvin.lim@globalsgp.com

Project Manager (FEED Design)
Mr. Bani
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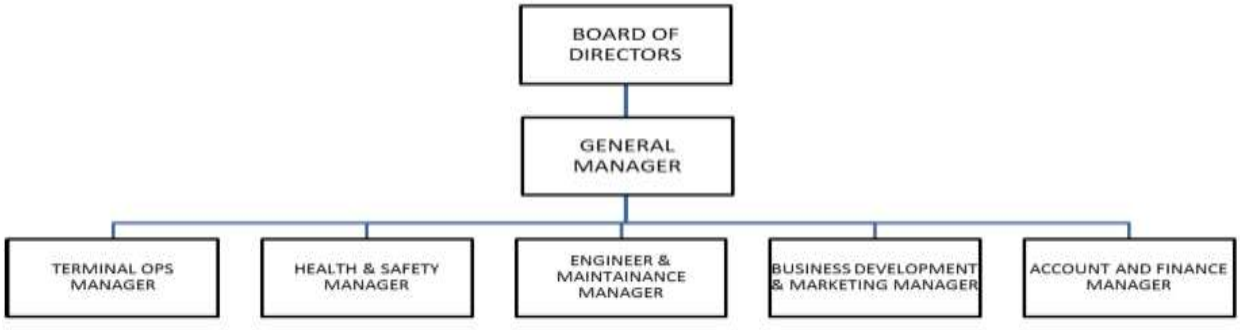
Tel: +670 7728 6603 2)

Ms. Maria Elizabeth (Project Secretary)
+670 77663574

3.2 Management Structure

The following is the general management structure of the company.

Figure 3.1 Management Structure of Global Oil Storage Terminal Company



A more detailed management structure that incorporates sub-divisions under each divisions will be provided in the complete EIS.

4. Detail of EIA Consultant

The EIA will be carried out by PEC Consulting, Lda., a Timorese-owned planning and engineering consulting company headquartered in Dili. PEC Consulting is headed by Sr. Krispin Fernandes, PhD., who has qualifications in chemical engineering, hydrology and environmental planning and engineering. PEC Consulting has experience in Timor Leste in the area of environmental and planning for projects including - irrigation infrastructure, water supply infrastructure, drainage infrastructure, fuel storage terminal and environmental impact assessment for the purpose of environmental licensing according to Timor Leste regulatory framework.

Staff involved in the environmental assessment work are listed in the following table.

Table 4.1 PEC Consulting Staff and Other Experts Involved in the Development

No	Staff	Expertise
1	Sr. Krispin Fernandes, PhD	Mr. Fernandes has more than 15-years of experience in environmental engineering, process engineering, and wastewater treatment and disposal into the deep ocean through a marine outfall. He has undergraduate degree in Chemical Engineering, hence is qualified to understand the manufacturing processes involved in beer production, petrochemical, food, and other types of process engineering.
2	Sr. Mario Marques Cabral, S.Si,	Mr. Marques Cabral has more than 15-years of professional experience in marine biology and fishery assessment including assessment of socio-economic characteristics of coastal community. He is a marine ecological specialist for PEC Consulting and has involved in most of

	M.Sc	the projects under PEC management.
3	Sr. Vincencio dos Santos, SE	Trained Economist and social impacts assessment specialist. Mr. dos Santos has three years of experience in data collection and analysis of social and economic profiles of local communities.
4	Sra. Rosalyn Fernandes, S.T. MURP	Rosalyn has substantial professional experience in delivering small to large scale environmental impacts assessment documents, including for fuel storage development, University Campus development, Sanitation Improvement Schemes, and others. She has recently finalized a task as senior environmental specialist who writes the environmental assessment reports for ADB loan funded road project.
6	Sr. Venancio Rego Fernandes, S.T.	Trained in Industrial Engineering, Venancio has experience working as plant engineer in major manufacturing establishment in Indonesia, environmental officer and recently as a project engineer for stream flow and meteorology study in Timor Leste.
	OTHER SPECIALISTS	
8	Dr. Mont KaniaDewi, S.T., M.T.	Head of Air Quality Laboratory,Faculty of Civil and Environmental Engineering, Bandung Institute of Technology (ITB – Indonesian acronym). Mrs. Kania, is responsible in providing observation data on air quality baseline.
9	Muslim Muin, PhD	Ocean Hydrodynamic and Oil Spill Expert, Bandung Institute of Technology (ITB), Indonesia. His involvement will be focused on oil spill analysis and modeling in the Jetty or from leaking in the storage facility that eventually polluted the marine water body.
10	Ir. M. Taufik Hizbul Haq, MS	Marine Coastal Ecological Specialist, University of Diponegoro (Undip-Indonesian acronym), Indonesia. His involvement will be conducting underwater survey for marine resource identification in the coastal area and particularly related to the fish, coral, and marine habitat, which will be affected by the project in case of oil pollution due to spill.
11	Ir. Amirundin, MsC	Marine and Terrestrial Biology, University of Diponegoro, Indonesia. His involvement will include coastal terrestrial biological identification that will be impacted by the construction and operation of fuel storage facility.

PEC Consulting has a vision to support sustainable infrastructure development in Timor Leste through proper planning and engineering designs that also adhere to the social and environmental safeguarding principals.

The areas of specialties of PEC Consulting include:

- Hydrologic and hydraulic analysis for various infrastructure development
- Environmental Impacts Assessment (EIA) and Licensing for various infrastructure projects
- Survey - topographic and bathymetric data collection
- River flow estimation and catchment Analysis
- Hydro-meteorological data collection

A complete resume of the above specialists will be provided in the complete EIS.

5. Legal Framework

The government of Timor – Leste has established a set of laws for the protection of the environment, facility workers and the general public from negative impacts of large scale fuel storage development. Relevant legislations to the proposed development are as noted in the following table.

Table 5.1 Summary of Relevant Laws in Timor – Leste that relevant to the proposed Project

Agency	Relevant Laws
Ministry of Tourism, Commerce, Industry, and Environment	Decree Law No.5/2011
	Decree Law No. 26/2012 on Environmental Base Law
	Law on Biodiversity (March 2012)
Ministry of Agriculture and Fisheries (MAF)	Decree Law 5/2016 on Protected Area
	Law No.6/2004 on Legal Basis for Management and Regulation of Fisheries and Aquaculture Law No. 12/2004 on Crimes Related to Fisheries
National Petroleum and Mineral Authority	• ANPM Decree – Law No. 1/2012 on the Downstream sectors • ANPM Regulation no.2/2014, of 24, October 2014, first amendment of ANP regulation No. 1/2012 on Administrative Procedures, Requirements, and Fees for Granting, Renewal and Modification of Downstream Activities' License • ANPM Regulation no.3/2014, of 24, October 2014, first amendment of ANP regulation No. 1/2013 Installation and operation of Fuel filling Station • ANPM Regulation No. 1/2016, March 2, 2016, on Installation and Operation of Fuel Storage Facilities • ANPM Regulation No. 1/2017 (First Amendment of ANPM Regulation No. 1/2016) Review of the following diploma ministerial will be provided: • DM No. 44/2017 • DM No. 45/2017 • DM No. 46/2017 • DM No. 47/2017
Ministry of Health	Decree law 5/2009 related to drinking water quality and distribution Decree Law No. 33 /2008: Public Hygiene

Ministry of Finance	• Taxation system : Law 8/2008 – tax and duties • Business registration : DL 4/2011
SEFOPE	Labor law and Code: Law 4/2012
Trade Invest	Investment law : Law 15/2017
Civil Defense	Civil Protection: Law 2/2010

More detailed review and description of the above listed legal frameworks will be presented in the EIS and EMP report. Besides the national legal framework, other international best practices or standards should be adopted in the absence of the national standards.

- Air emission quality standard
- Noise and vibration
- Marine water quality standards
- Hazardous material management standard

Table . Applicable International Standards in Absence of Timor Leste's Standards

Environmental Standard	TL National Standard	International Standard
Drinking Water Quality Standards	Adopted WHO standards	WHOs
Waste water effluent	None	WHO/USEPA
Ambient Air Quality Standards	None	IFC/WHO
Heavy Metal Standards	None	WHO
Noise	Leq55dB(A) per UNTAET Regulation	World Bank
Vibration	None	USEPA
Soil	None	IFC/World Bank
Ambient receiving water quality standard		IFC/WHO
OHS	None	IFC/ISO - 81001

Regulatory framework for the above has not been established for Timor Leste. In absence of national standards, international standards shall be adopted. In addition to the above legal framework (national and international), project development should also consider and comply with relevant international best

practice to meet the objective of the environmental, health, safety, and social safeguard principles. Relevant international standards and Best Practices are identified below:

1. World Bank Environmental Health and Safety General Guidelines - EHS Guidelines for Ports, Harbor, and Fuel Terminal
2. Stakeholder Engagement: A Good Practice Handbook for Companies Doing Business in Emerging Market
3. IFC Performance Standards.

Of particular importance is Performance Standards (PS) adopted by the International Finance Corporation (IFC). The relevancy of the IFC performance standards is summarized in the following table.

Table 5.2 IFC Performance and Relevancy to the Proposed Project

IFC Performance Standards	Relevancy to Proposed Development
IFC PS I: Assessment and Management of Environmental and Social Risks and Impacts	The environmental and social impacts assessment will be conducted as part of the study in this project. All the relevant standards (environmental and social indicators) will be considered and follow in order to ensure sustainability of the project within the environmental and social safeguard policy
IFC PS II: Labor and Working Condition	The Plan and design of the system will considered a good working condition to ensure the safety of , construction and operation within the proper occupational health and safety (OHS) standard
IFC PS III: Resource Efficiency and Pollution Prevention	Resource efficiency should be considered
IFC PS IV: Community, Health, Safety and Security	Community health and safety related to the spill, fire, and major emergency situation should be considered and anticipated
IFC PS V: Land Acquisition and Involuntary Resettlement	Several houses should be relocated and compensate as, they are very close the project area and could be affected by the project, especially in case of emergency condition
IFC PS VI: Biodiversity conservation and Sustainable management of living natural resource	Marine ecosystem as a primary recipient of the pollutant if released by the project. Therefore, study and identification of biodiversity in marine aquatic environment will be a major part of the study to provide comprehensive information on the status of marine environment as baseline information for future reference. The mitigation measure on managing the pollutant and prevention will be key to help reduce the risks in order to achieve sustainable operation and keep natural ability of ecosystem to recover from pollutants.
IFC PS VII: Indigenous people	Local people in Lauhata should be well consulted and be beneficiaries of appropriate jobs created in the development.
IFC PS VIII: Cultural Heritage	Aipelo Prison preservation and protection from impacts to the proposed development project.

Furthermore, the proposed development also has very high risk from fire accident. Therefore, Best Industry Practice would be considered in designing the system. The following standards of the designing the fuel storage and its' fire management plan shall be considered.

Table 5.3 Industry Standard to be considered

No	Design Component	Common Practice	Review
1	Storage Tank Design and specification	API 650 and 620	Standard design and material selection for fuel storage system
2	Fire Management System	NFPA330	Standard Guideline to the fire safety concept of the flammable liquid storage
3	Electrical Installation code and standard	NFPA 70	Provide a guideline on the electrical installation system
4	Standard for low, medium, and high expansion foam	NFPA 11	This standard is intended for the use and guidance of those responsible for designing, installing, testing, inspecting, approving, listing, operating, or maintaining fixed, semi-fixed, or portable low-, medium-, and high expansion, and compressed air foam fire-extinguishing systems for interior or exterior hazards
5	Standard for dry Chemical extinguishing system	NFPA 17	This standard includes the minimum requirements to ensure that dry chemical fire extinguishing systems will function as intended throughout their life to protect life and property from fire
6	Standard for installation of foam –water installation and foam – water spry system	NFPA 16	Standard design and installation of foam water and water spry system
7	Flammable and Combustible Liquids Code	NFPA 30	Provide a reasonable requirement for the safe storage and handling of flammable and combustible liquids
8	Flood Frequency Standard Design	River flow of minimum 50 –year of flood frequency should be considered	Storage facility locates adjacent to the river and prone to the riverine flooding. Therefore, designs of retaining wall, floor level area must consider appropriate frequency of rainfall design. • Retaining wall • Crossing bridge • Floor level

Review of legal framework and best standard practices to be considered related to the proposed business development and relevant impacts, as well as environmental protection will be presented in the EIS and EMP.

6. Study Area

6.1 Project Location and Study Boundary

The project is located along the national road of Dili – Liquica, approximately within 30 minutes of overland travel from Dili to the west. Study area would be composed of project footprint, surrounding areas including residential, marine water body, upland catchment system that will affect the project by contributing runoff rate to the river nearby the project location.

Figure 6.1. Project Location in Reference to Capital Dili

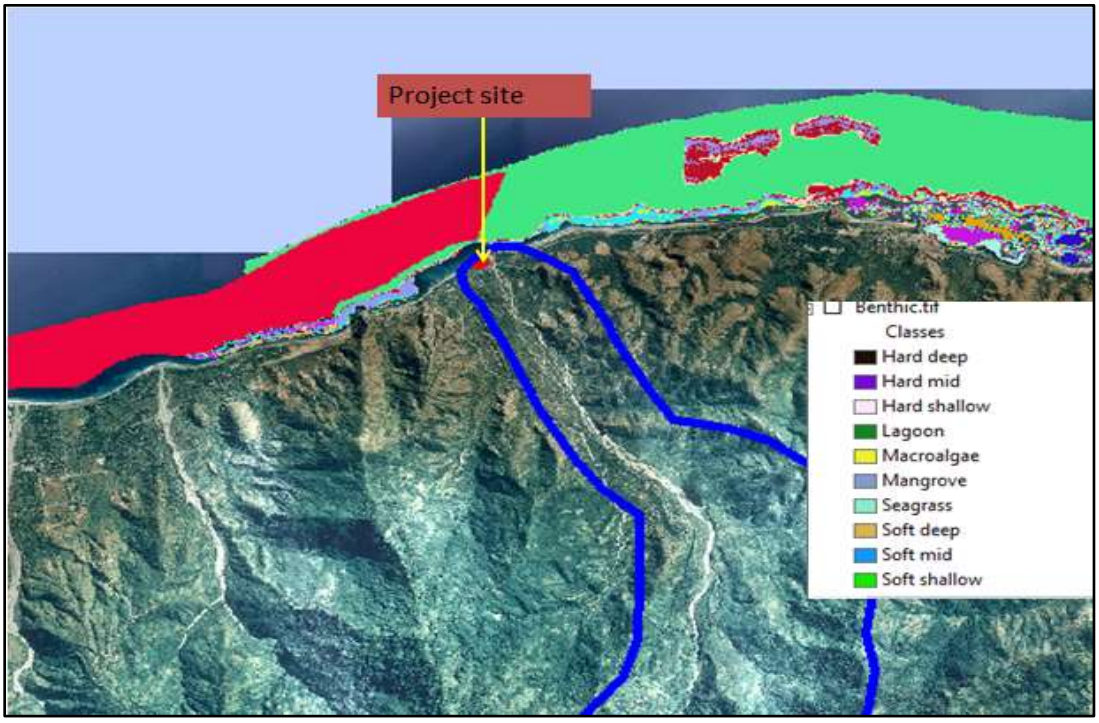
Figure 6.2. Project Location along the National Road of Dili – Liquica

The study area however, will cover up to the radius of 15 km. This is due to the investigation on the coastal resources and potential pollution contributions from the project that will be transported along the coastline either to the west or to the east will be investigated within the radius of 15 km. The following map shows the coverage of study from the project location toward the east, west, north and south.

Figure 6.3 Extent of the Study

Bounded the proposed project site in the north is marine water body, which potentially be impacted by the project during the pre-construction, construction and operation and maintenance stages of the project. Major impacts potentially happen during the operation and maintenance stage where oil spill originated from leaks at the jetty, along the pipeline and at the storage facility would make its way to the marine water. The following figure shows the NOAA coastal research that has shown the coastal marine habitat. In addition, a preliminary data collection study during the EIA suggested that at a depth of up to 20 m where is most of the marine resources such as coral, mangrove, benthos, and fisheries, are located.

Figure 6.4 Secondary Information on Marine Resources along Northern Coast of TL

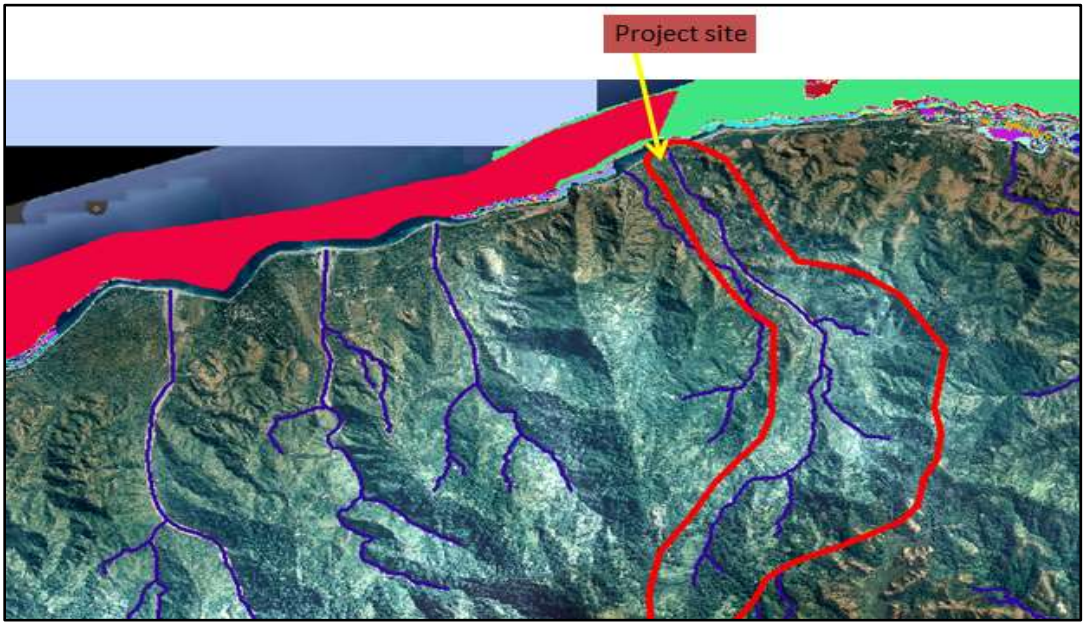


Source: National Oceanographic and Atmospheric Administration (NOAA) Coastal Research Program

It is therefore proposed that environmental investigation toward the northern side will be limited by a water depth of up to 30m, as much of the marine resources are found within this depth. Horizontally toward the east and the west of the project site, the extent of the study is proposed to cover a radius of 15 km per preliminary oceanographic modelling conducted where it was found that pollutant movement will be up to 15 km from point of origin, to either side of the project site, depending on the season and magnitude of current.

Toward the southern boundary, the study will cover up to the boundary of the watershed for a total contributing area (catchment area) of 18 km^2. Several streams and one large, intermittent river made up the Mota Ulun catchment contributing runoff during the rainy season. High turbidity is expected during the flooding event due to the geological formation, climatic and vegetation profile of the northern part of the country. This highly turbid water is flashed off into the marine water which temporarily affects the near coast water quality.

Figure 6.4 Mota Ulun Catchment



A rainfall-runoff analysis will be conducted to estimate flooding risk carried by Mota Ulun river that will directly affect the project.

6.2 Project Boundary/Surrounding Uses

The proposed development is located along the northern shoreline of Timor Leste. It is bounded by the sea in the northern part, residential houses to the south, a river to the east and local community houses to the west. Aipelo prison, a historical site, is located approximately 250m to the west of the site. Along the North coast of Liquica, various beautiful touristic places could be found and have been identified as sites to be improved for tourism purposes.

The old Aipelo Prison and other touristic places, along the north shore of Liquica areas, could be affected by the project during the pre-construction, construction and especially the operation and management stage, in the event of emergency such as major oil spill in the sea and large scale fire accident.

- Salt Lake Maubara
- Maubara Fort
- Lauhata Resort
- Black Rock
- Loes River

Toward the eastern side of the project boundary, there are recreational resorts and government major project that could potentially affected by the project.

- Tibar Port Development
- Industry parking area
- Tibar Resort area
- Kaitehu, protection area due to special coral reef

Toward south, the project location is bounded by the following features:

- River contribute runoff to the marine aquatic environment
- Mountain hike
- Coffee plantation in Bazartete area

In terms of cross border impacts, the transport of pollutant could affect the receiving environment (water body) from the project to east, west, and northern part of the project. Therefore, more focus of the study should be on the east, west, and northern boundary of the project site.

6.3 Timeline of Study

The study is planned to be completed within 6 months, including data collection and report preparation. An additional 2 months have been added to account for review needed by the regulatory agency, in this case the ANPM. Indicative work plans is presented in the following table.

Table 6.1 Work Program and Expected Timeline of EIS Preparation

No	Item Work Implementation	Time Table - Month									
		1	2	3	4	5	6	7	8	9	10
1	TOR Preparation										
2	Geotechnical Site Investigation										
3	Stakeholder Engagement of the TOR and Scoping Study										
4	Submission of Draft Report on TOR										
5	Technical Review of documents (TOR) by ANPM and project										
6	Address comments to the reviewed documents										
7	Re-submit the TOR to ANPM and project owner										
8	preparation of draft report of EIS and EMP										
9	Stakeholder Engagement of the draft report of EIS and EMP										
10	Community Consultation in Kaitehu										
11	Submission of Draft Report on EIS and EMP to ANPM and project owner										
12	Reviewed by ANPM										
13	Address comments to the reviewed documents of EIS and EMP										
14	Re-submit the EIS and EMP to ANPM and project owner										
15	Approval of EIS and EMP documents										

7. Scope of Environmental Impact Assessment

The EIA study will be cover the following scope:

I. Present detail overview of the proposed development project
II. Review of the existing environment and establishment of baseline environmental characteristics
III. Impact Analysis
IV. Impact Management Plans
V. Monitoring Plans
VI. Stakeholder and community engagement programs

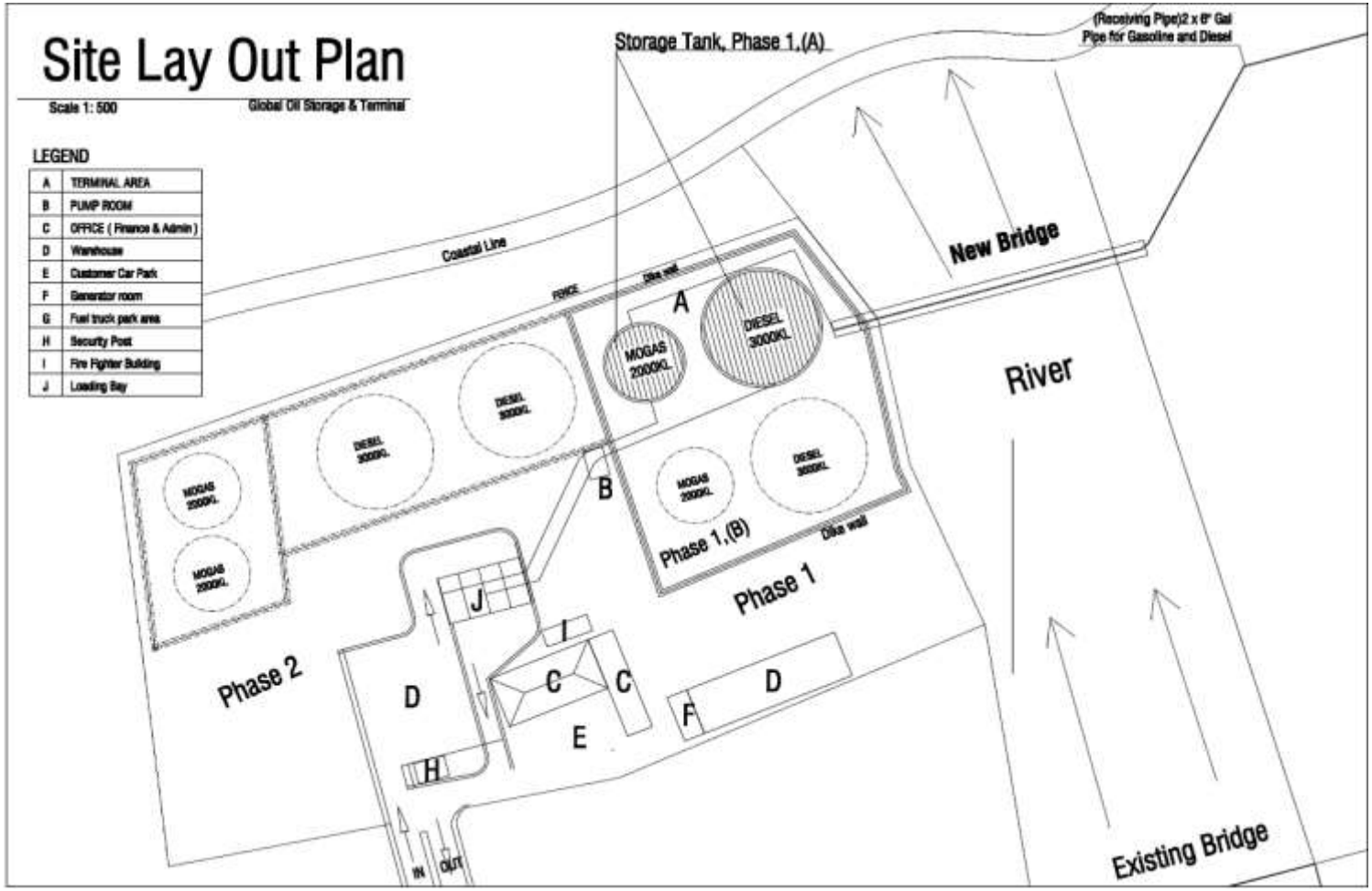
7.1 Description of the Project

7.1.1 Project Overview

The proposed development project consists of construction of fuel storage tanks and supporting facilities. Total areas for the project is 1.2 Ha, that has been secured by project owner. Project owner has also planned for the use existing jetty structure located approximately 300m to the east of project site as unloading point of oil from tanker ship. The following figure provides information on the general layout of the project. Current lay out is at a conceptual level, with more detailed layout/project engineering design to be provided once they are made available by the engineering department.

Construction of the facility is planned to be completed within 2 years. It is projected, that by 2022, the facility will be operated fully by the project proponent or any other designated operator.

Figure 7.1 Project Concept and Site Plan (See Annex 4 for more detailed drawing)



7.1.2 Project Rationale and Feasibility

The project proponent proposed the development facility based on market analysis of demand growth of fuel supply in Timor – Leste and the opportunity to construct a new facility that will strengthen their existing business in the country. The new storage facility will also help in rapidly increasing in-country storage capacity that will contribute to easing of price fluctuation of fuel in domestic market. At the same time, having such a large capacity of storage will ensure competitiveness of the business, the price of which will eventually be passed on to the customer in the form of better retail price at consumer's level. Market feasibility study done by the project owner suggested that current increasing trend in fuel consumption will continue and therefore, it is profitable for the project owner.

7.1.3 Project Financing

The proposed development project will be financed through one hundred percent equity from the parent company in Singapore. The construction of the facility will be completed within 2 years with operation planned to commence by 2022. The facility will be operated fully by the project proponent. It is estimated that revenue over 10 years of operation in Timor Leste will cover the investment.

7.1.4 Petroleum Product Type

There two petroleum products that will be stored and distributed within this proposed facility. They are gasoline and diesel fuels, which are mainly used in Timor Leste as the source of automobile fuel and also other such power generation fuel. The specifications of gasoline and diesel fuels are presented in the following table.

Table 7.1 Summary of Physical and Chemical Properties of Gasoline

No	Parameter	Units	Limits		Grade	Test Method
			Min	Max		
1	Sulphur	mg/kg		150	All grades	ASTM 0543
2	Research Octane Number (RON)	--	92		All grades	ASTM D2699
3	Motor Octane number (MON)	--	78		All grades	ASTM D2700
4	Distillation, Final Boiling Point	°C		210	All grades	ASTM D86
5	Olefins	% v/v		18	All grades	ASTM D1319
6	Aromatic	% v/v		42	All grades	ASTM D1319
7	Benzene	% v/v		3.0	All grades	ASTM D5580
8	Lead	mg/L		5.0	All grades	ASTM D3237
9	Oxsigen	% m/m		2.7	All grades (no ethanol)	ASTM D4815
				3.5	All grades (with ethanol)	ASTM D4815
10	Ethanol	% v/v		10	All grades	ASTM D4815
11	Oxygenates Except Ethanol, Each	% v/v		1.0	All grades	ASTM D4815
12	Phosphorus	mg/L		1.3	All grades	ASTM D3231
13	Copper corrossion (3hrs at 50°C)	rating		Class 1	All grades	ASTM D130
14	Existent Gum (washed)	mg/100 ml		5.0	All grades	ASTM D381
15	Induction Period	minutes	360		All grades	ASTM D525
16	Rapid Vapour Pressure	kPa	45	65	All grades	ASTM D323
17	Flexible Volatility Index	index		100	All grades	ASTM D86 & ASTM D323

Table 7.2 Diesel Fuel Specifications

No	Parameter	Units	Limits		Test Method
			Min	Max	
1	Sulphur Content	mg/kg		500	ASTM D5453
2	Cetane Index	–	45.0		ASTM D4737
3	Density at 15°C	kg/m³	820	850	ASTM D4052 ASTM D1298
4	Distilation T95	°C		360	ASTM D86
5	Polyaromatic Hydrocarbon (PAHs)	% m/m		11	IP 391
6	Ash Content	% m/m		0.01	ASTM D482
7	Viscosity	mm2/s	2.0	4.5	ASTM D445
8	Carbon residue (10% distilation residue)	% m/m		0.2	ASTM D4530
9	Water Content	mg/kg		200	ASTM D6304
10	Total Contamination	mg/kg		24	EN 12662
11	Conductivity at Ambient Temperature	pS/m	50.0		ASTM D2624
12	Oxidation Stability	mg/L		25	ASTM D2274
13	Colour	Rating		2.0	ASTM D1500
14	Copper Strip Corrosion (3 Hours at 50°C)	Rating		Class 1	ASTM D130
15	Flash Point	°C	61.5		ASTM D93
16	Filter Blocking Tendency	Rating		2.0	ASTM D93
17	Fatty Acid Methyl Ester (FAME)	% v/v		5.0	EN 14078
18	Lubricity	mm		0.46	IP 450

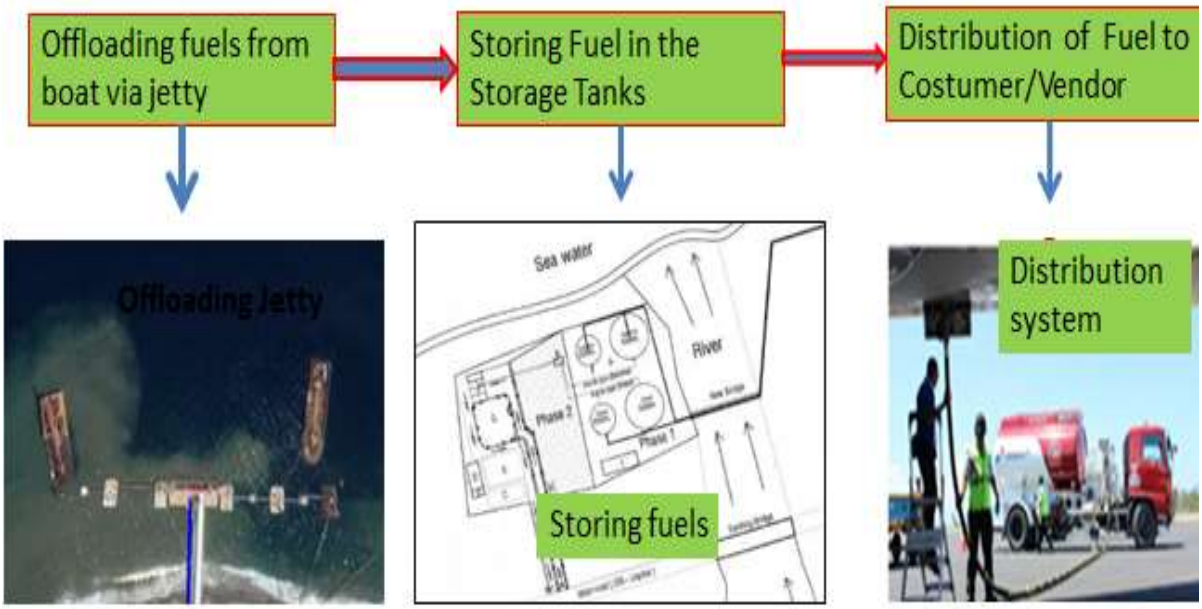
Understanding these physical and chemical properties are very important and they indicate the type of pollutant that will be transferred to the receiving environment such as soil and water body.

7.1.5 Project Components

The proposed development consists of the construction of fuel storage tanks and supporting facility on a 1.3 Ha land area. Land for the development has already been secured by project proponent. General lay out for the fuel storage complex is provided in the following figure.

Project components consist of - (i) unloading of fuel in Jetty, (ii) storing the fuel in the storage tanks, (iii) transporting and distributing the fuel from the fuel storage to users and small vendors of the fuel in Timor Leste. All the required facilities such as storage tanks, piping system, utilities, office, parking, etc., shall be constructed as part this development project. Information related to project component, including processes involved will be described as followed.

Figure 7.2 Overview of Main Project Operation Components



Offloading Jetty

The jetty has already been constructed (existing jetty structure). Project proponent will use this jetty as unloading point and in return the project proponent is subject to user charge that will be applied by the owner of the jetty. The existing jetty was desgined and constructed in 2012 -2013 to serve the purpose of offloding of breakbulk cement to be stored in the facility owned by the jetty owner. The total designed capacity of jetty is around 20,000 DWT. Project proponent planned to carry out unloading of its petroleum products twice a month. It is planned that fuel tanker with the capacity of 4,500 – 5,000 KL will transport the product, which will typically carried by the ship with a maximum capacity of 12,000 DWT (Dead Weight Tonnage).

Figure 7.3 Existing Off Loading Jetty (around 100 from the shoreline)

Figure 7.4 Jetty Platform

Figure 7.5 Jetty Structure

Piping System

A piping network will be constructed in order to allow for fuel transfer from unloading point to the storage tanks and from storage tanks to the fuel truck. The design and specifications of the piping system will be carried by the professional independent engineers by taking the standard best practice in relevant industry (American Petroleum Institute/API standard).

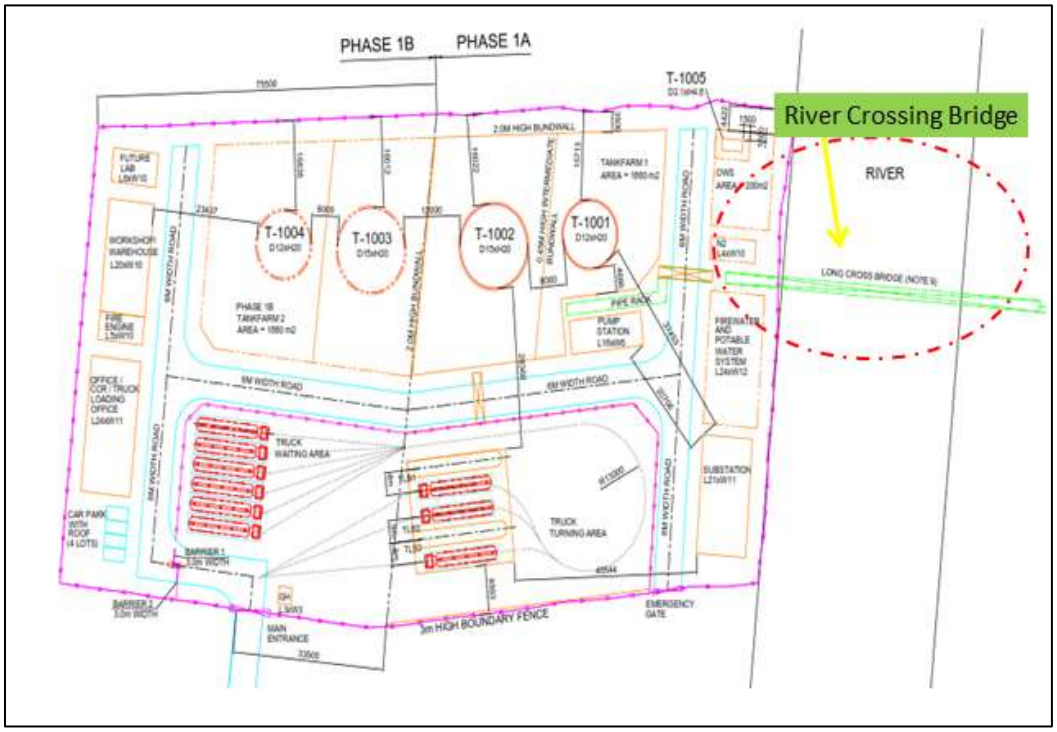
Figure 7.6 Concept Layout of Main Fuel Pipes

Two fuel pipes, one for gasoline and the other one for diesel fuel with the size of 6 inches, will be installed from the off loading jetty platform all the way to the storage tank. The pipe shall be above the ground and laid on the top of river crossing bridge. Detail layout of pipeline in respect to jetty, storage tanks, and other facilities will be provided in the draft EIS and EMP.

River Crossing Bridge

As the off loading jetty and storage area is divided by an existing river, a bridge crossing structure will be developed as part of the project. The bridge will be constructed such that it will be able to withstand high river flow. A hydrology analysis will be conducted as part of the EIS, however, preliminarily, it is recommended that the bridge structure has to be designed to withstand a minimum of 50 years flooding frequency. A more detailed study will be conducted to provide flooding magnitude information that will be used in detailed design work.

Figure 7.7 Concept Design of Facility and Crossing Bridge



Storage Tanks

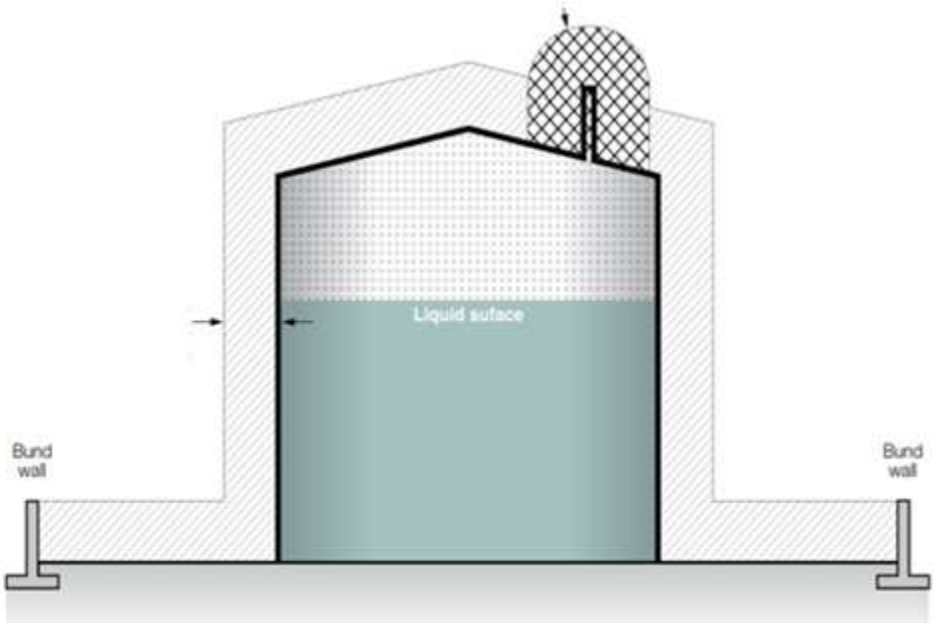
A total of 4 storage tanks, with the capacity of 2,000 m^3 and 3,000 m^3 will be constructed on the 1.3 Ha of land that has already been secured by project owner via long-term lease arrangement with the land owner. Project development phasing and volumes of tanks to be built are presented in the following table.

Table 7.3 Number of Storage and Respective Volume

Phase	Number of Tank	Volume of each Tank, m3	Total Volume (m3)	Height (m)	Diameter (m)	Type of Fuel
Phase 1 - A	1	2000	2000	12	2000	Gasoline
	1	3000	3000	15	3000	Diesel
Phase 1 - B	1	2000	2000	12	2000	Gasoline
	1	3000	3000	15	3000	Diesel
Total	**4**		**10000**			

A total volume of 5,000 KL storage tank will be constructed in the first phase (phase A) of the project and it is expected to be completed by the end of 2021. After the completion of the phase 1 A, the management will start to plan for the phase 1 B with an additional volume of 5,000 KL storage tank, aimed to be complete by the end of 2025 if found feasible. The design and construction of the fuel storage system shall include all necessary components to operate sustainably by considering health, safety and environment (HSE) aspects. This includes but not limited to bund walls as the secondary containment that will contain the fuel if there shall be any overflow or accident in the fuel tank.

Figure 7.8 Typical Tank Design with Secondary Containment



The decision of whether or not to expand to phase 1-B will depend on the country's economy and rental demand for storage tank. Therefore, design for phase 1-B is subject to change. The design of the fuel storage tank, including the material selection, type of tanks, tanks spacing, and ratio of height to diameter shall follows standards recommended by the API.

Fuel Distribution System

Fuel in the storage shall be pumped into the distribution unit, where it will then be loaded on to the fuel truck for further delivery to the fuel filling station. Detail information on the distribution system, will be presented later in EIS and EMMP.

Utilities System

Utilities required consist of water, electricity and back-up power system as well as life and fire safety system (described separately below). The utilities are necessary components to ensure smooth operation of the facility.

Water Supply System

Water will be sourced from a groundwater pumping well, which will be constructed as part of this project. In normal condition, the capacity of water demand will be reasonably small around 2000 L/day or 0.14L/s assuming the pump is continuously active for four hours per day. A much larger amount, however, will be needed during a fire event.

A pool that store water for every-day use and fire event will be constructed near the storage area with a total capacity of 3000 m^3. The pool will be filled with water from the well in the facility which will require a gradual pumping until it reaches the capacity. After the capacity is reached, the pumping rate will be reduced to cover the daily need of 2000L/day and evaporation loss. Detail information on the production well for water supply and capacity of the pool will be provided in the EIS and EMP report.

Power Supply

Power supply for the project will be source from the national power grid available in the project site. The power will be utilized for pumping water and fuel, general office need, and other electricity needs. The total power requirement is around 1 MW per year during operation stage, which is a reasonable size of power consumption for this type of facility.

Wastewater and solid waste treatment

Two types of waste will be produced from the facility, the wastewater and solid waste. Wastewater will be mainly coming from domestic sanitation activities which include black water (resulting from toilet flush) and grey water (resulting from kitchen sink, other washing facility) and runoff during rainy events. Black and grey water will be flushed into a septic tank which will be designed to allow for in-situ treatment of the water with effluent discharged into the drainage which will eventually enter the marine waterbody. Storm runoff, on the other hand, will be washed off the ground surface in the project area and likely to be contaminated by fuel products (due to minor spill). Storm runoff will pass the oil-water separator to catch the oil prior to the release of the treated wastewater into the drainage system. Detailed engineering design (DED) of each wastewater treatment system (septic tank and oil-water separator) will be provided as part of design approval. A description of the utilities will be provided in greater detail in the full EIS and EMP.

Fire Protection System

Fire management system is an important part of project development, as fuel is susceptible to fire. Project proponent shall construct a system that meet the international life and fire safety standards to ensure integrity of its own facility, safety of workers and surrounding community.

Fire protection system shall consist of the following element:

- Pump, with a high capacity pumping head to the reach a storage tank of 20 m high
- Fire hose
- Fire hydrant system
- Moveable fire extinguisher
- Fire water system (pool)

Site layout on the arrangement of fire management system, including the equipment, fire fighter team, and mechanism of responding should fire actually happens will be presented in the EIS and EMP reports.

Support Office

Support office mainly consists of the office space for staff, security post, parking zones, and unloading zone of the fuel from storage tanks to the buyer trucks. Detail engineering design on the support office will be presented as part of the EIS and EMP report.

7.1.6 Project Implementation

This environmental impact assessment and management plan shall cover the three stages of project implementation from project preparation, construction, and operation plus maintenance. The decommissioning on the other hand, as it may occurs, after many years, will be treated separately, which may require another environmental management plan (EMP)

Pre-Construction

Included in the pre-construction stage is project preparation which consists of land acquisition, engineering design, preliminary community consultation and site preparation, e.g. fencing. The environmental impact assessment is also conducted during the pre-construction stage to inform on important parameters that should be considered during the engineering design and site preparation. Additionally, in adherence to Timor Leste's foreign private investment legal framework, investment certificate is being sought from relevant agency at this stage.

Construction

This stage includes mobilization of the contractor and supply material, actual construction of the tank farm and other facilities. During the construction stage, detailed design including the environmental management plans are ready to be built into the facility in the following sequence:

a. Land preparation (site grading) and foundation work
b. Water bore drilling
c. Storage construction/installation
d. Office construction
e. Yard pavement
f. Storage tanks
g. Pipe installation
h. Complete all the utilities required
i. Testing and operating

The duration of construction depends on how good preparation for the development has been with all factors that will ensure smooth construction has been considered.

The following implementation timeline shall be used as an indication for project implementation.

Table 7.4 Design and Construction Schedule

	2019								2020											
AGENDA	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
ENVIROMENTAL STUDIES AND LINCESING																				
DESIGN AND PROCURAMENT																				
START OF CONSTRUCTION																				24
PROCESS OF TRADE INVEST																				

Operation and Maintenance (O&M)

Upon the completion of the construction and commissioning (testing of facility and equipment), the O&M stage started. During this phase, facility workers and customers are present in the facility while all activities are on-going. Fuel importing and transfer are happening at the jetty and tanks are in use to store fuel. Transfer of fuel to bring to the customer from the storage tank to the trucks is also on-going. All HSE measures should be in place to ensure accident free operation.

7.2 Description of Existing Environment

Review and description of the existing physical and bio-physical environment is an important component of the study which provides the baseline existing information of environment prior to the commencement of the project, as well as provides a general overview of more detailed study and primary data collection to support the EIA. Important components of existing environment consists of climate and weather, topographic, water resources, air quality, geology and soil, which important are information project development (design construction, and operation). Not only, that but also, understanding of these mentioned physical information will provide the data and information to the government as regulatory body to monitor and compare the physical parameters change to the baseline before the project started.

Moreover, the other existing environment such as marine ecosystem, terrestrial flora and fauna, public utility, as well as non-physical component of existing environment such as socio-economic profile, public service, an occupational health and safety would also be important to be investigated and presented as part of the environmental impact assessment study. Brief description of the most relevant existing environment, including the existing data, as well as proposed data collection for the completion of the study are presented in the following sub-sections.

7.2.1 Topography

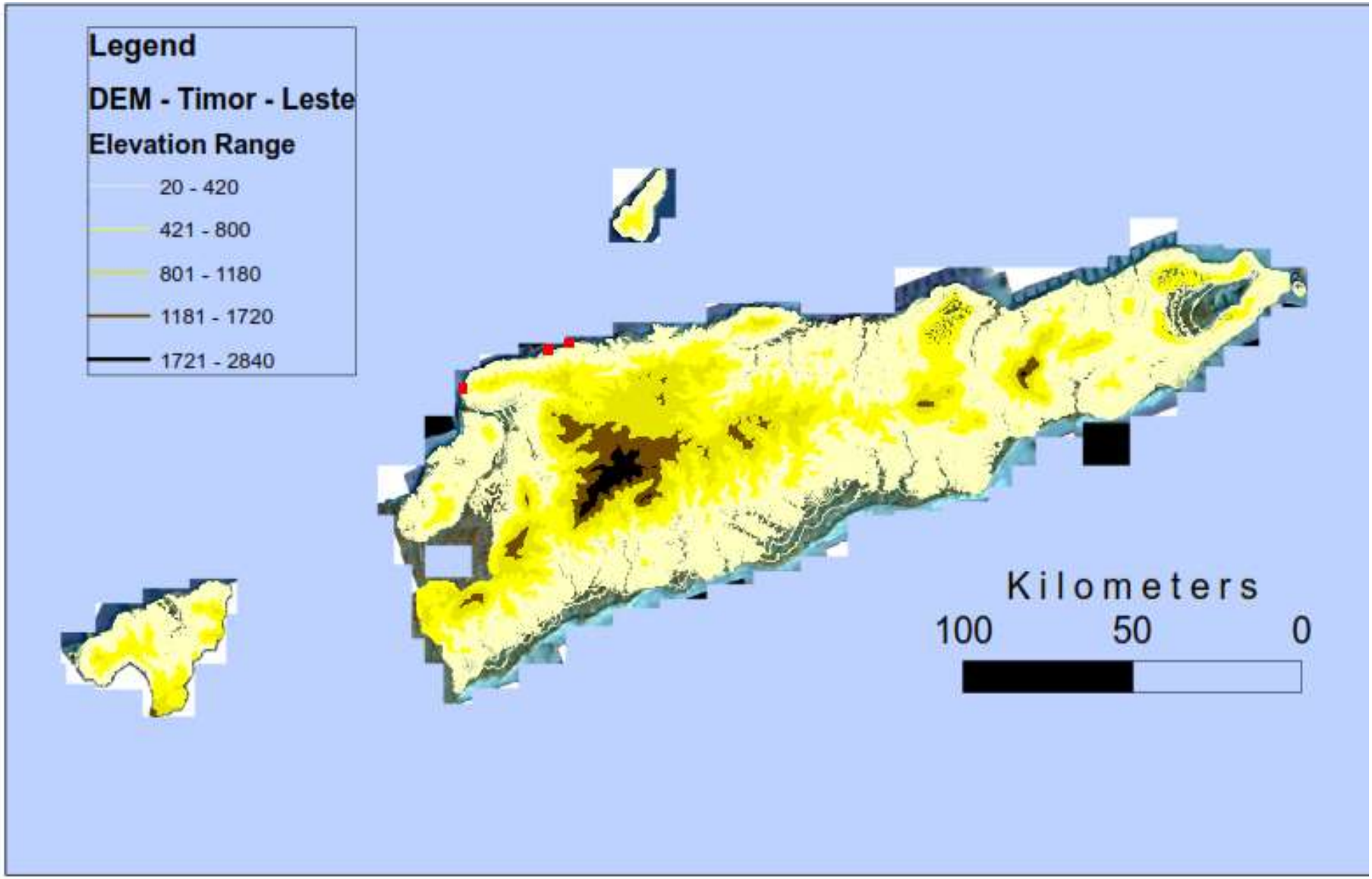
A topographic condition in a simple term is the representation of elevation point above certain reference point (or benchmark), that describe the natural landscape of the terrain system. Because it shows the elevation difference between one points to the others, it does very useful data in the design and construction of various infrastructures. Therefore, any project development, which involves a certain large area, the topographic data should be collected. In the proposed development project, the topographic data shall be useful in the design of the landscape system that consider free or minimum flood impact from the upland catchment system, design of various utilities (pump, water system, energy, etc.).

The project location is in the coastal area of low laying, which is prone to flooding from high frequency of storm runoff as well as coastal inundation. The use topographic in this case will be important and useful for the following estimation:

- Catchment definition to define the contributing area of runoff into the mouth of the river, as well as other hydrological parameters such as landscape slope, channel slope, and other dimension, which are useful in the hydrological modeling. For this application, the topographic data with the spatial resolution of 90 meter, that widely available could be sufficient.
- Detail design related to the project, such as landscape, pumping design of the bridge, level of the tank to be constructed respect to other structures, and other purposes that need high resolution of the topographic data (in 10 mm spatial resolution). For this purpose, the project owner will collect the data by mobilizing the ground survey team.

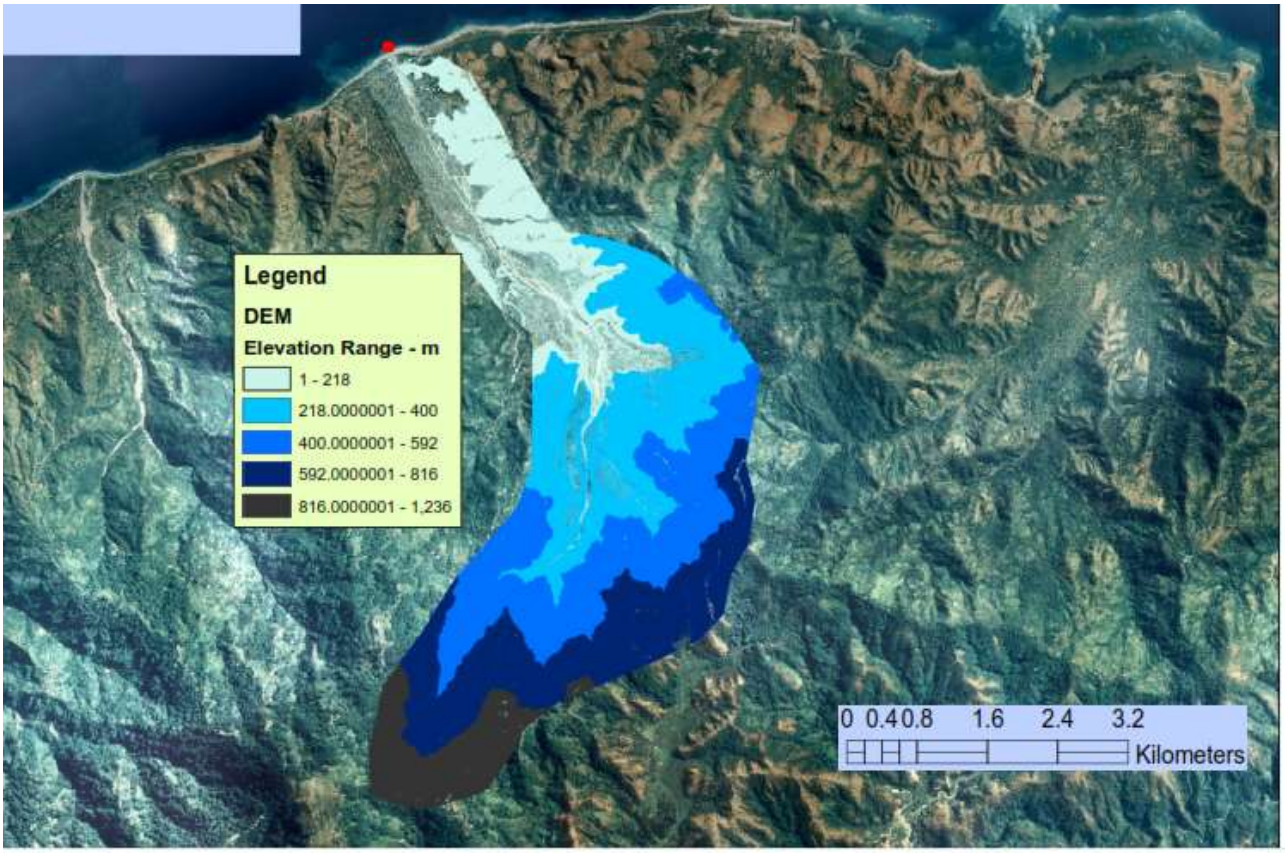
The following map shows the topographic information derived from the ASTER Digital Elevation Model (DEM) by https://earthdata.nasa.gov/learn/articles/new-aster-gdem .

Figure 7.9. Topography Information of Timor Leste (90 meter resolution)



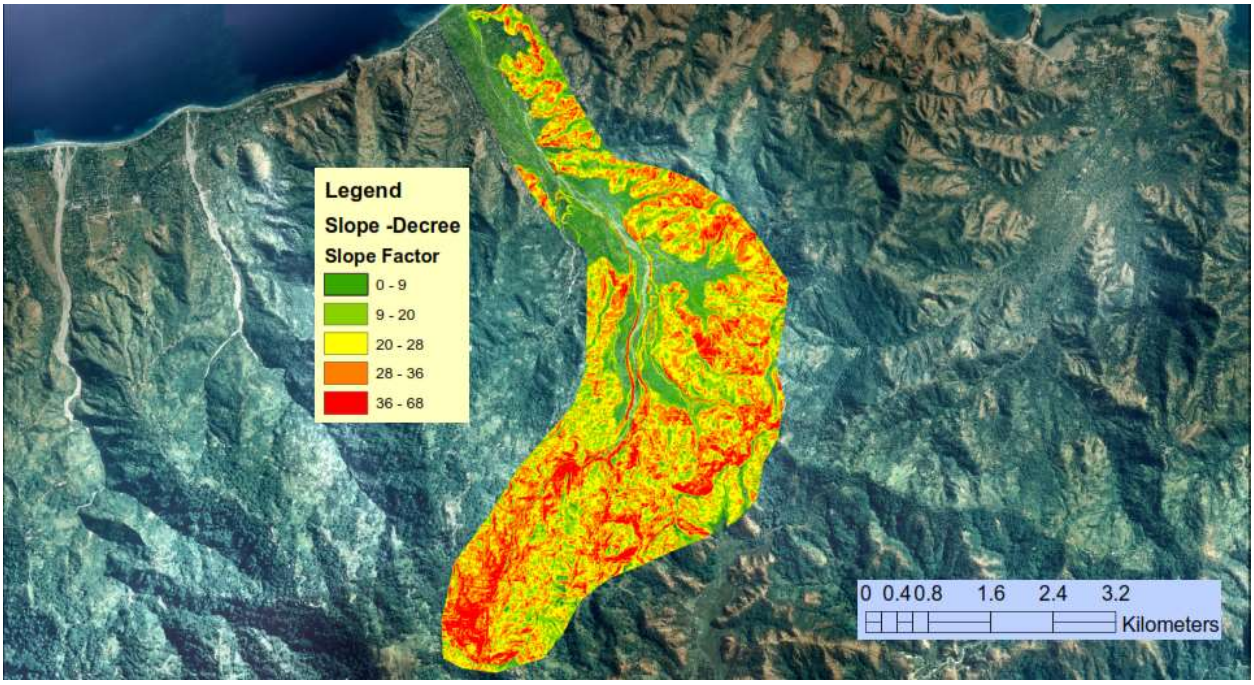
For further application to the project location, the DEM for the Lauhata catchment system was derived by using the standard ArcGIS software. The result of the DEM that cover the location, where the proposed development will be constructed can be seen in the following figure.

Figure 7.10. Elevation Range and Terrain System



From the above elevation in the form of DEM, the various land characteristic such as watershed, landscape slope, river channel and river network, can be derived. This information is provided in the section 7.2.3 (Hydrology and flooding). The following figure, slow the slope of the landscape of Lauhata watershed.

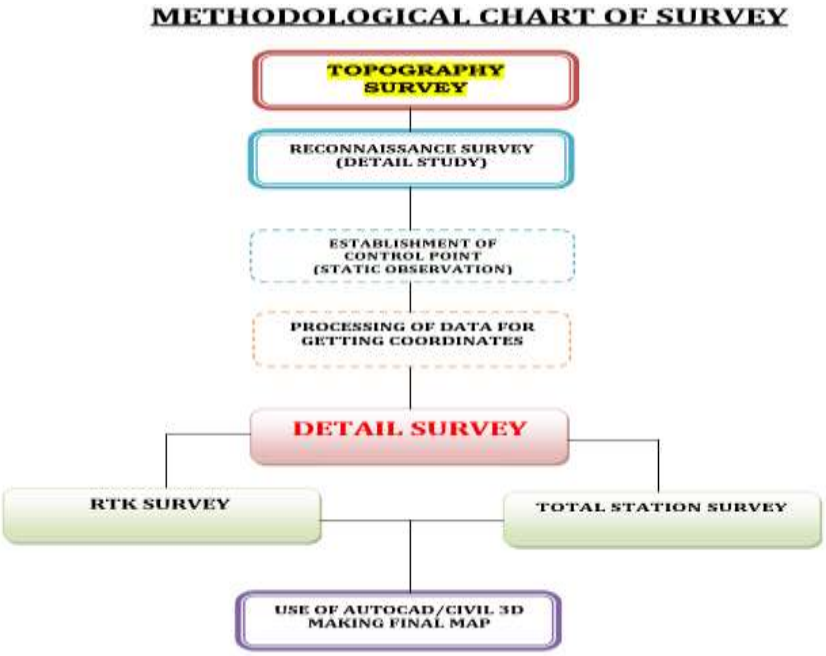
Figure 7.11. Landscape Slope Factor Estimated by DEM



It is shown by the slope landscape estimation that the upland catchment system is fairly steep in terrain (30 – 70- decree), which should transport the runoff at the faster rate or time duration of the hydrological process is short. However, the project is located at the slope factor between 0 and 9 decrees, which is the low laying area.

The more detail topographic data will be required in the design and construction of various systems such as floor level design, grading, excavation, cut and fill design, and other design and construction purposed of the project. The detail of ground topography must be surveyed directly by the surveyors. As part of project preparation and design, a topographic site survey will be conducted to provide more accurate information for design and construction. The methodology of ground survey of data collection is basically, using the differential GPS that has precise measurement of elevation point. The following figure, provide the general overview of methodology of ground topographic survey that will be used by this project.

Figure 7.12. General Overview of Topographic Survey Methodology



The following figure shows the most common use of differential GPS that uses in the ground survey of topographic data collection.

Figure 7.13. Equipment of Topo Survey and BM establishment

The step of data topographic data collection:

- Establishment of Benchmark (or reference point of survey).
- Data collection (a person, use the GPS and collection data point)
- Process the data and convert into the topographic map of drawing
- AutoCAD program programing is commonly used

Further detail information regarding the ground survey topography using the differential GPS will be presented in the EIS and EMP report.

7.2.2 Geology

Geotechnical or engineering geology study for any project activities is very important due to the geo-hazard impact, which can cause geological hazard (Natural hazard) to the project site area. The geological hazard, possible to occur in the project site including; landslide, flooding and coastal hazards. More detail geological site investigation would normally conducted, as part of the project preparation study to know more detail soil and rock characteristic in the vertical direction, which are useful for foundation design, liquefaction, soil bearing capacity, and other purposes.

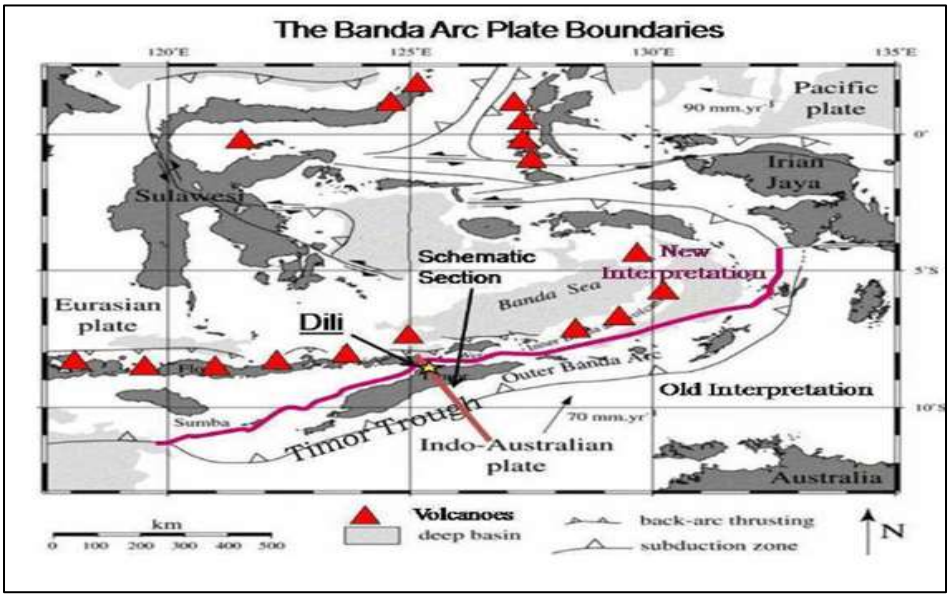
As part of the EIA study, the review of regional study on the geological formation of Timor –Leste will be provided by previous study, including the site visit to the project location to collect the geological footprint/evidence in the local context. The geo-technical site investigation will be conducted as part of the study to collect for detail information of rock type, soil texture, and other physical as well as chemical properties of soil in the vertical direction.

In general the methodology of geological and hydro-geological analysis by this is to review the exiting expert opinion of the regional geology and hydro-geology, related to the project area, and further data collection related to rock type and groundwater data collection.

7.2.2.1 Review of Regional Geology and Hydro-Geological Information

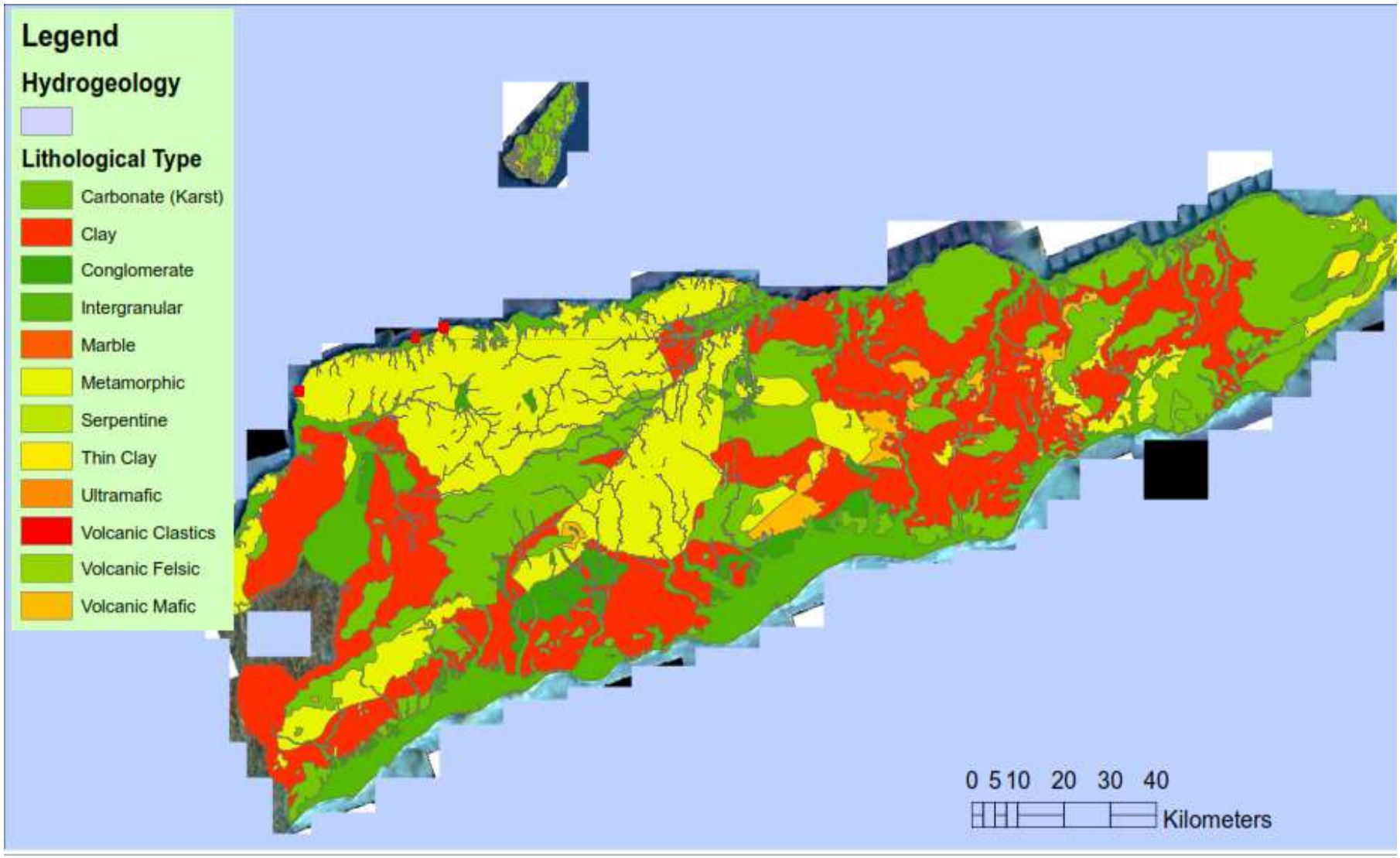
The geology of Timor Leste is complex in both composition and tectonic influence. Timor Island is part of Banda Arc, marked by a string of islands and underwater formations that are thought to be the results of collision of the Indo-Australian Plate, the Pacific and the Eurasian Plate. Timor Island, according to Hamilton (1978) and other experts is formed from fragments from the Australian plate, deep marine sediment thrusted upward by the collision, oceanic crust and Quarternary sediments brought by the collision.

Figure 7.14 Timor Island Geological Formations



The geological condition (rock type and properties) will control groundwater storage and flow. Therefore, hydro-geological investigation in terms of lithology and aquifer type is important. According to the Australian Geoscience (2012), the lithological type of Timor Island is dominated by carbonate, intergranular, and "***Metamorphic"*** rock types, where each type of rock has different characteristics in storing and transporting water.

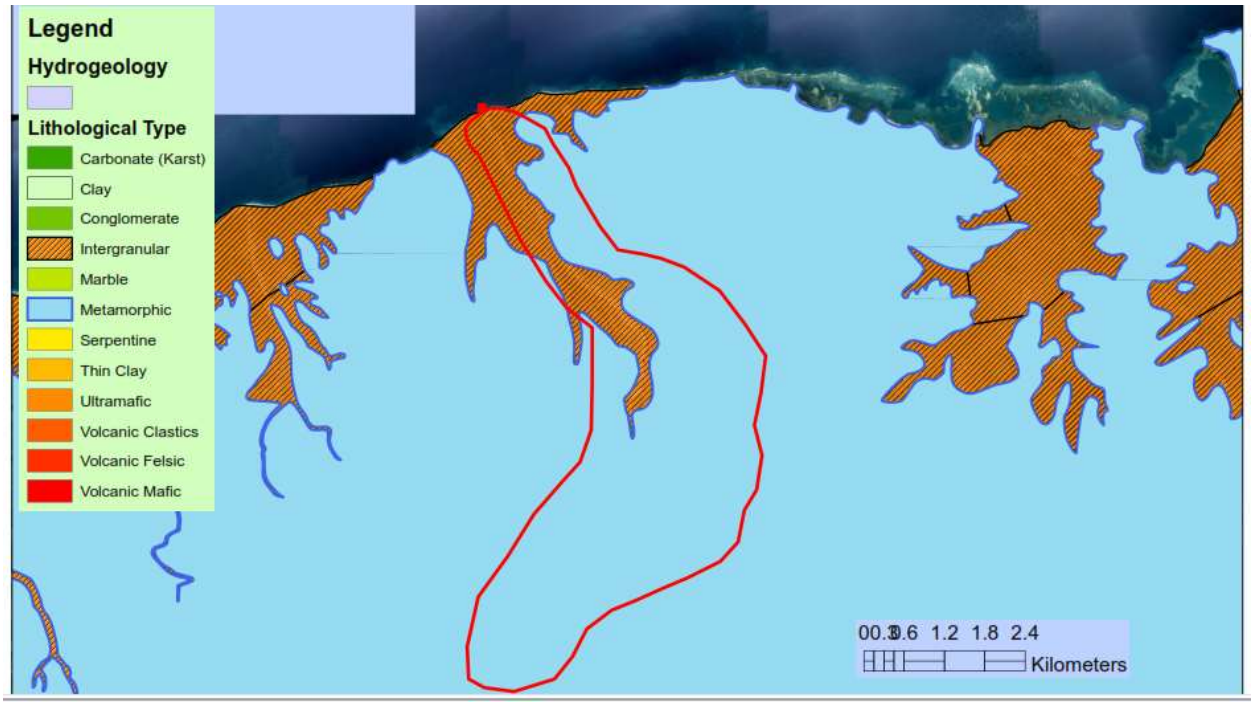
Figure 7.15 Timor Leste Lithology/Rock Type



Source: Australian Geoscience, 2012

The rock type in the project location, as indicated in the following map, is dominated by the metamorphic and intergranular type.

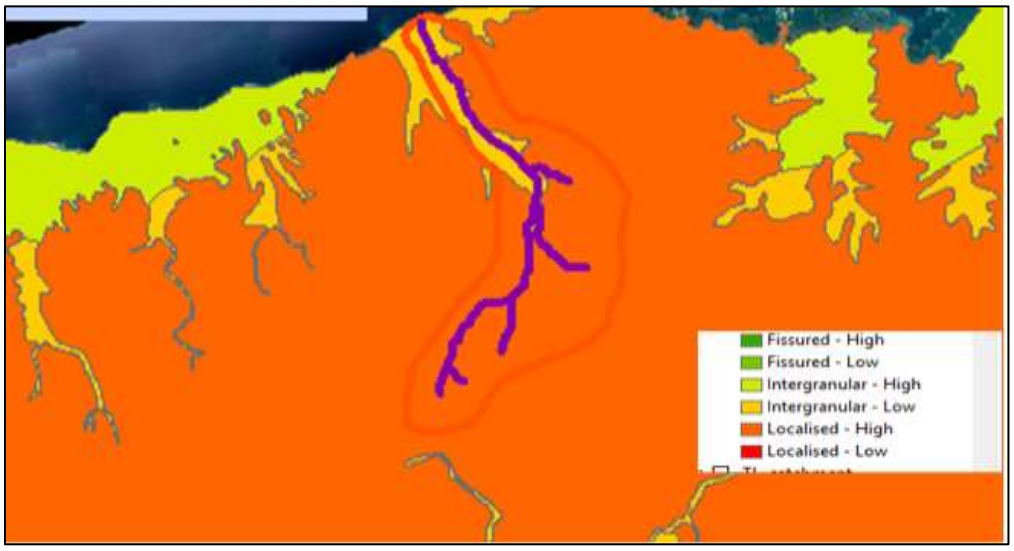
Figure 7.16 Lithology/Rock Type in the Project Area



Source: Australian Geoscience, 2012

The most relevant application of the geological rock type is the assessment of the groundwater, as rock is essentially the storage of the groundwater. The following map shows the type of aquifer in terms of groundwater storage and transmitivity in the project area.

Figure 7.17 Aquifer Type in Project Area



The type of aquifer is classified as intergranular low, where the type of aquifer is confined and normally has very low groundwater yield that is susceptible to rainfall change and seawater intrusion. As aquifer and recharge area is reasonably small, fresh water availability in the groundwater system is limited. The same study of Australian Geoscience also suggested that around the project area, only brackish water would exist. A preliminary testing of the shallow and deep groundwater wells around the project area suggested that the groundwater availability near the shoreline is dominated by brackish water. Further testing will be conducted in the upstream to know the salinity profile as the distance of well is further away from the shoreline. Further assessment on the local rock type within the proximity of project location will be done by this study as part of deep bore testing.

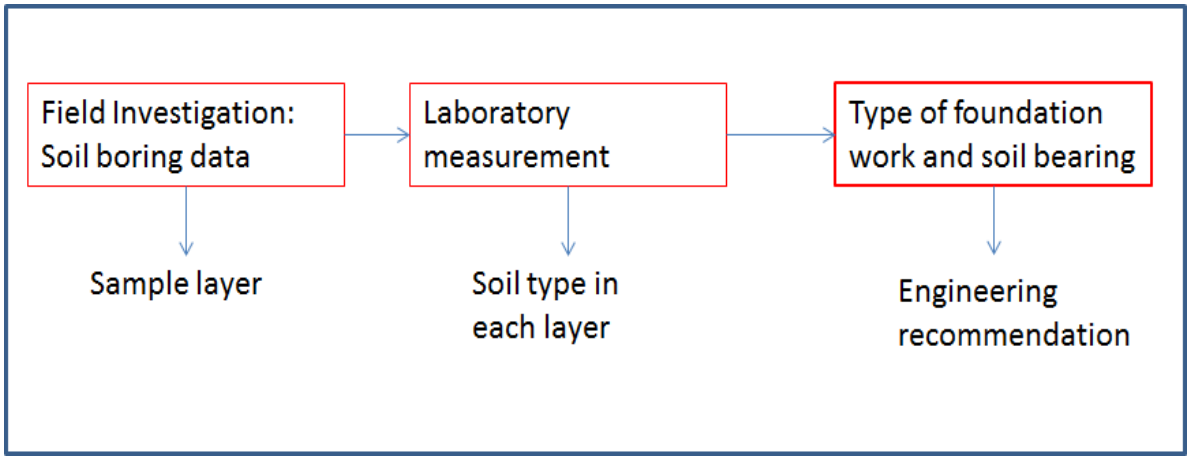
7.2.2.2 Rock Type Data Collection in the Project Site

Rock type data will be collected by the project owner, to understand the structural type of rock under the ground, which should provide information for the foundation design and other major structure by this project. The methodology of geotechnical site investigation will be conducted as part of the EIA study by with the following approaches.

- Drilling two boreholes to explore subsurface stratigraphy and groundwater conditions and to obtain samples of the subsurface materials for laboratory testing
- Conducting laboratory tests on selected soil samples recovered from the borehole to evaluate pertinent physical and engineering properties; and
- Analyzing the field and laboratory data for the Engineering and to develop engineering recommendations.

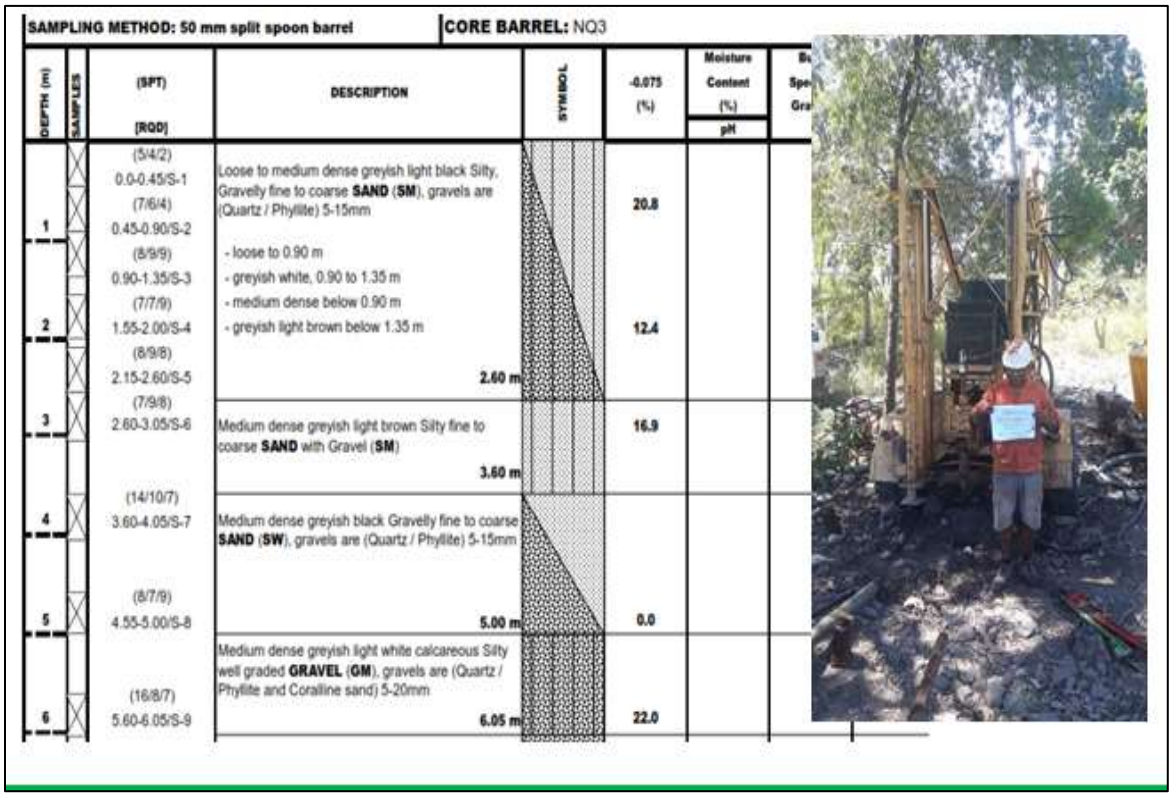
The geotechnical investigation team shall be mobilized in the project site to perform the geotechnical soil boring data collection. The following figure shows the methodology and workflow of soil data collection and engineering recommendation for the foundation works.

Figure 7.18 Proposed Field Study and Application of Result



The expected results of the soil test would be information on the type of soil in each depth, water content, and permeability of the soil.

Figure 7.19 Examples of Soil Test Results

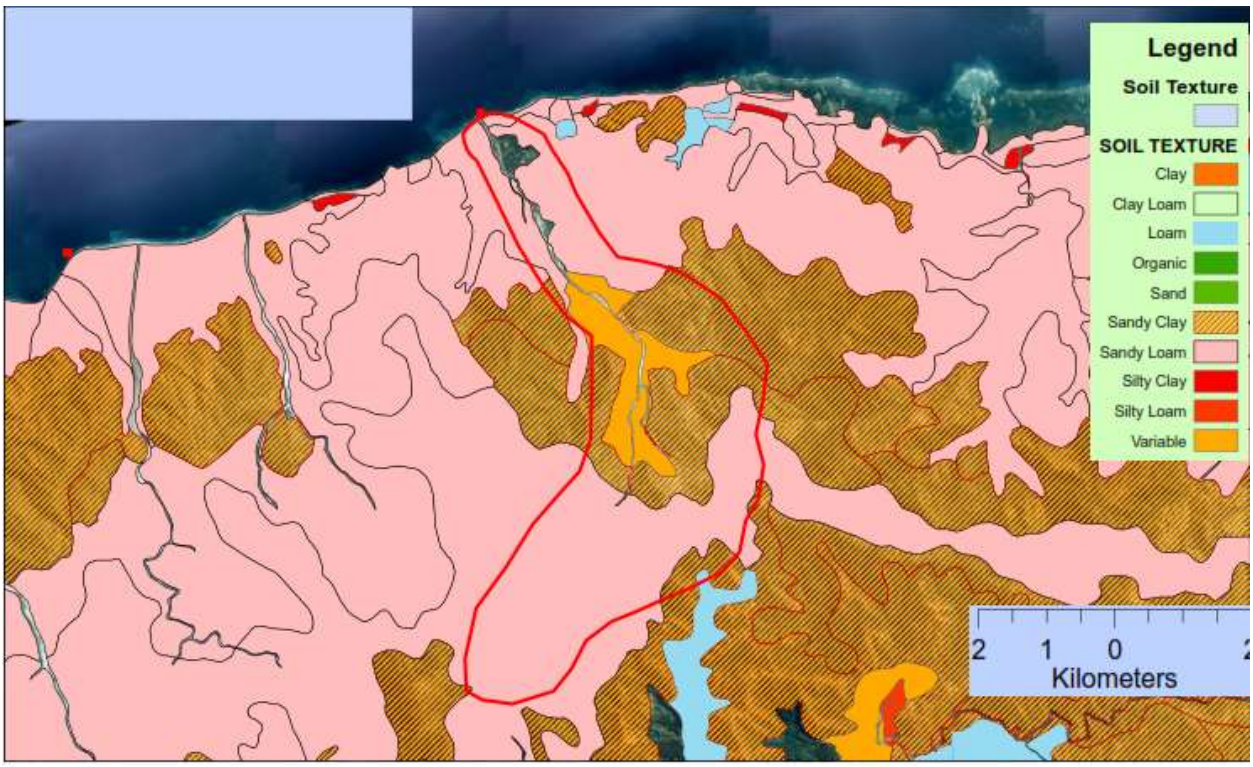


Further detail on the field work and the expected result will be reported in the EIS and EMP documents

7.2.3 Soil

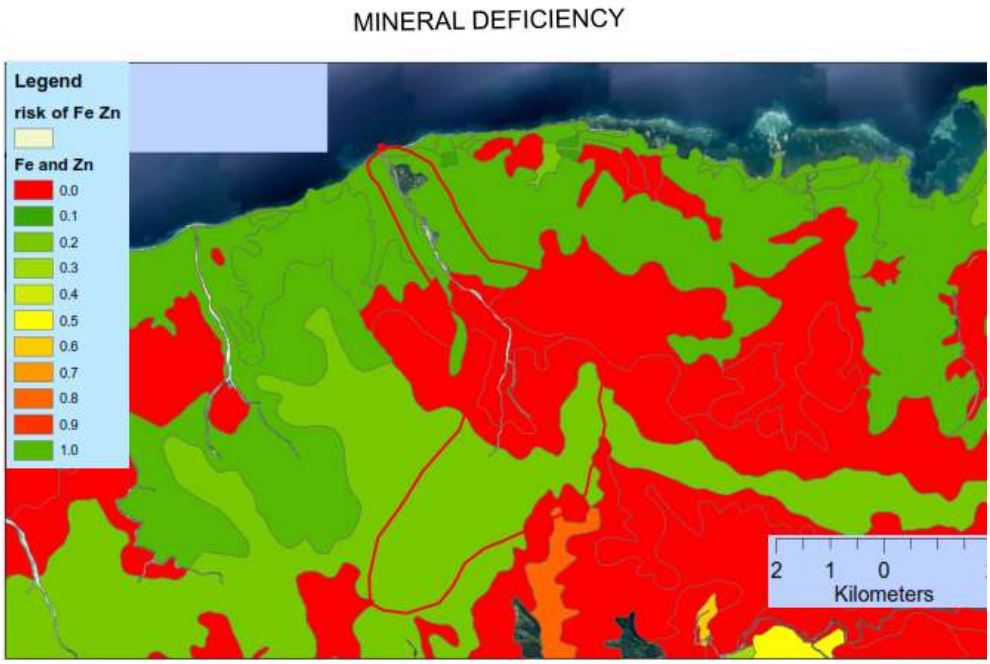
Understanding of the soil characteristics/properties can be very important for various purposes and applications, including the agriculture, water resources, contaminant transports, and others such as design and construction of the infrastructures. Soil type/texture around the project location was identified as sandy –loam and sandy soil, which is not suitable for agriculture crop production. The following map shows the soil texture map prepared for the purpose of agriculture development by the Ministry of Agriculture, Forestry and Fishery (MAFF, 2012). The data as presented in the following map was derived from the data points that were collected during the Portuguese administration. The data points were plot in the GIS and the spatial interpolation was made and the following maps can be produced.

Figure 7.20 Soil Texture Map



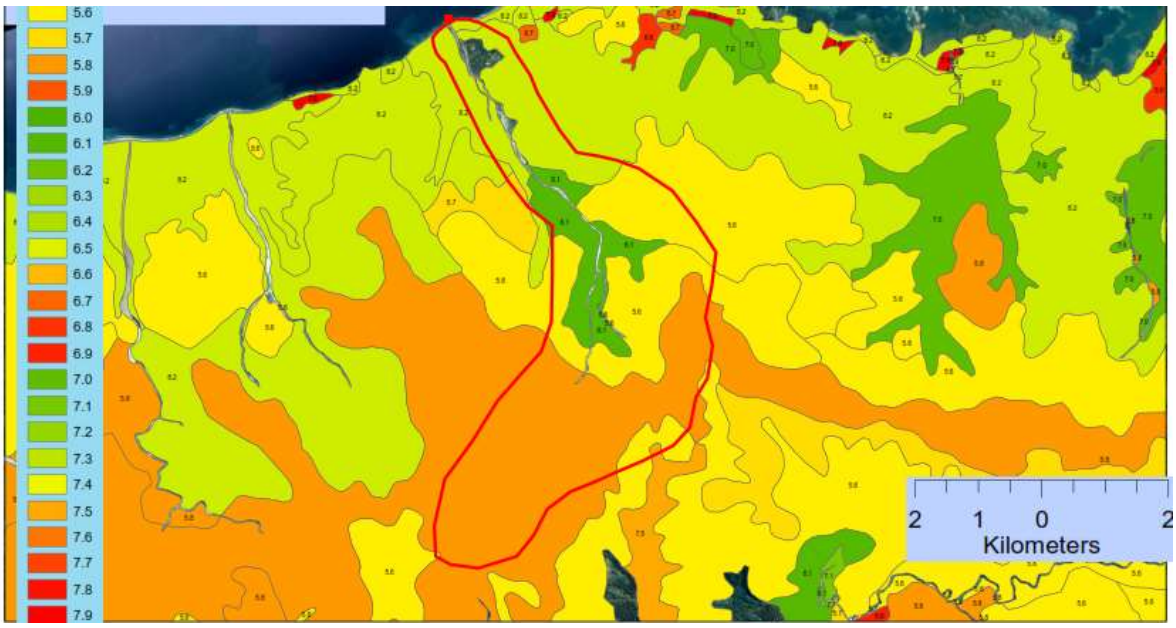
The direct observation of top soil in the project area indicated the result of soil type, which dominated by the sandy soil. The MAFF through the Seed of Life or SoL Program has also collected some of the data related to mineral deficiency in the soil which can be used as indicators for soil suitability for the agriculture purposes.

Figure 7.21 Soil Mineral Deficiency Map



In term of pH, secondary information for the project site indicated that the pH of the soil is around 6, which is acidic.

Figure. 7.22 PH Value of Top Soil



This type data is mainly useful for the agriculture application in determining the site suitability for certain crop to be adopted. Soil investigation will be conducted as part of this study to determine the soil

properties such as permeability, water retention, and the type of rock layer, total hydrocarbon, which may be useful in monitoring or estimating the transport coefficient of contaminant and other transport phenomena in the future. Furthermore, for the baseline soil quality data in relation to the petroleum hydrocarbon or chemical that related to the downstream petroleum product will be conducted by this study. The Total Petroleum Hydrocarbon (TPH) and Pb, are the main chemical parameters of the soil that will be measured through the sample collection and measurement in the laboratory

The authority, in this case, the ANPM, has asked the project proponent to provide the measurement also with the mineral contain in the soil, such as Mg, Zn, N_2, and Fe. However, given the nature of the proposed project is not related to this mentioned chemical element. These chemical elements are most relevant to the agriculture application. The most relevant chemical compound in the soil however, to the proposed development project is the total hydrocarbon, soil permeability, soil texture, type, water retention, and which will be measured as well by this project. Within the radius of 1 KM, 5 samples point of the top soil will be collected and the measurement of the total petroleum hydrocarbon (TPH), PH, and heavy metal compound (Pb). Furthermore, five soil samples within the project area will also be taken for the measurement of TPH, and Pb. The follow table shows the GPS coordinate of the location of sampling points.

Table. GPS Coordinate of Sampling Points

	FID	Shape	No	Name	X	Y	TPH	Pb
▶	0	Point	12	Soil1	125.384253	-8.568047	0	0
	1	Point	13	Soil2	125.383882	-8.567395	0	0
	2	Point	14	Soil3	125.383494	-8.568073	0	0
	3	Point	15	Soil4	125.382827	-8.568158	0	0
	4	Point	16	Soil5	125.383073	-8.568775	0	0
	5	Point	17	Soil6	125.376366	-8.573055	0	0
	6	Point	18	Soil7	125.380545	-8.570273	0	0
	7	Point	19	Soil8	125.384679	-8.57249	0	0
	8	Point	20	Soil9	125.387435	-8.566938	0	0
	9	Point	21	Soil10	125.393169	-8.565103	0	0

Figure 7.23. Soil Sampling Location within the Project Area

The method of sample taken is simple dig the soil up to the 50 cm depth and taken soil sample. Put the sample in the container to maintain the moisture level. Sample will be taken to the laboratory to measurement the desire parameters, which are the TPH and Pb. The methodology of parameters measurement in the laboratory consists of gravimetric and volumetric method. Detail location (including the exact location), detail of parameters measurement method will be presented as part of the EIS and EMP report

7.2.4 Meteorological Data

Meteorological data is very important information to be collected in order to support the proper planning and design of various supporting infrastructures, including the proposed development project. Long-term data collection would be required to provide reliable information for the design and construction of the system that related to the meteorological event and normally the data collection is the responsibility of the Government entities. Usually, the meteorological station should be established to collect the meteorological data.

Although, Timor – Leste Government has made a significant effort in the meteorological data collection, the availability for purpose of planning and design is limited in both space and time. This means that the time history of meteorological in a station could only be short (i.e. 1 or 2 years' time) or the space between station to the other station is very large, which become an issue of spatial representation of data utilization. The following important meteorological data, from the nearest stations, that already established to the project location will be reviewed and how to utilize certain data in the design of the system will be carried out by this study.

- Rainfall data

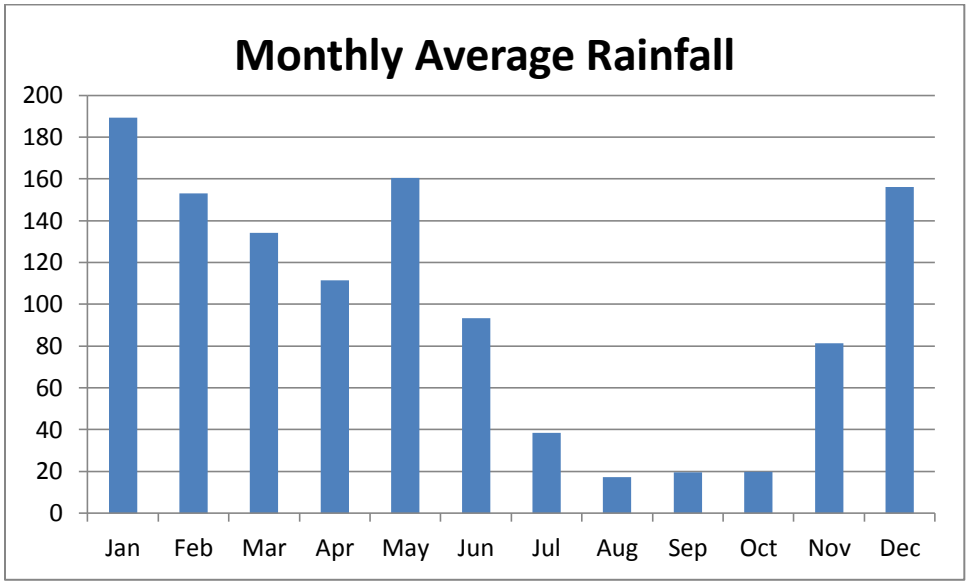
- Temperature data
- Relative humidity
- Evaporation
- Solar radiation
- Wind speed and direction

The meteorological data for Dili and Liquica area will be reviewed and utilization of the data, especially, the rainfall data would be important information to be analyzed reasonably for the purpose of the design and development. The following map shows the location of meteorological stations, nearby project location, where the data will be used in the absence of local data.

Figure 7.24. Location of Meteorological Data

Brief review of some historical record for the above mentioned meteorological parameters, within the proximity of project location is presented in this TOR. Rainfall pattern in Timor Leste is a seasonal dry tropical climate characterized by warm temperature and several months of dry period in each year. For Liquica area, rainy season is between November to March with average mean monthly rainfall from below 50mm to slightly higher than 100 mm.

Figure 7.9 Monthly Average Rainfall in Liquica Area



While the coastal area is seeing less rainfall, rain events in the mountain area could also affect the project, as it is located next to a river bed, where runoff from the mountain shall be discharged into the marine water as receiving water body. Compared to similar region such as Dili, which is also a coastal town with similar elevation range, the rainfall volume in Liquica could be higher by 50%, which can used as an indication for storm water drainage design and the magnitude of flooding in the nearby river.

The following table shows the comparison of annual average rainfall volume in adjacent areas of Liquica.

Table 7.5 Annual Average Rainfalls of Various Stations Adjacent to Dili

Station	**Annual Average Rainfall, mm**
Dili	940
Dare	1530
Ermera	1765
Liquica	1383

Source: Ministry of Infrastructure, 2010.

The above data indicated that IDF curve used in rainfall design in Liquica area should be 1.5 times higher than in Dili. For Dili, an IDF curve was developed as part of the preparation of a drainage master plan. This could be adopted in the flood flow estimation by this study by incorporating a factor of 1.5 to ensure a conservative estimation. Note that it is better to collect primary data for rainfall, however, in the absence of Government investment in rainfall station for the area, estimation such as the one proposed can used.

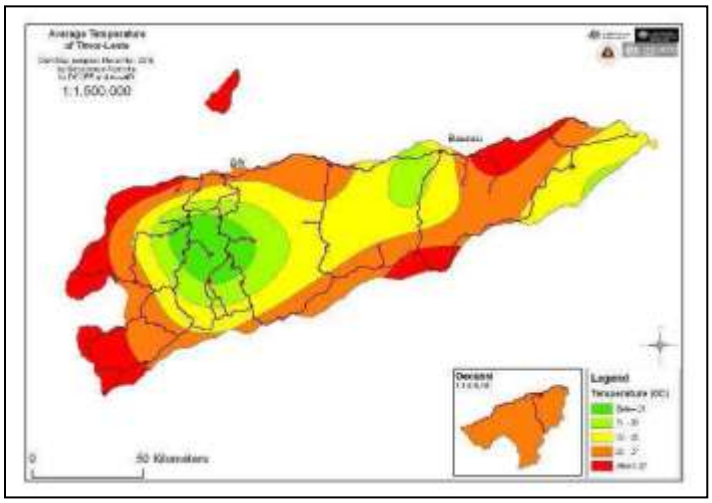
Maximum daily rainfall data recorded at ili airport station were used to update IDF curves developed by earlier efforts in 1994 and 2003 (The Government of Indonesia, 1994; GHD, 2003). Although available

rainfall record is in fairly short period (23 years), the data were used in the development of IDF curves because it is deemed a better starting point rather than adopting available IDF curves from other places. IDF curves adopted from other places may be more reliable because they were developed from long historical data with high temporal resolution. However, the curve may not reflect the actual condition of drainage system in the area. Another factor that is taken into consideration when using available local data is that showing how the data were utilized and how they should be improved will send a positive reinforcement to local authorities collecting the data and encourage them to improve data collection in the future.

Historical rainfall data collected in Dili airport between 1977 and 2010 were used to develop IDF curve for Dili drainage master plan work. Maximum daily value for a given year is selected as one data point. Using almost 23 years of data point, the average maximum and the standard deviation of daily rainfall volume can be calculated.

Timor Leste's temperatures vary considerably according to altitude with northern coastal areas typically registering the highest temperatures. The northern areas of the county from the coast to 600m elevation have an approximate annual average temperature of 24°C. The project is located in areas between Dili and Liquica is noted as having average daily temperatures above 27°C (see Figure 7.25).

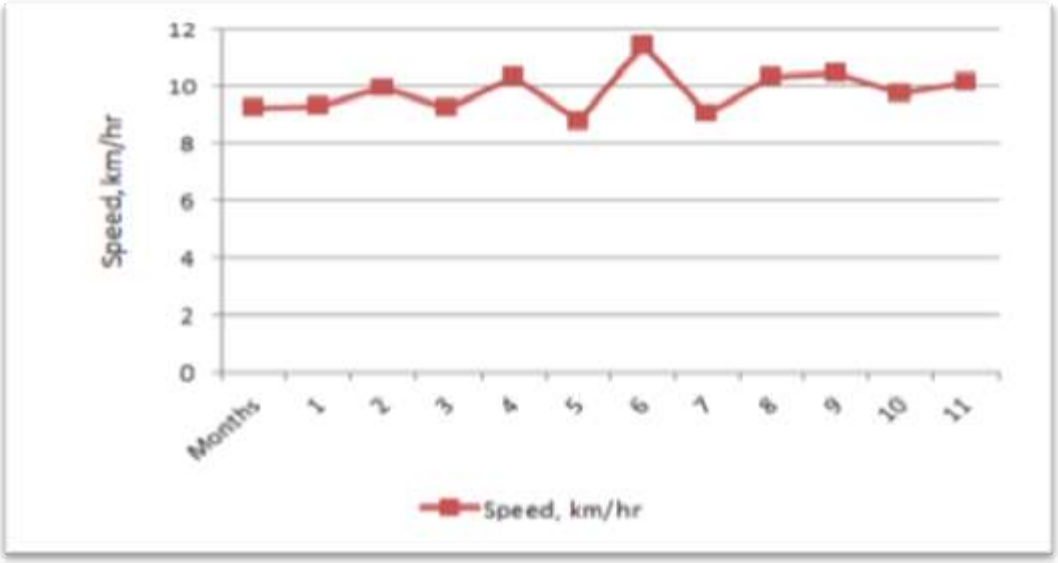
Figure 7.25 Average Daily Temperatures in Timor Leste



Source: Agriculture and Land-Use Geographic Information System Project, 2007

Wind speed in the country is typically mild between 8 and 12 km/hr. Elevated wind speed happened between June and July each year.

Figure 7.26 Average Monthly Wind Speed



Other climate factors such as solar radiation and evaporation rates could also an issue to be considered in designing the system to be resilient during the operation of the facility. However, these parameters are

mainly constant throughout the year and the impacts to the proposed development facility could be considered minor. The data availability of the climate and weather is still limited and therefore the engineering approximation and expert judgment in determining the design of climate related infrastructure would be very important.

Recently, Ministry of Agriculture and Fisheries (MAF) through the Seed of Life (SOL) has established automatic weather stations in various places in Timor – Leste, including in Liquica to collect the actual local data that will be useful in the development design standards to support the engineering design of infrastructure. The following map shows the location of the automatic weather stations around the project location. Climate related data from these stations will be obtained, used in the analysis and reported in the EIS.

Figure 7.27 Map of Auto weather Stations

More detail information on the utilization of the metrological data for the analysis, especially for the hydrological modeling will be presented in the EMP and EIS.

7.2.5 Groundwater

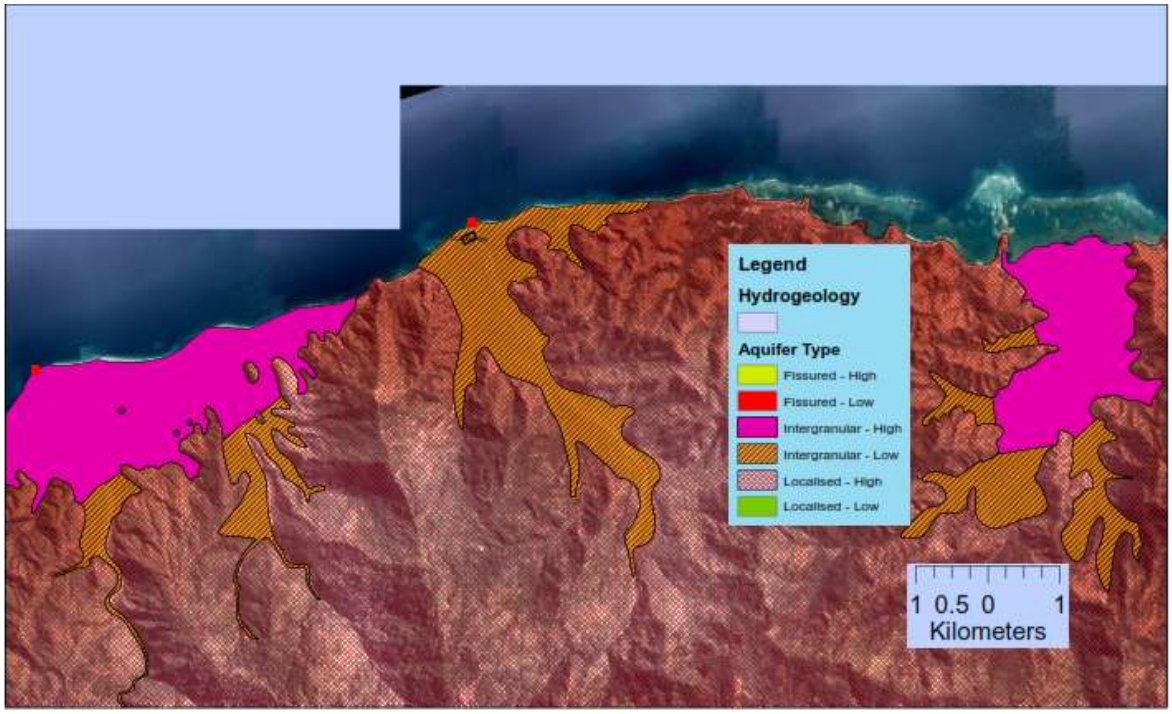
Groundwater aquifer is a very important water resources storage that provides the clean water with the very high quality, except that the water is several meters under the ground surface. In order to utilize the groundwater, one has to construct the groundwater well and install all the necessary pumping system to transport water from the aquifer to the manmade storage that usually human installed above the ground surface. Groundwater availability, in a certain area, shall be depended on the type of aquifer, as underground storage, rainfall amount that infiltrate into the groundwater, as recharge rate, and other hydrogeological phenomena, that transport water from one aquifer to the other.

Field visit to the project location indicated that groundwater is most common water resource utilized by nearby residents, as well as private businesses nearby.

. Figure 7.28 Shallow Water Well Near Project Location

However, investigation on the groundwater resources shall be required in order to know the groundwater potential in the local aquifer. Knowing the potential resource availability is very important information so that the groundwater resource utilization shall be sustainable. The hydro-geological information in the project area, as presented in the section 7.2.2, that the type of lithology in the project area has potential groundwater availability.

Figure 7.29. Aquifer Type of Groundwater in the Project Location



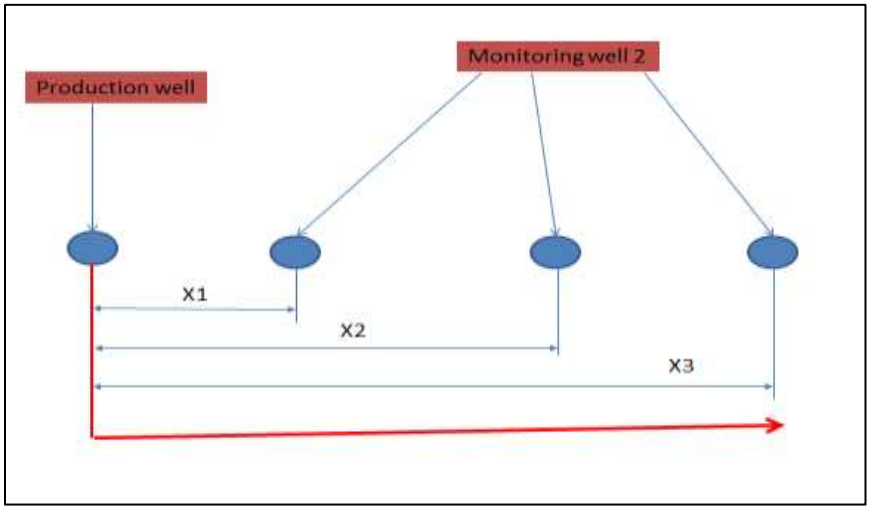
Groundwater will be the main water supply source for the proposed development. Although the capacity requirement of the water demand is fairly small, at the 2000 L/day, testing of the groundwater sources (quantity) and quality will be conducted. A pumping test will be conducted as part of the study to determine the sustainable yield of groundwater aquifer in the project location.

Moreover, the quality of the groundwater will be measured at DNSA laboratory to determine if any treatment of the groundwater is needed to fulfill the needs of the project. Currently, a shallow well exists in the site, however, a deep groundwater production well and one groundwater monitoring wells will also be constructed. The pumping test will be conducted during the construction of the two wells to determine sustainable pumping yield.

Proposed pumping test will be conducted for several scenarios:

- Pumping Rate variations with constant time against constant distance of monitoring well
- Constant pumping rate with variations over the distance

Figure 7.30 Proposed Pumping Test Works



The pumping test will provides the data of the local aquifer conditions and the impact of pumping to the water level drop in the aquifer (determine through observation of the monitoring wells). This analysis will be used as basis to propose mitigation measures in order to minimize impacts during operation of the storage facility. The method of pumping test can be described briefly as follow:

7.2.5.1 **Pumping variation and monitoring at X =**0

Under this setting, the pumping at various rate (30 L/min, 60 L/min, and 120 L/min) will be applied and monitor the drawdown level in the well. The sensor will be installed inside the well. The continuous pumping for 24 hours will be conducted. The water level monitoring from logger will be download for the analysis.

The expected data will be:

- Time series of aquifer level versus pumping rate
- Maximum aquifer level drop by various pumping rate

7.2.5.2 Pumping variation at X =0 and monitoring at X = X1

The same pumping at various rates (30 L/min, 60 L/min, and 240 L/min) will be applied. However, monitoring of drawdown level will be done at the distance of X1 (to be determined) of monitoring well. The sensor will be installed inside the monitoring well. The continuous pumping for 24 hours will be conducted. The water level monitoring from logger will be download for the analysis.

The expected data will be:

- Time series of aquifer level versus pumping rate
- Maximum aquifer level drop by various pumping rate

7.2.5.3 Pumping variation at X =0 and monitoring at X = X2

The same pumping at various rates (30 L/min, 60 L/min, and 240 L/min) will be applied. However, monitoring of drawdown level will be done at the distance of X_2 (to be determined) of monitoring well. The sensor will be installed inside the monitoring well. This monitoring will at the well belong to the community so that the impact of the pumping to the community well (shallow well) will be studied

The continuous pumping for 24 hours will be conducted. The water level monitoring from logger will be download for the analysis. The expected data will be:

- Time series of aquifer level versus pumping rate
- Maximum aquifer level drop by various pumping rate

The water quality testing for wells surrounding in the project location will also be conducted. The following wells have been identified as the groundwater source utilized by local community surrounding project site (Figure 7.38). Exact location (geographic coordinates) of the wells is provided in the following table.

Figure 7.31 Locations of Community Wells

Table7.8 Location of Existing Groundwater Wells

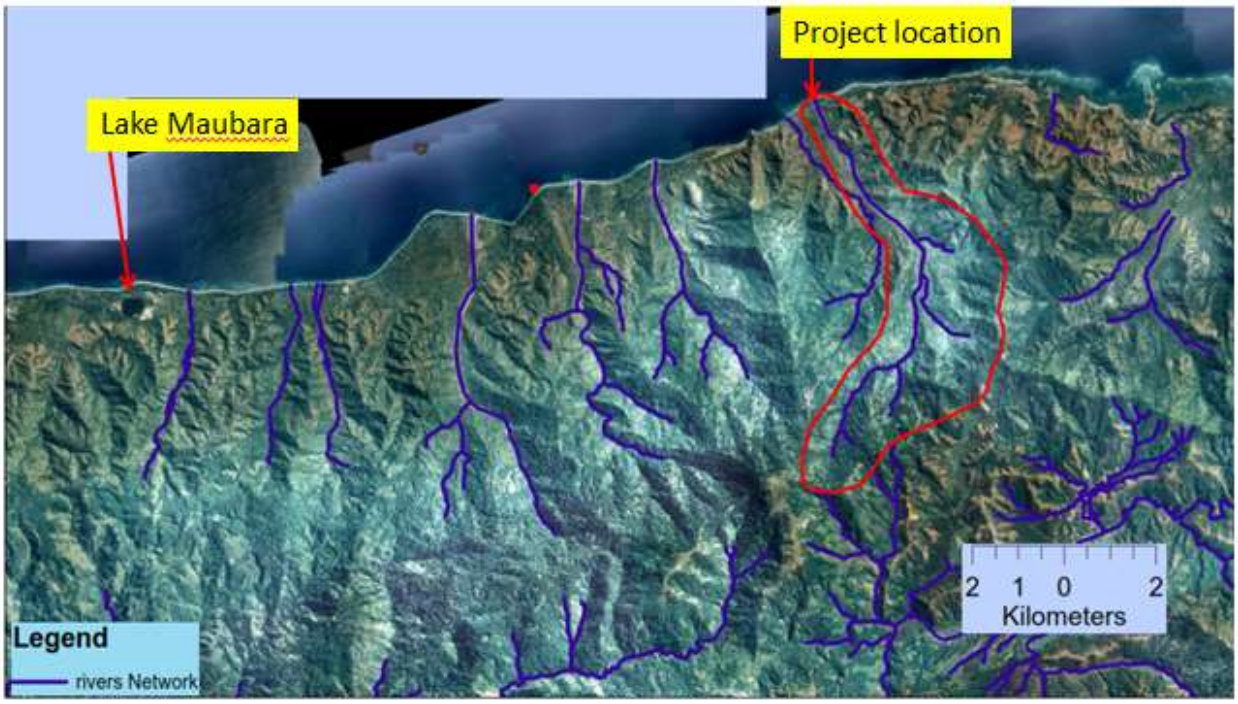
No	Name	X	Y
1	Community 1	125.399	-8.594
2	Global	125.383	-8.568
3	Community 2	125.383	-8.572
4	Company	125.391	-8.581
5	Timor Cement	125.385	-8.568

In addition to the pumping test study, the sample of groundwater from each well will be taken for the measurement of physical, chemical, heavy metal, and biological parameters. Two pumping well will be constructed and location will be determined, which will be used as testing point of the pumping. The quality of these five identified wells plus the additional two wells will be measured as part of the EIA study. Further detail methodology of pumping test, quality measurement, and result and other related analysis, such as sustainable estimation based on the water consumption will be presented in the EIS and EMP documents

7.2.6 Hydrology and Surface Water

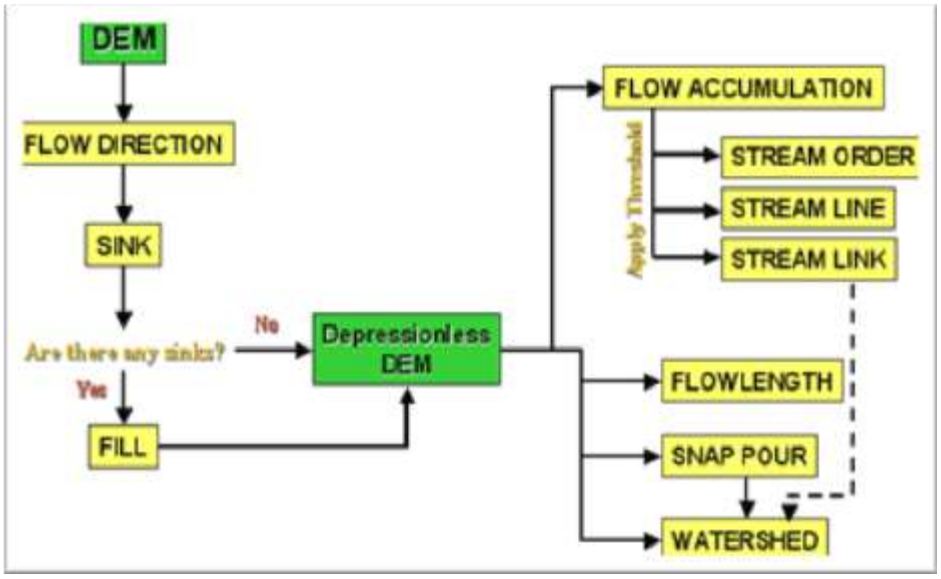
The main water course besides the marine water in the project location is the surface and groundwater systems. The following map shows the catchment system where project facility is located. The river network within the catchment system is mainly dry throughout the year, except during the rainy day, where flashflood could potentially become an issue in the project location.

Figure 7.32 Catchment and Surface Water System



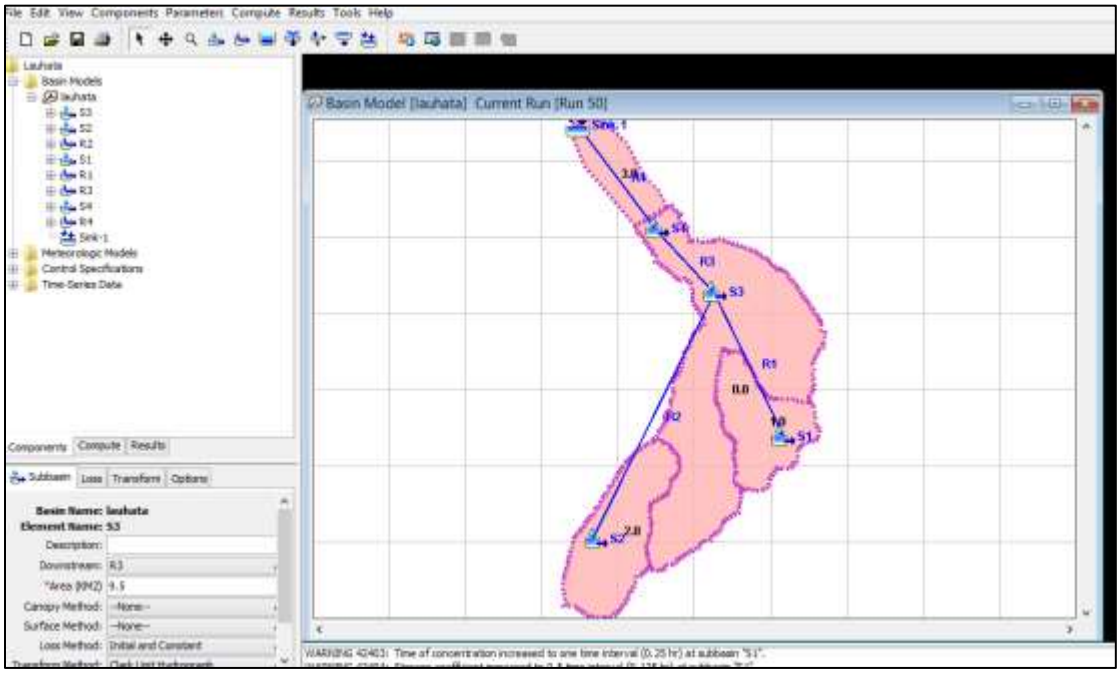
Flooding is one of the important natural hazards that need to be investigated as part of the preparatory study. Worst case scenarios that the project could face is high frequency rainfall occurring at the same time as high tide conditions, that will produce major inundation in the coastal area. Flood water from the upland catchment meets the coastal inundation which could undermine the existence of the project. While most rivers are mainly dry except during the rainy season where river carries storm runoff generated from the upland catchment. In order to estimate the flooding rate in any catchment system, the catchment as system would need to be determined. As described from the previous section (7.2.2) that the DEM is the most common use of data to determine accurately the catchment system. Using the GIS method and DEM the catchment of Lauhata can be determined. The methodology of catchment estimation based GIS method can be summarized as followed:

Figure 7.33. Summary of Catchment Definition in GIS



The result of the above methodology is the catchment with the parameters required for the hydrological modeling system. The hydrological modeling software using by this study is the one derived by US. Army Corp of Engineers or HEC-HMS modelling package to perform the flood flow estimation.

Figure 7.34 Example of HEC-HMS



Important model parameters to be considered in the modeling are:

- Area of each sub-catchment

- Average slope
- % of impervious area
- Time of concentration
- Lag time

Using the GIS tools and topographic data defined earlier, important hydrological model parameters can be determined. The output of the hydrological model will be used in the hydraulic modeling to assess flooding risk that the catchment contributes to the project area during the operation of the proposed development facility. Particularly, the high rainfall frequency such as 50 –years of rainfall would likely to produce a high flow/flooding in the river and potentially produces overflow in the bridge, as the bridge is assessed as bottle neck of the river flow. Preliminary assessment of river condition indicated that the natural river has larger capacity to retain high flow of flood water, except at the bridge, that act as bottleneck to the flow. Overflow will likely occur in this bridge. The following pictures provide the geomorphology of the river.

Figure 7.35 Width of River at Upstream Location

The assessment indicated that the width of the river was estimated to be around 70 m the average depth of 1.8 m, which shows the river has a very large capacity.

Figure 7.36 Flow Bottleneck at Existing Bridge

The downstream of river section on the other hand, shows that the river capacity getting smaller. Information from the local population suggested that at one time, overflow occurs in the road, as the carrying capacity of cross section under the bridge is much smaller than the upstream or downstream cross section.

Figure 7. 37River Downstream Location

Surface water from the river near the project site is only available during the rainy day. Few hours after the rain, the river goes back to dry. Some further upstream along the catchment, there is spring water utilized by local population as water source. As a prolonged dry season progress, the spring water will also dry out. Samples will be taken from both the spring water and the river during rainy days to measure water quality. Test will be conducted locally at DNSA laboratory. The method of sample taken basically putting/catching the storm water flow in the river during the rainy day and bring to the laboratory for further measurement. The physical, chemical, heavy metal parameters will be measured within the storm runoff, which will provide the baseline information for the future reference. Particularly, the Total Petroleum Hydrocarbon (TPH) will be measured, in order to understand if there shall be any existing activity that polluted the ground surface and washed off by the storm runoff.

In general two methods shall be applied to estimate the TPH and Pb in the sample:

- Gravimetric Method, which is to measure the weight of sample and moisture
- Volumetric method, which to measure the volume of the sample to measure in the instrument for reading the TPH and Pb

Further detail of measurement on the methodology and how the working related instrument will be presented in the EIS and EMP

7.2.7 Coastal Hydrology

Coastal hydrology deals with the water movement in the coastal area. As the project will be located in the coastal area, the understanding of hydrological process in the coastal region could be important and significant. The project can be affected by the water movement in the coastal area, such as coastal inundation, which in the very large event, can be considered as tsunami and vice versa, the project may contribute negatively to the coastal hydrological process itself, such as contaminant transport to the coastal water that eventually spread-out into the wider coverage area. Therefore, study and investigation of hydrological coastal process can be significant to the project development.

The hydrological process (rainfall-runoff), as described from the previous section, shall contribute the runoff to the coastal water body. However, for the project, coastal, area is mainly the beach, where the main hydrological process, is affected by the low and high tides. During the low tide, the coastal shall not be inundated, so storm runoff coming from the upland catchment, shall not contribute any major impact, unless at the very large storm such as 50 –years of ARI. On the other, during the high tide, thee coastal hydrological event can affect the project, as coastal tends to be inundated. The situation could be major one, with high storm surge occur, during the high tide. In this case, the project location could be indicated. Furthermore, coastal hydrological process can also deal with the contaminant transport from the land based area to the coastal and eventually polluted the marine water.

Therefore, it is important to study the flooding flow from the upland catchment system and high tide the sea water movement inland is significant, to understand the wave/tidal impact to the sustainability of the project during the operation. The contaminant transport related to the project (oil spill, etc.), can also contribute a significant impacts to the marine water body. The result of the study will be used to properly design the floor level of the project area, to minimize the coastal flooding.

The important data and information required to carry out the coastal hydrological assessment related to the project development can be summarized as followed:

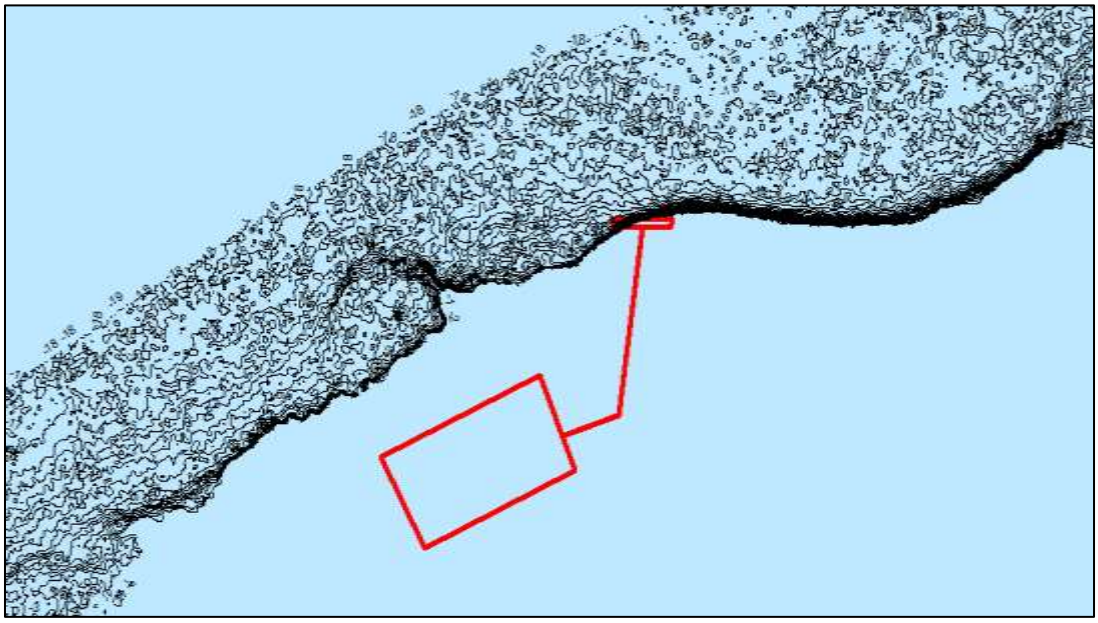
- Bathymetric
- Ocean current direction
- Tide measurement

As the above data is expensive to be collected, in this study, secondary data will be sufficient to approximate the process and draw the conclusion, so that marginal safety in the design can be taken in order to minimize the impacts that may occur during the operation of the proposed development project. The limited measurement of the tide will be conducted by this study to measure directly the low and high tide, which can be used as information to design the floor level and other coastal protection structure needed to help reduce the risk during the operation.

Bathymetric

Understanding the bathymetric profile is very important for various purposes in engineering design for the purpose of navigation. The proposed project will incorporate the use of existing jetty with clear navigational route where ships have docked. Therefore the bathymetric and marine hydrodynamic investigation will be conducted for the purpose of analysis of pollutant transport. The following bathymetric data was derived from satellite images, done by NOAA in 2014.

Figure 7.38 Bathymetric Data for the fuel Spill Modeling



The information will be used for proper design of the coastal protection system to ensure that safety operation of the propose development facility. As the data only cover the shallow water up to the depth of 20 meter, other secondary data of bathymetric would be need, especially, for the purpose of marine hydrodynamic modeling to estimate the widespread of oil spill in the jetty. For this case, the bathymetry from the US NOAA GEODAS can be used. The interpolation of water depth will be made. Further detail information related to marine hydrodynamic modeling related to the oil spill will be presented as part of the EIS and EMP reports

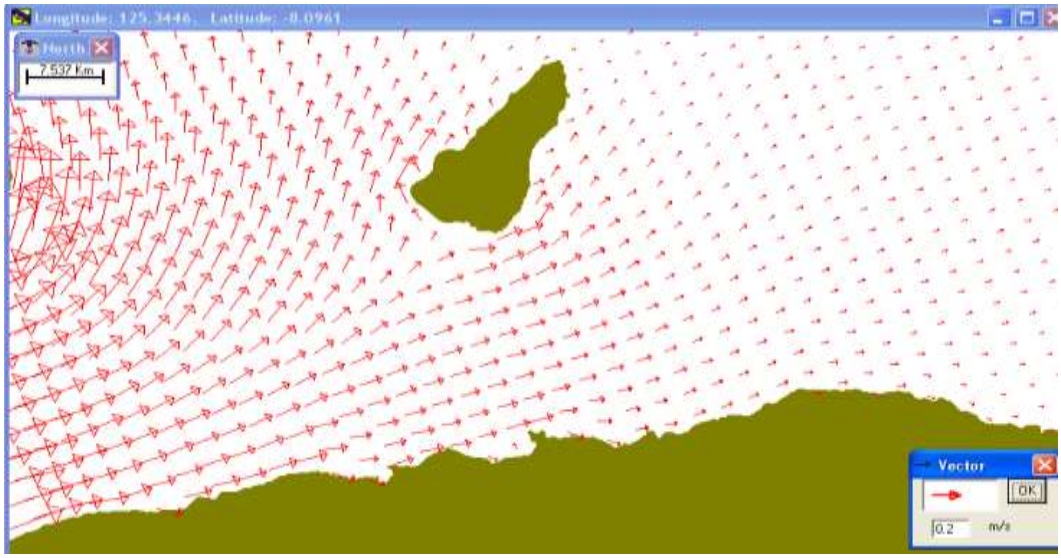
Marine Hydrodynamic

Important marine hydrodynamic data to be collected area low and high tides, ocean current, temperature, and other physical and chemical properties of the ocean. The temporary tide gauge will be established the collect the data of high and low tides and current of the ocean flow. The location of measurement will be

selected to installed sensor safety for data collection. Potential spot would be at the existing jetty support or pillars. Further detail on the measurement of tidal, is presented in the section 7.3.10.

Other marine hydrodynamic data such as wind and ocean current shall be extracted through the computational domain by NOAA with global surface data. The Ocean current for instance, can be derived from the global observation in the Ombai Strait

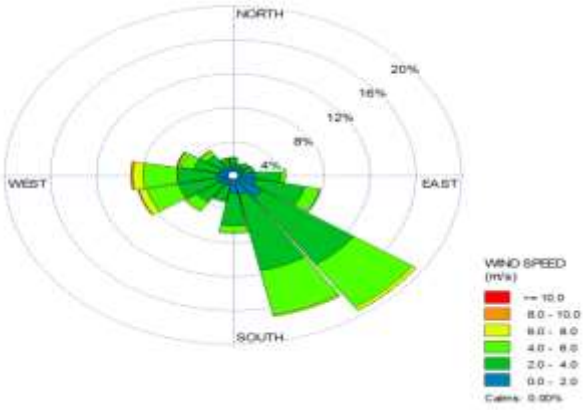
Figure 7.39. Ocean Current for West Season in the Vicinity



The above hydrodynamic data should be useful in performing the marine hydrodynamic modeling to calculate the movement of the oil in the sea due to spill. The current and direction however change from one season to the next.

The wind speed and direction are also very important factor to considered, not only for the modeling purpose, but also useful during the operation of the proposed development facility. The observed data is very limited however, some computational data was derived from the global data at the US. National Oceanic and Atmospheric Administration (NOAA). The version used in this study is NCEP Reanalysis 2, NOAA/NCDC blended daily in surface wind. Similar to ocean current, the wind speed and direction would also variable from season to the other. The following figure presented the approximation of the speed and direction of the wind.\

Figure 7.40. Wind Rose at Area Study (derived from NOAA surface data)



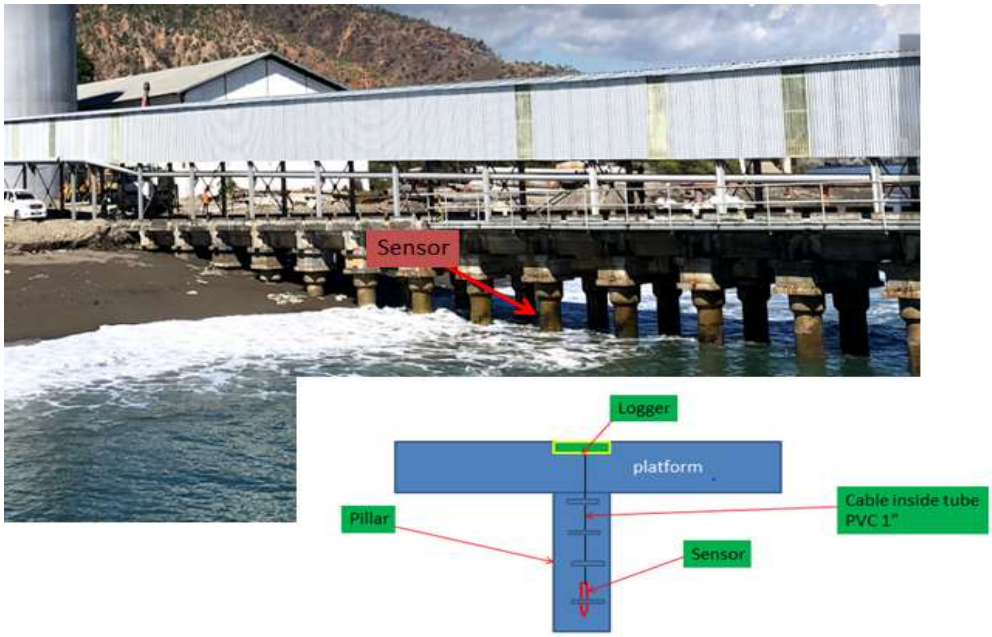
More detail information related to marine hydrodynamic modeling shall be presented in the EIS and EMP report.

Tidal Level Measurement

As part of the study, data collection will be conducted on tidal level. Tide gauge will be installed at the existing jetty at the bottom of jetty platform with data collected every 15 minutes for a total of one month observation. Results are used in the analysis for coastal surge in order to adjust the floor level height and any necessary coastal protection structure.

Figure 7.41 Location of Proposed Tide Gauge

Figure. 7.42 Installation of Tidal Gauge



The measurement method is based on the hydraulic pressure that measured by the automatic sensor, installed under existing bridge of the jetty. The water depth, shall be calculated by the following equation, which should be done automatically by the instrument and store the data inside the data logger.

$$P = \rho g H$$

Where P = hydraulic pressure

ρ = density of sea water

G = gravity acceleration rate (= 10)

The method of measurement by installing the water level sensor and monitor the height of the water level overtime. The data logger will store the time series of the data and anytime the data can be downloading via mobile phone. Detail data, location of data collection, and data will be presented as part of the EIS and EMP

7.2.8 Bed Sediment Contamination

Bottom sediment quality measurement, particularly, related to the pollutant contributed by the petroleum related product is very important to establish the baseline information for the regulator and project owner to monitor and evaluate the impact of the project during the operation and maintenance. The likely pollutant that contributed by the fuel storage operation is total petroleum hydrocarbon and lead, will be measured in the bottom sediment quality in the coastal area. In case of oil spill in the jetty or pollutant

contribution from the fuel storage operation, the current will deploy all the pollutant into the coastline. Therefore, the measurement of the bottom sediment quality in the coastal area is important baseline information. The following map shows the proposed sampling data collection of the bottom sediment.

Figure 7.43. Proposed Sampling Location of Bottom Sediment in Costal Area

The sample of sediment will collected during the low tide condition and sample shall be stored in the plastic container that is properly seal in order to maintain the same moisture level in the field condition and during the measurement. The collected sample shall be brought to the certified laboratory to measure the TPH and Pb. The methodology is to take the sediment sample in the designated location and stored inside the storage (plastic container) that has proper seal to maintain the moisture condition. The samples are taken to the laboratory for the measurement.

In general two methods shall be applied to estimate the TPH and Pb in the sample:

- Gravimetric Method, which is to measure the weight of sample and moisture
- Volumetric method, which to measure the volume of the sample to measure in the instrument for reading the TPH and Pb

Further detail information on how the sample will be measured, instrumentation, and result of the measurement will be presented as the part of the EIS and EMP documents

7.2.9 Sea Harbor Water Quality

Marine water quality/sea water quality is very important baseline environmental information to be provided for the future reference, due to the nature of the project that will potentially affect the marine water. If the marine water is polluted by the petroleum products, the quality of marine water body will be affected. In order to know, the impact of the project during the operation, if there shall be any pollutant contributor, then the comparison of the current quality and baseline quality should be done.

Figure 7.44 Sampling Locations of Marine Water Quality

Marine water quality sampling will be conducted for 5 sampling points in the radius of 15 KMs east and west boudary. The paramters measured will incldued the following:

- Phyiscal parameters, such as, Temperature, turbidity,
- Chemical paramters such as total hydrocarbon, heavy metal, etc.
- Biological Indicator of econsystem,

Total 21 paramters will be measured by this study, as baseline information that describe the marine water quality indicators. The following table shows the total parameters to be measured.

Table 7.7. List of Marine Water Quality Parameters to be measured

No	Parameter	Unit	Standard*
	Physical		
1	Turbidity	NTU	>3
2	Smell	-	-
3	Suspended Solid	mg/L	80
4	Solid Waste	-	0
5	Temperature	0C	Natural
6	Oil Layer	-	0
	Chemical		
1	pH	-	6.5 – 8.5
2	Salinity	0/00	Natural
3	Total Amonia	mg/L NH3-N	0.3
4	Sulfida	mg/L H2S	0.03
5	Total Petroleum Hydrocarbon	mg/L	1.00

6	Total Fenol	mg/L	0.002
8	Surfactan (deterjen)	mg/L LAS	1.00
9	Oil and Fat	mg/L	5.00
10	TBT (tri butyl tin)	mg/L	0.01
Heavy Metal			
1	Mercury	mg/L Hg	0.003
2	Copper	mg/L Cu	0.05
3	Zinc	mg/L Zn	0.1
4	Cadmium	mg/L Cd	0.01
5	Lead	mg/L Pb	0.05
Biological			
1	Benthic Composition	MPN/100 mL	1000

The sample of water was taken and put in glass bottle that already prepare and put inside the cool box to maitain the temperature level. The sample will be brougt to the certified laboatory in Bandung Institute of Tehcnology (ITB) for the meaaurement.

Some meaaurement such as PH, Salinity, were meaaured directyl by using the handheld intrument. Further detail desception on the measruement method and the principle of instrumentation will be presented later in the EIS and EMP

7.2.10 Marine or Coastal Ecology

Important coastal resources such as mangrove, coral and fisheries are at risk from negative impacts from the development. This is especially related to potential pollutant loading from proposed development facility. Particularly, in the case of oil spill, where oil enters the marine waterbody and transported through longshore current into the surrounding coastal resources, the magnitude of impacts should be able to be estimated to certain level. For this purpose, baseline data collection will be conducted on the coral, mangrove as well as physical, chemical and biological characteristics of the marine water.

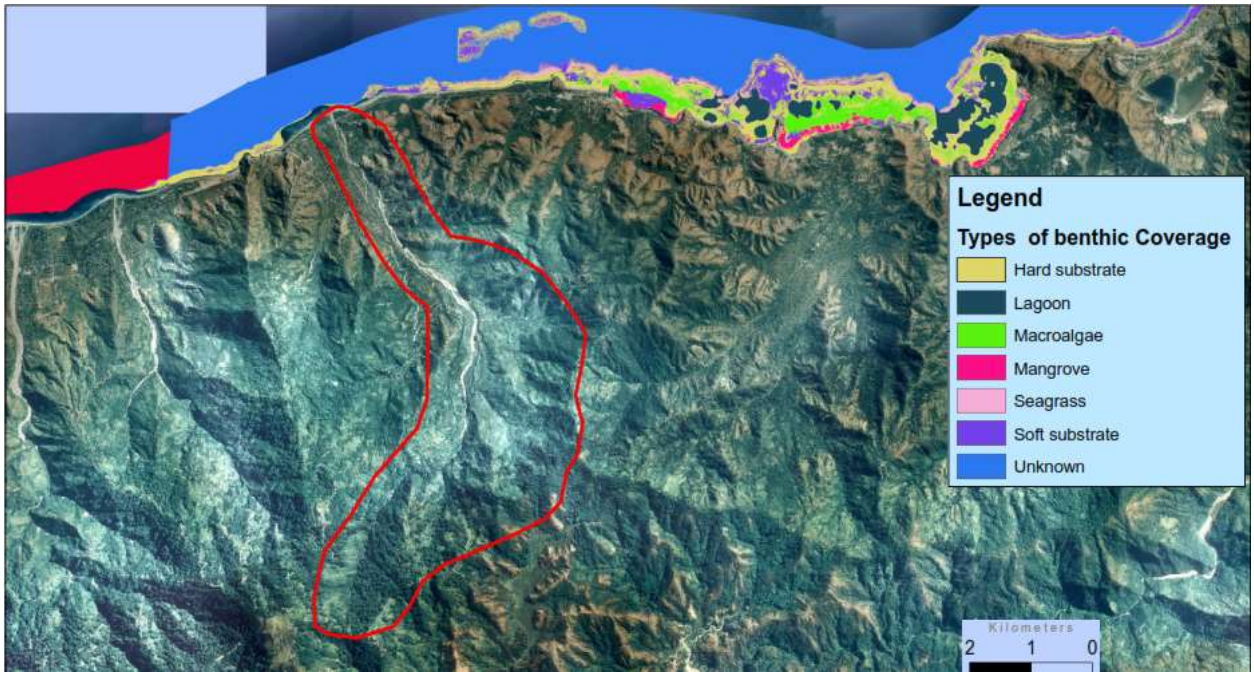
Benthic composition test will also be conducted as an indicator for sediment environmental health. The following coastal resources have been identified preliminary as important information to be assessed and surveyed:

1. Fisheries data collection with the method of direct survey by diver in the selected spot in the study area
2. Coral survey: The method of data collection is secondary data overall and selected spot survey by diver
3. Seagrass The method of data collection is secondary data overall and selected spot survey by diver
4. Mangrove, which will be collected by the visual observation and secondary data that already collected by past studies

5. Other bio-diversity (benthos, plankton, etc.), sample taken for bottom sediment and measurement the laboratory

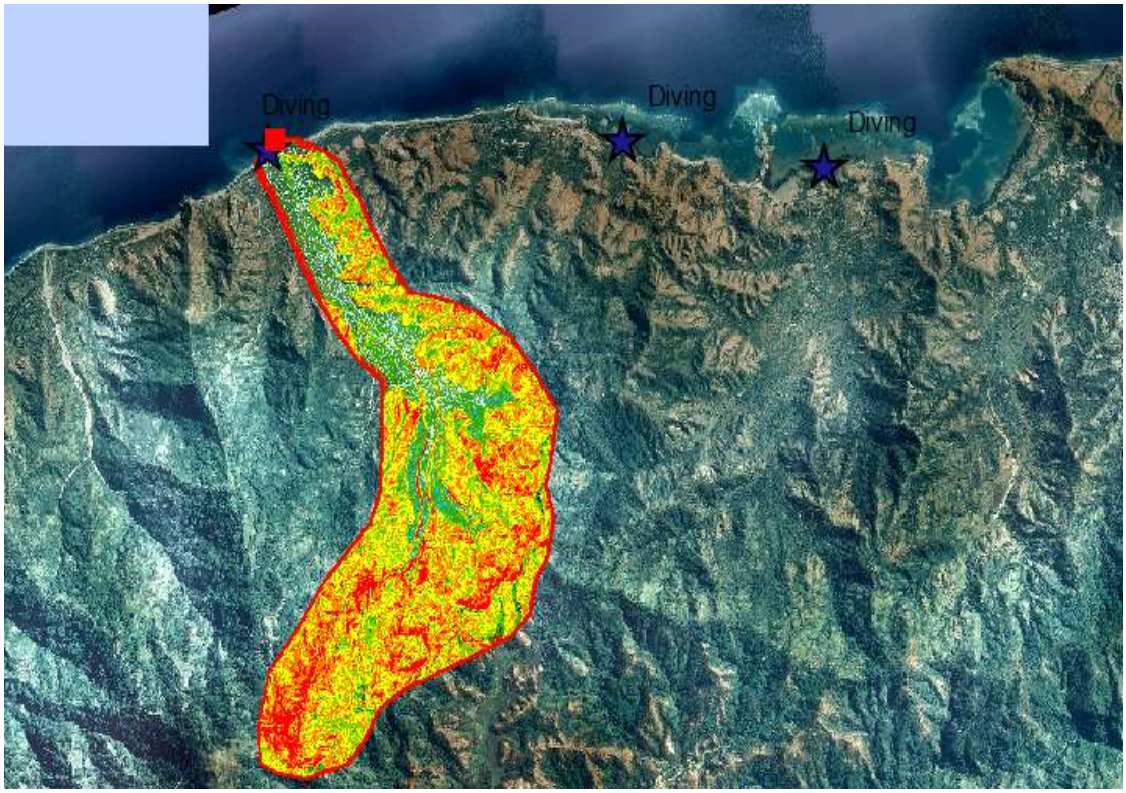
The secondary information from the NOAA – Coral Reef Coastal Assesment from 2013 – 2016 for north shore of Timor – Leste will be used. Particularly, related to the coastal resources that will be affected by the project, as mentioned above. The following map shows the coastal ecological resource assesment by NOAA from 2013 – 2016, which will be used as baseline information for coastal resource identification by this study.

Figure 7.45. Coastal Resources Identification in around the Project Area



Morover, the diver team will be mobilized in order to check in the verify and map out the marine habitat, such as coral and other marine resources such as benthos, fishes, seagrass, mangrove, and any flora and flauna that should be impacted by the project during the operation stage. Especially, the diving acitivty will be conducted within the radius of 1 KM boundary of project location.

Figure 7.46. Proposed Diving Spot to collect the Marine Ecological Resource for validation



These measured data will be used a complement existing data that have been collected by NOAA coastal research program. The data related to marine ecosystem such as magrove, coral, benthic, seagrass, and other flora and fauna will be conducted in each sampling sites which is thought to be representative of the area within 15 km radius

7.2.11 Terrestrial Flora and Fauna in the Vicinity

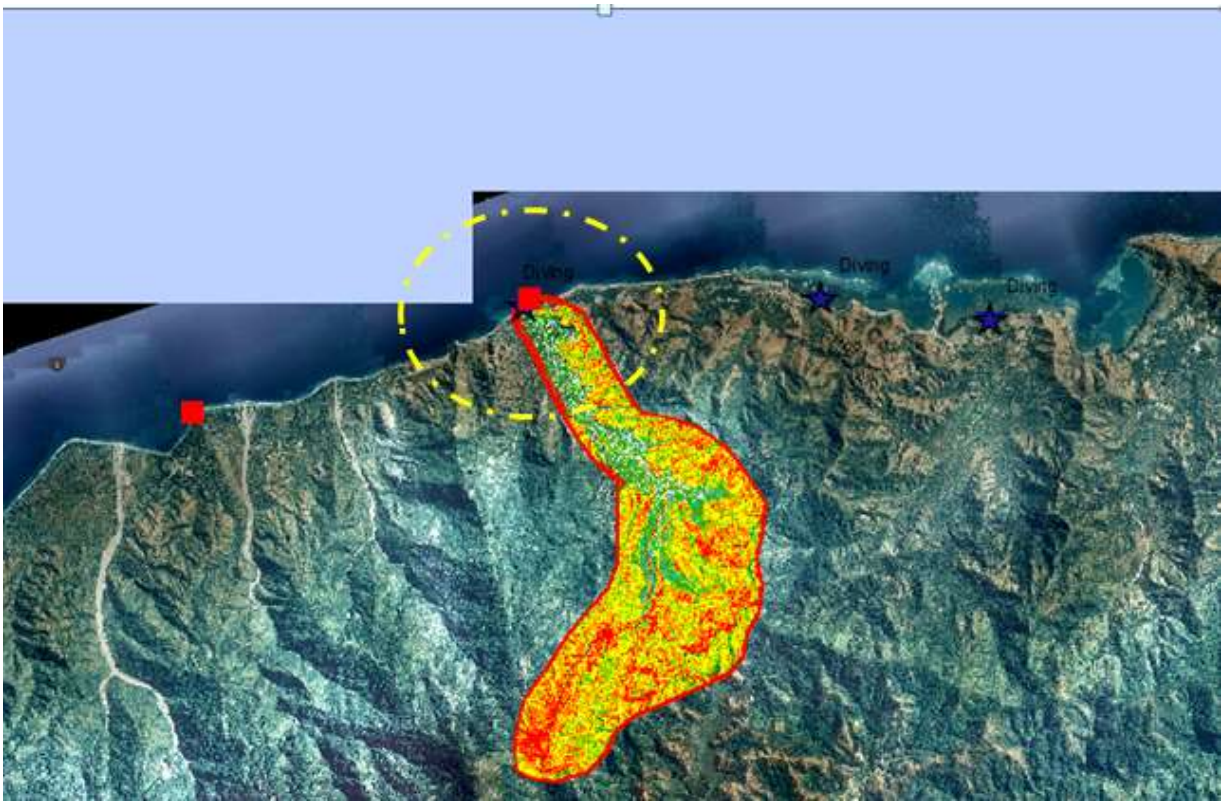
Terrestrial vegetation is mainly dominated by bushes and fast growing trees planted and used by local people as firewood. With the steep terrain of hill and less vegetation on the mountain side, ground condition is susceptible to higher erosion rate contributing sediment into the river and marine water body. More reforestation of the upland catchment would probably be needed in order to reduce erosion rate as well as retaining water in the upland catchment for the groundwater aquifer recharge.

The fauna on the other will also be further investigated in more detail to include assessment to the type of vegetation, birds, mammals, bats, reptiles, insect, and other assessment if there is any endangered species around the proximity of project location. The field works will be conducted by direct observation to know the type of plants, animal, wildlife, and other terrestrial flora and faunas within the boundary of the project area. Preliminary site investigation indicated that large animals consisted of domesticated animals such as cows, pigs, dogs, mainly associated with residential population nearby.

Figure 7.47 Examples of Existing Trees on Project Site

The following map shows the assessment area of the terrestrial flora and fauna, which will be conducted by this study.

Figure. 7.48 Boundary Study of Biological Assessment



Further detail assessment on the terrestrial flora and fauna around the project boundary will be investigated by this study and results will be presented in the EIS and EMP

7.2.12 Air Quality

The World Bank assessment on outdoor air pollution in Timor Leste (2009) noted that air pollution is currently not a major concern in Timor Leste where problems are usually localized and temporary relevant to activities that may be completed at a certain period of time, e.g. construction activities. Sources of air pollution in Timor Leste are typically:

1. Particulate Matter (PM) from construction activity, lack of road maintenance and clean-up program, forest fire.
2. Gas emission from vehicular movement and operation of power plant.

Air pollution from vehicle combustion starting to be of concern in the Capital Dili and other main roads due to the increasing number of cars, trucks and other vehicles. Air quality is commonly measured in terms of concentrations of NO_2, SO_2 , Particulate Matter (PM_{10}, $PM_{2.5}$) and Ozone. The following table contains WHO ambient air quality guidelines, which could be adopted in Timor – Leste in substitute of the national air quality standards currently unavailable.

Table 7.6 WHO Ambient Air Quality Guidelines

Parameter	**Average Period**	**Guideline Value (µg/m^3)**
Sulfur dioxide (SO_2)	24-hour	20
	10 minute	500
Nitrogen dioxide (NO_2)	1-year	40
	1-hour	200
PM_{10}	1-year	20
	24-hour	50
$PM_{2.5}$	1-year	10
	24-hour	25
Ozone	8-hour daily maximum	100

Source: IFC, http://www.ifc.org/

As the nature of the proposed project will contribute gas emission to the atmosphere, such as SOx, NOx, and CO_2, baseline data collection on these mentioned gases would be important. Baseline data will provide important information as reference prior to the commencement of the project.

As part of the study, baseline air quality measurement will be conducted to measure and monitor existing baseline air quality conditions. The following map shows project location in relation to potential sensitive receptors that could be affected by the emission from the project during construction and operation stages.

Figure 7.49 Project Location and Potential Receptor Location

1) Prisao Do Ai Pelo	260 meters
2) Residential Area	350 meters
3) Pathways	70 meters
4) Vida Diak Petrol Station	230 meters
5) Cement Timor	222 meters
6) Communities	91 meters

Methodology for baseline data collection would consist of 24-hour monitoring of air quality parameters and sampling. Samples were processed in certified laboratory[1] for air quality paramenters. The following map procides the proposed sampling points for air quality measurement.

[1] Air Quality Laboratory at Bandung Institute of Technology

Figure 7.50 Proposed Monitoring and Measurement of Air Quality Sampling

The air quality parameters indicator in term of PM2.5, PM10, NOx, Sox, and CO_2, as indicated from the previous section will be measured by this field investigation. The measured parameters of SOx, CO2, and NOx, was done in the field by using the field instrument that monitor and taken the data of these parameters directly.

While, the sample of particular matter (PM) was taken by filtering the air that flow through the filter (with the size). That filter that already retain particulate matter (PM 2.5 and PM 10) shall be brought to the laboratory for further analysis. The observation will be conducted for 24 hours and the filter will be placed inside the tight glass and bring the laboratory for the measurement. Measurement of the moisture shall also be taken in order to know the dry basis matter.

$$C = \frac{W2 - W1}{V}$$

Where, C = concentration of PM

W2 = weight of filter +PM

W1 = weight of Filter

V = volume of air

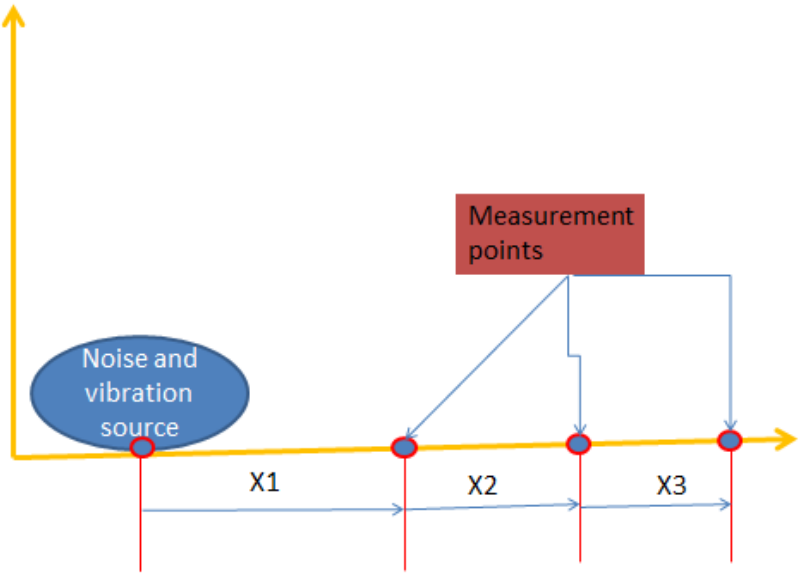
Detail setting of the equipment in the field and method of direct measurement will be presented as part of EIS and EMP report

7.2.13 Noise and Vibration

Noise and vibration could be also important environmental factor to be investigate and measure the baseline, particularly the noise and vibration could be an issue during the construction of the storage tanks such as foundation work, noise from vehicular coming in and out of the project site, as well as the construction of the above ground storage tank. The noise and vibration measure will be conducted within the project site to understand the noise and vibration variation between day and night

Typically, the measurement will be taken from various points with different distances from the source of the noise and vibration. Moreover, the measurement also taken to know the difference of noise and vibration background between day and night.

Figure 7.51 Illustration of the Proposed Field Measurement of Noise and Vibration Impacts



The heavy duty equipment will be operated in the project site with normal noise and vibration. The measurement will be taken from the point where the equipment operates and move the equipment further way from the equipment and observe the noise and vibration level. The observation of the noise background in the project location was conducted in order to know the following information:

- Difference background noise level between day and night
- The Noise level generated by a specific heavy duty equipment in various difference distance away from the source

The vibration measurement will use the vibrometer , which widely available in the market. The noise measurement other hand, will be also conducted by using the field measurement equipment by installing the instrument in a specific point and read the noise level.

Further detail information on the principle, equipment, and result of measurement will be presented in the EIS and EMP report

7.2.14 Existing Solid and Liquid Hazardous and Non-Hazardous Waste

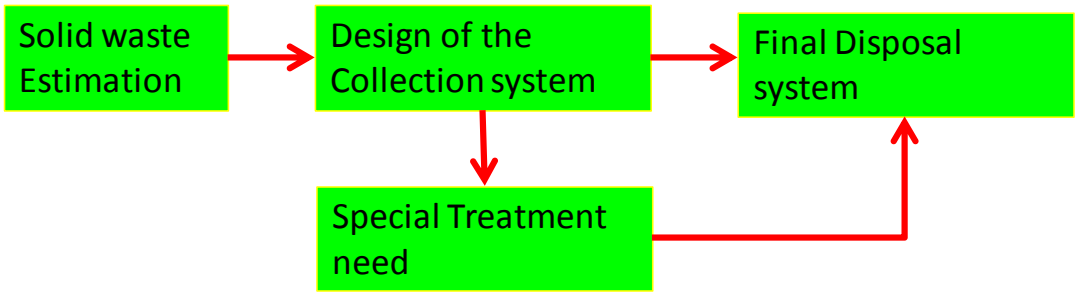
Solid waste collection in the urban area is still a problem for the country. The capital Dili has collection and disposal system, however, the service is still not very reliable much improvement is needed for both collection and disposal. Consequently, trash is piled for days without being collected creating unsanitary condition. On the other hand, the condition at Tibar landfill where ultimate disposal is conducted is also unmanaged creating hazardous condition to the surrounding area.

Figure 7.52 Burning of Solid Waste at Tibar Landfill

For the proposed development, project proponent planned to be responsible for the collection of its own solid waste and dumping in Tibar. Currently, the Government of Timor Leste has a plan to improve both collection system in Dili and the landfill/disposal system in Tibar. Because the improved collection system will only cover Dili area, project proponent's plan for the collection of its own solid waste will be appropriate. It is expected that Tibar landfill will introduce new regulations as well as possible charge once the system is improved. Project proponent will adjust accordingly.

The methodology of solid waste estimation will be conducted in order to know the quantity of solid waste produce during the operation. Based on the estimated information of the solid waste, the type of handling will be proposed in order to minimize the impacts of the solid waste to the project, community, and health hazard. The following figure describes the approach of solid waste management system during the implementation of the proposed development project.

Figure 7.53. Solid Waste Management Approach



Under the above approach, there should be general waste that involve and collection and disposal system and as well as type solid waste that considered hazardous, which required special treatment prior to final disposal system. Further detail assessment on the solid waste collection in the Liquica municipal level will be conducted by this study, particularly on how the solid waste produced by the current proposed development project shall be handled during the operation of the facility, including the hazardous waste, from the sludge at the bottom of the tank.

7.2.15 Socio –Economic

The proposed project location is within the Suco Lauhata, posto, administrative of Bazartete, and Municipio Liquica. The socio-economic profile of Timor – Leste and location content, according to the census 2015 will be present as part of the study. The availability of infrastructure, heath sector, education, employment, level of income, to name a few are some of indicators of the socio-economic measures that will be further investigated by the study as part of the environmental and social impacts assessment

This will rely on secondary data analysis from results of 2015 Census and other demographic and socio-economic study available. Results from data collection will be put in the context of the socio-economic condition of the country to arrive at a more comprehensive socio-economic profile of local community. Economic contribution in the form of job creation, tax payment and other that will result from the development will also be presented.

A primary data collection using sampling methodology will be carried out to study local community profile to inform on:

- Number of population in the household
- Household main source of income (type of job)
- Household income
- Place of work
- Education level
- Type of house
- Any thoughts on the proposed development
- Traffic data collection

The method of sample taken via questionnaires and direct interview one to one to collect the information. The detail information regarding the number of sample and result of data collection will be providing in the EIS and EMP report

7.2.16 Occupational Health and Safety

Occupational Health and Safety (OHS) will be integrated throughout project implementation from the Pre-Construction, Construction and Operation and Management phases of the project. According the IFC standard guideline on the occupational health and safety, the following important aspects of OHS should be considered as best practice to help reduce and minimize the risk:

- General facility design and operation
- Communication and training
- Physical hazard
- Chemical hazard
- Biological Hazard
- PPE
- Hazardous Material
- Monitoring

The operation and maintenance of the fuel storage terminal should also consider the OHS aspect, in the main issue related to chemical hazard, fire and explosion, and confined space. Further detail description on each hazard and relevance to the current proposed development projects with the relevant performance indicators will presented as part of the EIS and EMP document

7.2.17 Public Utilities

Public utilities availability in project area includes the national road of Dili – Liquica that has just recently been upgraded. The national electricity grid has also covered most part of the country, including in the project area which benefits the project. Other than these two, other vital public infrastructure such as water supply, telecommunication line, sanitation and waste collection service will be provided privately as previously discussed.

Figure 7.54 Main Dili-Liquica Road and National Power Grid

Detail assessment on other public utilities will be reviewed and presented in the EIS and EMP document.

7.3 Analysis of Alternatives

Several alternative scenarios have been assessed before coming into conclusion to propose for the current development. These alternatives include location alternative, business model alternative, scale of the project alternative and a no-development alternative. The following description provides discussion on alternatives considered for the development.

7.3.1 Location alternative

The project is essentially about importing of fuel products from foreign country to be stored and then distributed within Timor Leste. The most economical ways of delivering large scale fuel from a foreign country would be via tanker ships. Therefore, the most economical location of the project would be in the coastal area nearby Dili where most customers are located. The other requirement is the existence of jetty/harbor where ships will be docked before fuel is unloaded. If a jetty is non-existence, project owner has to construct its own at a significant cost. Taking into account these pre-requisites, a location right to the west or the east of the Cement Packing factory was considered (these are locations that will not need investment is bridge crossing). The Cement Packing factory already has a functioning jetty which was assessed as able to support the fuel piping system into the coastal location.

The sites immediate to the east and west of the Cement Packing factory, however, have not been available or suitable. The site to immediate to the west will be used by the Cement Packing plant for expansion

while the site east factory is a narrow coastal strip that will not be able to support the proposed facility. Therefore, the current location is chosen.

A further elaboration of the previously assessed sites will be included into the EIS.

7.3.2 Alternative Scale of the Project

In the beginning, project proponent planned to propose building larger capacity storage at 20,000 KL. Larger storage capacity means better business as higher capacity means higher profit. The plans for higher scale than what is currently proposed, however, has been scaled down due mostly to safety and environmental concern as higher capacity means higher risk for fire. Additionally, the development has been proposed in phases to better manage demand risk as higher capacity without demand means significantly less return on investment.

7.3.3 No Development Alternative

No development alternative is a situation where the project proponent is not proposing any development and operates as today where the project owner has supply the fuel with lower capacity of operation by moveable truck tanker. However, this means that positive impacts from the development such as higher tax, job generation and higher financial return would be not realized.

8. Environmental Impacts

Impact analysis as well as management and monitoring plans will be conducted for each stage of project development – (i) pre-construction stage, (ii) construction stage, (iii) operation and management stage and (iv) decommissioning stage. Impact analysis will put an emphasis on issues related to (i) hydrology of the area and its potential impacts to the proposed development due to the proximity of the project site to a river; (ii) potential impacts to marine pollution from oil spill related to the transfer of fuel from tanker at the jetty and potential for ground level oil spill from the tanks that make its way into the coastal environment.

Hydrological study will incorporate modeling using the Hydrologic Engineering Center - Hydrological Modelling System (HEC-HMS) model developed by the US Army Corps of Engineers (USACE). This model is a robust and well used model for flooding simulation. Furthermore, marine oil spill will include modeling using the integrated oil spill model incorporated into three dimensional ocean hydrodynamic model developed by Coastal Ocean Engineering Research Institute, Institute Technology Bandung in Indonesia. The model is called Model Tumpahan Minyak (MoTuM). Further detail information on the potential impact during each stage of project implementation is presented in the chapter 9.

Major development at the scale of the project has the potential to cause significant negative impacts to the environment as well as the socio-economic well-being of nearby community. To a certain degree, positive impacts might also be realized especially for local economy. Negative impact must be assessed, managed

and minimized while positive impacts are desirable and should be further enhanced to realize the full benefits to the society. Impact analysis are usually categorized into the following major classifications – (i) pre-construction impacts, (ii) construction impacts, (iii) operation and maintenance impacts and (iv) decommissioning impacts. Impacts are generated from activities conducted within the above classifications. As such, analysis of impacts should be embedded on a clear description of processes and activities for each step.

While all impacts should be assessed, it is important to understand the most important impacts which could generate the most severe consequences. For a facility like a large scale storing of fuel, the most important impacts are associated with fuel transferring, storing and distribution of fuel into tanker trucks. All of these are potentially happening during the Operation and Maintenance period. Therefore, during the formulation of the EIS and EMP, an emphasis will be put into the description and analysis of potential impacts from this. Potential impacts during pre-construction and construction are deemed temporary or with potential magnitude that are not as severe as those during the O&M period. While the decommission stage has taking out from this impact assessment, per comment from the ANPM, as during this period the project owner to submit the separate EMP. Further detail of the potential impacts in each stage of project implementation is presented as follows.

8.1 Pre-Construction Impacts

The Pre-Construction phase is a time when project preparation is undergoing. Detailed Engineering Design (DED) is being prepared while EIA is being conducted. Land clearing and fencing are also part of this phase. The site is a total of 1.3 HA sparsely vegetated coastal land with no sensitive coastal resources affected. Therefore, there are not much impacts expected during this phase. It should be noted that the site has actually been cleared with permanent fence constructed at the time of the writing of this ToR. Therefore, only land clearing impact is discussed under the Pre-Construction impacts due to its implication to the need of some landscaping be incorporated in future design of the facility.

8.2 Construction Impacts of the Phase 1 A

After engineering design and other preparation have been finalized, the construction phase is ready to start. During this phase, land is being graded and compacted, trenches dug for foundation. Upon completion of earthwork, physical construction (civil works) started from the foundation, storage tanks, offices, piping system, utilities, including water supply system, sewerage, life and fire safety, electrical system and others.

The impacts generated during the construction period are generally temporary, which will stop at the completion of works. Minor impacts such natural land conversion into the storage facility (losing vegetation and other natural habitat) is irreversible but it is tolerable concerning the existing plant and vegetation that has limited economic value and the fact that existing land parcel is not a habitat for certain endangered species. Other impacts that may contribute cumulatively would be storm runoff generated during rain events that could transport sediment of soil, which will be accumulated in the marine waterbody. However, this could be minimized by scheduling works during dry season and when the rainy season comes, the site has already been fully paved so that there is no existence of uncover soil, which

will potentially generate erosion and produced high sedimentation rate. Potential impacts during this phase are laid out in the following table.

Table 8.1 Summary of Impacts during the Pre-Construction and Construction Phase 1A

No	Potential Impacts	Nature of Impacts	Scope of Impacts	Source Activities	Impact Indicator
Pre-Construction Impacts					
1	Vegetation Clearing	Negative, direct, long term (loss of existing vegetation is forever, although some offset is possible through a little landscaping at appropriate location within the facility). This type of impact is irreversible	Localized within site	Land clearing	Number of trees and other vegetation loss
Construction Impacts					
1	Air Quality	Negative, direct and short term during construction period only. The impact could be cross border localized (within the certain distance)	Localized within the facility, however, fugitive dust can be blown by the wind into residential, businesses and school facilities nearby.	Movement of earth, sand and rocks during earth working activities, physical construction, increased vehicle traffic and operation of equipment during construction.	Level of Particulate Matter (PM) in the air, PM2.5 and PM10
2	Noise and Vibration	Negative, direct, short term during construction period only	Noise nuisance could affect community and local business nearby; vibration could impacts the buildings in the vicinity of the construction.	Construction of foundation	Noise and vibration level, complaint from nearby community.
3	Marine water pollution from storm runoff	Negative, direct, to the increase of turbidity of marine water as a result of rain washing away sediment in the construction site. The pollution can have a cumulative impact to the marine water body.	Spoil will be washed up from the 1.2 HA of project site, the amount of which will depend on the pile of spoil in the construction facility. Nearby marine water quality will be impacted.	Site clearance, foundation work, and grading.	Increased turbidity.

4	Traffic	Negative, direct, short term during construction period only.	Localized in the stretch of road in front of the facility.	Related to the increase of traffic for transporting construction material.	Increased traffic jam in front of facility
6	OHS	Negative, direct, short term during construction period only.	Localized to workers and visitors in the facility.	Related to all construction activities, including earth and civil works.	Workers working condition, use of Personal Protective Equipment (PPE)
8	Socio-economic Impacts (i) Impact on social cohesion, order and security in the area; (ii) Impact to job generation, other economic linkages to the local community.	Negative, direct, short term during construction period only. Few house will be relocated so this is kind of a permanent impact but proper compensation should be applied Positive, direct, short term during construction period only due to the short term nature of construction work	Typically localized to surrounding community Because number of workers during construction will not be many, it is believed that the scale of impact is limited to the workers and their immediate family only.	Related to potential for disruption from unruly behavior by construction workers in the construction camp and construction facility. Related to job generation during construction period.	Complaint from local community Workers satisfaction of the payment level.

8.3 Operation and Maintenance Impacts of Phase 1 A

While potential impacts during the Pre-Construction and Construction Phases are all considered minor impacts, those that are generated during the Operation and Management phase consists of major and minor impacts. Major impacts should be identified during project planning, therefore avoidance or mitigation of the impacts have already been integrated into the design and construction of the facility. As previously noted, major impacts are impacts related to activities from fuel transporting from tanker into the storage tanks, storing within the tanks and dispensing to tanker trucks. There are also potential for major impacts associated with maintenance of the storage tanks which are usually done every few years. Major impacts is discussed as followed.

8.3.1 Flooding Impacts

The project is located near a river, which is subject to flood risk due to high frequency rainfall. Flood water could potentially cause damage to the side of the facility and encroach all the way to the reach significant portion of the facility. Failure in parts of the facility could lead to oil spill. Hydrological modeling tool will be used to understand flood magnitude and other information to be considered in the design and construction of the facility so that the risk of flooding could be minimized.

Figure 8.1 Storage Facility and River Bed

Naturally, the proposed site is in much lower topography than the upstream of the river. Additionally, existing bridge along the national road connecting Dili and Liquica is a bottleneck to river flow meaning that overflow could occur at that point. When overflow occurs, proposed location will be flooded from the

national road direction. Modelling will reveal the magnitude of flood and provides recommendation as to the appropriate level of elevation to the storage facility.

8.3.2 Pollutant Transport /Oil spill Impacts

A large scale of oil spill would be considered as an emergency situation and could potentially occur in two places:

- At the jetty (during unloading)
- Piping system (from jetty to fuel storage system)

The study only present a hypothetical assumption, if a large oil spill occur, due to any other event such as accident in the jetty (strong wind, high tide, earth quake, etc) and sudden damaged of in the tanks due to explosion. Under these hypothetical l conditions, a significant volume of fuel will enter the marine waterbody.

Figure 8.2 Potential Oil Spill at Two Points in the Operation

Should the above accidents happen, in order to efficiently mitigate the impacts, understanding the quantity and quality of impacts, particularly the space and time distribution would be important. Several scenarios will be presented using the MoTuM model to understand the fate of spill, therefore, informing on the mitigation measures.

The model will also shed light on the potential for cross border impacts such as whether or not oil spill will able to cross sea boundaries and land in neighboring country's shore.

8.3.3 Groundwater Impacts

The proposed development project will extract groundwater from the groundwater aquifer to fulfill demand for water supply in the proposed facility. At the same time, there is potential for oil spill to percolate into the ground from within project location into the groundwater aquifer in the area. Therefore, potential groundwater impacts from the development consist of two types of impacts:

- Groundwater extraction impacts (from pumping)

Water demand in the facility is estimated to be 2000 L/day, which is reasonably small. However the pumping test will be conducted from the well that will be constructed by the project owner to see the marginal capacity of the groundwater and compare with the pumping rate of 2000 L/d (or 0.14 L/s)

- Quality of groundwater impacts (from oil spill)

The transport of contaminant from the ground surface to the groundwater aquifer is an important subject to be investigated as part of this impact analysis, due to the presence of shallow groundwater level in the project area.

Oil spill that percolates into the groundwater could have a permanent and irreversible impact to the resource. Therefore, impact analysis and proper mitigation measures should be reliably conducted.

8.3.4 Large Fire Impact

Another important impact related to the fuel transportation, storage, and distribution is related to the fire. Fire only occurs when the following 3 conditions are met:

- Fuel
- Oxygen
- Ignition

In case large fuel spill, two things (fuel and oxygen) will be meet. If an ignition happens, a large scale fire will occur. Fire impacts people (workers and others) present within the facility and when large enough with the certain climatic condition, it can impact surrounding community.

In case of large fire accident, it potentially impacts the following properties, including:

- Public transport along national road
- Several houses located within 50 meter radious from the storage tanks
- Marine water body and beach accessability

The design of the facility should be in consideration of the reciever of impacts such that the impacts would be mitigated appropriately. Particularly, design and construction should consider minimum distance between fuel storage tanks (source of fire) and the nearest public facility or residential locations.

8.3.5 Occupational Health and Safety Impacts

Air Quality due to Volatile Organic Compound (VOC)

Gasoline is a volatile organic compound typically producing high level of VOC in the air. Specifically, air pollution due to VOC could be generated during unloading at the Jetty, leaks within the system, during works inside tanks for maintenance purpose and during transferring of fuel from storage tank to tank trucks.

Bottom Tank Sludge

After several years of operation, sludge will be formed at the bottom of the tank requiring maintenance work to clean for the purpose of maintaining the quality of the fuel product stored in the tank. Roughly 0.05% of the total volume could be considered as the amount of bottom tank product. By taking the total volume of the tanks at 10,000 KL, the volume of bottom tank sludge will be around 5,000 L. This sludge is considered hazardous substance and should be handled and disposed properly.

Confined Space

Confined space related to the fuel storage system is the storage area, including the secondary containment, which should be highly regulated entry where only qualified person can access.

8.3.6 Climate Change Impacts and Coastal Inundation

Climate change and its impacts could affect the existence of the project, given the project is located at a coastal area and by river bed, which shall be prone to the riverine flooding and coastal inundation. Furthermore, utilization of groundwater as the main water supply source, may also affected by the seawater intrusion to the local aquifer, especially in case of prolong dry season, where fresh water volume in the groundwater storage decreases. Further detailed assessment on the magnitude of the impacts shall be presented in the EIS and EMP documents.

8.3.7 Positive Impacts to Economy

Besides the negative impacts as presented earlier, the project development will also produce various positive impacts that are desirable and should be leveraged into their full potential. The following positive impacts are preliminarily identified and will be further analyzed in the EIS:

- Reasonable size of foreign direct investment
- Contribution in terms of tax payment to the government. Note that an increase in the net revenue from this proposed development project will also mean an increase in the tax payment
- More competition in fuel supply and distribution, which translates into the best value for money to the consumer
- The presence of the project in the project location would also create other economic and business opportunity to grow in the area
- Positive social contribution from the corporate to local population

Summary of impacts are presented in the following table.

Table 8.2. Summary Impacts during the Operation of Fuel storage Facility (phase 1 A and Phase 1 B)

No	Potential Impacts	Nature of Impacts	Scope of Impacts	Source Activities	Impact Indicator
Operation Impacts					
1	River Flooding	Negative, direct, medium to long term depending on the magnitude of impacts. The even caused impact could be very short time but impact could be huge and permanent and irreversible	Community and project location (low land area), could lead to oil spill when oil transport pipes are affected by the high river flow. - Impact could have a cumulative impact, depending on the number of storm occur - This impact is also irreversible - Further create cross border impacts from the project area to other places or island due to current and transport of fate	Related to overflow of flood water in the river (riverine flooding) affecting the facility during heavy rainfall event	Flood level in the river and rainfall volume in certain duration
2	Marine water pollution	Negative, direct, long term during the O&M period	• Could spread into larger area brought by current so has cross border issue • Cam create a cumulative impacts in the recipient environment/water body • Irreversible impacts • Expensive to clean and compensation could be the solution	Related to oil spill during: • Offloading fuel in jetty • Transporting oil along the pipe • Fuel storage operation Pollution from solid and liquid waste leak into the nearby coastal water.	Marine water quality

3	Traffic	Negative, direct, long term during the O&M period	Localized in the stretch of road in front of the facility	related to slowing down of traffic due to vehicle coming in and out of the facility; potential accident if not carefully managed	Increased traffic jam in front of facility, police report of accidents
4	Life and fire safety impacts	Negative, direct, short to medium term depending on the magnitude of impacts	Fire accidents could range from small to large scale fire. • Impacted in the local and transportation system •	Inadequate fire prevention operation at storage tanks and within the facility in general	Number of fire accidents within a month and a year
5	Groundwater	• Quality • Aquifer sustainability	• Contaminant transport downward • Over pumping of groundwater • Aquifer damaged could be an irreversible impacts such as seas water intrusion • No cumulative impacts, as aquifer would have recovery time once the pumping stop	Groundwater aquifer	Groundwater quality, land subsidence, sea water intrusion
6	OHS	Negative, direct, long term during operation	• Localized to workers and visitors in the facility. • In case of loss of life, the impact could be permanent and only offset is the solution • Impact could be cumulative, with	Related to day to day activity of fuel storage operation, release of VOC affecting workers, inadequate workers protection.	Working condition

			increasing number overtime		
Maintenance Impacts					
7	Life and Fire Safety	Negative, direct, short term impact during maintenance phase	Localized to workers and visitors in the facility due to risk of fire and explosion;	Related to inadequate release of inflammable gasses prior to carrying out of maintenance activities.	Fire accidents
8	Hazardous waste production	Negative, direct, short term impact during maintenance phase	Localized to the facility due to production of hazardous waste from residue sludge.	Related to the production of oil residue from the bottom of tanks.	Pile of oil residue in the facility, handling of residue.

8.4 Construction Impacts of Phase 1 B

Construction of phase 1 B will take place some-time in the future justified by increase in demand. Work will consist of construction of additional two fuel storage tanks that will connect to the existing piping system. Yard preparation for phase 1 B will have been completed together with construction of phase 1 A. Prior to the commencement of this phase, an EMP will be submitted. An important consideration in the EMP is that the construction will happen in a facility that is already in operation. Therefore, there are a different set of potential impacts on top of the potential operational impacts of phase 1 A.

Therefore, major impacts during this stage of construction and operation would be summarized as followed:

1. Increasing fire hazard due to welding work, as a source of ignition
2. OHS related to the fuel storage welding and installation
3. Impacts of operation of the fuel storage from the phase 1 A

Table 8.3 Likely Impacts from the Construction of Phase 1 B

No	Potential Impacts	Nature of Impacts	Scope of Impacts	Source Activities	Impact Indicator
Phase 1 B - Construction Impacts					
1	Noise and Vibration	Negative, direct, short term during construction period only	Noise nuisance could affect community and local business nearby; vibration could impacts the buildings in the vicinity of the construction.	Storage welding, cutting metal, etc	Noise and vibration level, complaint from nearby community
2	Traffic	Negative, direct, short term during construction period only.	Localized in the stretch of road in front of the facility.	Related to the increase of traffic for transporting construction material.	Increased traffic jam in front of facility
3	OHS	Negative, direct, short term during construction period only.	Localized to workers and visitors in the facility.	Related to all construction activities, including earth and civil works.	Workers working condition, use of Personal Protective Equipment (PPE)
4	Fire hazard risk	Welding create an ignition source and in case any leaking the facility can be easily be on fire	In the storage tank 1 A, loading and unloading bay	Welding and tank operation	Fire detection system
No	Potential Impacts	Nature of Impacts	Scope of Impacts	Source Activities	Impact Indicator
Operation Impacts of Phase 1 A					
1	River Flooding	Negative, direct, medium to long term depending on the magnitude of impacts;	Community and project location (low land area), could lead to oil spill when oil transport pipes are affected	Related to overflow of flood water in the river (riverine flooding) affecting the facility during heavy rainfall event	Flood level in the river and rainfall volume in certain duration
2	Marine water pollution	Negative, direct, long term during the O&M period	Could spread into larger area brought by current.	Related to oil spill during: 1. Offloading fuel in jetty 2. Transporting oil along the pipe	Marine water quality

				3. Fuel storage operation 4. Pollution from solid and liquid waste leak into the nearby coastal water.	
3	Traffic	Negative, direct, long term during the O&M period	Localized in the stretch of road in front of the facility	related to slowing down of traffic due to vehicle coming in and out of the facility; potential accident if not carefully managed	Increased traffic jam in front of facility, police report of accidents
4	Life and fire safety impacts	Negative, direct, short to medium term depending on the magnitude of impacts. The risk of fire is high, as part of welding work shall create the ignition of fire	Fire accidents could range from small to large scale fire.	Inadequate fire prevention operation at storage tanks and within the facility in general	Number of fire accidents within a month and a year
5	Groundwater	• Quality • Aquifer sustainability	• Contaminant transport downward • Groundwater pumping	Groundwater aquifer	Groundwater quality, land subsidence, sea water intrusion
6	OHS	Negative, direct, long term during operation	Localized to workers and visitors in the facility.	Related to day to day activity of fuel storage operation, release of VOC affecting workers, inadequate workers protection.	Working condition
Maintenance of Facility Impacts					
7	Life and Fire Safety	Negative, direct, short term impact during maintenance phase	Localized to workers and visitors in the facility due to risk of fire and explosion;	Related to inadequate release of inflammable gasses prior to carrying out of maintenance activities.	Fire accidents
8	Hazardous waste production	Negative, direct, short term impact during maintenance phase	Localized to the facility due to production of hazardous waste from residue sludge.	Related to the production of oil residue from the bottom of tanks.	Pile of oil residue in the facility, handling of residue.

9. Assessment and Evaluation

Clear criteria and indicators to assess environmental and socio-economic impacts are needed to better predict risks, pattern and magnitude of impacts. The following table outlays affected area, criteria/ indicator and methodology employed in the assessment of impacts. All of this information will later lay the foundation for the proposed management and monitoring measures to be incorporated into the facility.

Table 9.1 Affected Areas, Criteria/Indicator and Methodology for Impact Assessment

Affected area/site	Criteria/Indicator	Sampling and measurement Methodology	Instrument
Soil	Total Petroleum Hydrocarbon	• Field samples taken to the laboratory • Gravimetric and Volumetric methods	ASS and oven, digital balance
	PH	No sampling but insert the PH probe into Soil and take reading	PH meter probe
	Pb	• Field samples taken to the laboratory • Gravimetric and Volumetric methods	AAS
Marine Water Body	Turbidity	Direct field measurement by using the field instrument	Turbidity probe -portable
	Smell/Odor		
	TSS	Taking water sample to the laboratory and using the gravimetric method to estimate the TSS	Oven and digital balance
	Solid waste	Sample taken to the laboratory and using the gravimetric method	Oven and digital balance
	Temperature	Direct field measurement in the field with the field instrument	Temperature Probe - Portable
	Oil layer	Sample taken to the laboratory and using the gravimetric and volumetric methods to estimate the total weight of oil layer	ASS and oven, digital balance
	pH	PH probe	PH probe
	Salinity	Direct measurement in the field with the salinity meter or conductivity meter	Salinity Probe or conductivity meter

	Total Ammonia	Water sample taken to the laboratory and using the titration method to estimate the total ammonia	ASS - Atomic Adsoprtion Spectro
	Sulfide	Sample taken to the lab and taken the reading from the instrument	Destilator
	Total Petroleum Hydrocarbon	• Field samples taken to the laboratory • Gravimetric and Volumetric methods	ASS
	Total Phenol	• Field samples taken to the laboratory • Gravimetric and Volumetric methods	ASS
	NO3	Cadmium reduction method	ASS
	Surfactant	Anionic surfactant	Spectrometer
	Oil and Grease	Soxhlet Extraction	Spectrometer
	Hg	Direct Air acetylene Flame	ASS
	Cu	Direct Air acetylene Flame	ASS
	Zn	Direct Air acetylene Flame	ASS
	Cd	Direct Air acetylene Flame	ASS
	Pb	Direct Air acetylene Flame	ASS
	Benthic composition	Micro-biological Measurement in the laboratory	Micro-biological Measurement in the laboratory
Marine Habitat	Mangrove - total area	Visual observation or measurement of satellite image	Personnel
	Coral - Percentage of young coral	Diving to measures the coral identification	Diving equipment and diver
	Fish Diversity	Diving to measures the diversity of fish	Diving equipment
	Bottom sediment - Total Hydrocarbon	• Sample taking to the laboratory • Gravimetric and Volumetric method	ASS or TOC analyzer
Ambient air quality	NO2, SO2, , CO2	Portable equipment: CO2 –meter, SO2 meter, and NO2 meters brought to the field and t taken the	Portable Instrument of measurement

		reading directly	
	PM (2.5 and 10)	• Field Sampling by filtering the PM • Bring the sample to the laboratory to measure the PM	Set of equipment: - Pump - Filter - Hose - etc
Surface water Quality – River	• Total Petroleum Hydrocarbon • Pb	• Gravimetric and Volumetric method • Gas chromatographic	ASS
Groundwater	Quantity - pumping rate	Auto-water level measurement	Auto-water level measurement
	Quality : TPH and Pb	• Sample taking to the laboratory • Gravimetric and Volumetric method • Gas chromatographic	AAS
Ambient noise and vibration – community	Noise and Vibration level	Field measurement of the noise and vibration level	Vibrometer and noise meter (portable one for the field application)
Worker or people	OHS record	Incident report -daily or monthly	Incident report -daily or monthly
Socio - Economic	Level of income of the country and local population	Government statistical report	Government statistical report

10. Environmental Management Plans (EMP)

Based on various impacts that will be assessed and quantified by this study, an environmental management plan will be proposed to mitigate or offset each impact. The scope of the management plan shall include mainly the following:

- Measures related to the management of impacts to the integrity of the project from flooding by adjusting project design and construction of the floor level. Including in the management measure is flood prone design and construction of the facility incorporating proper rain frequency parameter. A river training work could also be proposed.
- Measures related to mitigating risks due to accidental spill of oil/fuel in the marine waterbody
- Measures related to mitigating risks from fire accidents
- Emergency response system for accidental spill and fire.
- Managing impacts due to occupation health and safety system

Environmental Management Plans (EMP) that will be proposed by this study shall cover the phase 1 –A of project implementation, which include pre-construction, construction, operation and maintenance, and de-commissioning stages. If the decision to proceeded the construction of the phase 1 B shall be made, then the project owner will submit the updated EMP that covers the construction of the phase 1 B, operation of phase 1 A, and operation of phase 1 B, as well as decommission of phase 1 A and phase 1 B

10.1 EMP during Pre-Construction Phase 1 A

Much of the Pre-Construction activities have been carried out at the time of the writing of this ToR. The only relevant issues that should be noted is that vegetation clearing should be off-set through some landscaping at appropriate location within the facility, for example in the office area.

10.2 EMP during Construction Phase 1 A

During the construction stage, all of the impacts should be managed on-site. Of importance are impacts related to noise and vibration to the local community, sediment spill into the ground and nearby coastal water, traffic and Occupational Health and Safety (OHS). All of these impacts can not be avoided, therefore, mitigation measures will be proposed to be incorporated into the construction methods. Monitoring plans will be proposed to put in place a surveillance system that will be able to anticipate potential for severe impacts from happening.

10.3 EMP during Operation and Maintenance Phase 1 A

Most severe impacts from the development have the potential to happen during the Operation and Maintenance phase. The EMP for this phase should pay particular attention to the avoidance of flooding through engineering design of the site, life and fire safety through adherence to API standards for storage design parameters, mitigation to the risk of oil spill, fire response system and others. Mitigation of oil spills will be recommended through standard mitigation measures such as the oil-water separator incorporated into the storm water drainage from within the bund wall while an organization structure that incorporate an HSE division should be put in place. Monitoring plans will also be recommended.

As the major impacts may occur during the operation of the project/facility, a rigorous environmental management plan (EMPs) would be required in order to minimize the impacts. The following table presents the general overview of the EMP coverage.

10.3.1 Minimized Flooding Hazard

The scope of EMP in minimizing the impact of flood hazard from river during the heavy rainfall frequency can be achieved by the following actions:

- Design of higher floor level of the storage tanks
- River training work (section nearby the project location)
- Flood retaining wall
- Flood hazard warning system (installation of auto weather station in the upland catchment)
- Proper emergency preparedness and recovery system

Further detail on each of this plan and how to implement the plans will be presented in the EIS and EMP report.

10.3.2 Reduce Risk of Oil Spill

Risk of oil spill could be mitigated by the following actions:

- Proper design and construction of the system (storage system, piping system, jetty) to prevent or minimize the probability of spill
- Standard Operating Procedures for the O&M of the facility
- Proper hazardous waste management especially related to the handling and disposal of bottom sludge

10.3.3 Fire Management Plan

The nature of project that involves flammable liquid material will be prone to fire hazard and required proper fire management system to reduce the risk and achieve sustainable operation. The scope of the EMP plan, would involve the following important topics related to proper fire management system.

- Proper fire management system
- Fire management team in place
- Fire equipment
- Emergency Fire Response plan
- Proper fire detection system
- Fire Evacuation route
- Fire drill system
- Proper design of facility, including spacing between tanks for fire management access

Further detail information will be presented in the EIS and EMP documents.

10.3.4 Groundwater monitoring well

As presented in the impacts identification section, groundwater utilization and the presence of the project could affect future groundwater quantity and quality. Although, the rate of utilization is small, mitigation measures are important to be presented in the form of EMP to help reduce risks associated with over pumping. The following important components are proposed as part of the EMP:

- Identification of sustainable pumping rate
- Monitor groundwater utilization
- Construct monitoring well
- Find alternative such as rain harvesting to fulfill some of water demand
- Apply water conservation system in the facility to reduce the water utilization

10.3.5 Storm Water Management

During rainy season, storm water runoff have the potential to wash pollutant accumulated in the surface area within the project area. This pollutant could include minor oil spill and mainly deposit solid material/particle in the ground surface. Storm water will wash and transport them into the marine water body and cause marine water pollution. Scope of the mitigation measures include:

- Oil-water separator (technical solution to catch the oil and release the water only)
- Proper application of SOP to minimize the oil spill within the storage facility
- Proper handling and disposal of hazardous material

10.3.6 Major Explosion

Major explosion, such as in the event of major fire, could become a life treating and in this situation, the action should be taken are related to minimizing the impacts, including:

- Evacuation plan
- Proper early detection system
- Emergency recovery system

10.3.7 OHS

Occupational Health and Safety (OHS) measures are very important to be implement as part of EMP so that any impact related to the job could be managed and minimized to ensure the safety of operation, environment, and workers involve in the operation of the system.

The scope of EMP related to the OHS may include but limited to the following:

- Chemical Hazard
- Fire and explosion
- Confined space

10.3.8 Community Health and Safety (CHS)

Community health and safety in this project may include potential exposure of public to large fire and explosion, large oil spill that contaminate marine water body, and chemical hazard as well. Further detail information shall be elaborated in the EMP document.

Table 10.1. Summary of EMP during the Construction of the Project (Phase 1 A)

Stages of Project Implementation	Causes of Impact	Description of Impact	Mitigation/Preventive Measures/Offset	Proposed Monitoring Measures
Site Preparation and Construction	Site clearance	Loss of vegetation	1. Required soil compaction in the project site before rainy season to avoid erosion and sedimentation due to storm water 2. Fenced the project area from public access 3. Landscaping later on	Visual inspection in the project site
	Construction of Storage Tanks	Noise and vibration	1. Limit the use of equipment producing noise and vibration to during the day only 2. Use of newer equipment producing less noise and vibration	Monitoring for complaints from workers and nearby residents
		Oil and lubricant spill	1. Minimize leak from the operation of equipment during construction and careful storage of fuel and lubricant. 2. Regular maintenance of equipment to prevent oil and lubricant leakages	Monitoring for leak during site preparation and construction and at storage
		Waste produced by workers' activities	1. Keep non-biodegradable solid waste in garbage bins and disposed-off at Tibar Landfill 2. Keep hazardous waste in a dry place away from water runoff and coordinate with local waste authority on proper disposal sites. 3. Biodegradable waste to be composted on the site.	Visual inspection and monitoring
		Temporary air quality degradation	1. Worker to utilize personal protection to prevent the direct exposure to dust and particulate matter 2. Regular watering and compacting of area where vehicle will pass through	Visual inspection and monitoring

	Construction of Supporting facility (office, pipe system, etc.)	Noise and vibration	1. Limit the use of equipment producing noise and vibration to during the day only 2. Use of newer equipment producing less noise and vibration	Monitoring for complaints from workers and nearby residents

Table 10.2 Summary of EMP during the Operation and Maintenance of Fuel Storage Facility- phase 1 A

Impacts	Description of Impact	Mitigation/Preventive Measures/Offset	Proposed Monitoring Measures
Flooding	Flooding from the river could damage properties in the storage facility	• Elevated floor level of the storage facility • Loss of life (in case very frequency of flood) • Flood proof study • Emergency evacuation • Prediction of rainfall • Flood retaining wall in the river section	Flood proof inspection , rainfall measurement and flood warning system
Major Oil spill	Major accident that cause oil spill in Jetty and Piping System	• Proper emergency response system with the competence team • Delineated impacted area in marine waterbody to focus on the necessary cleaning • Design of the system with higher safety standard so that the probability of spill could be minimized • Application and follow proper standard operating procedure to reduce the risk of spill • Proper treatment of the contaminated marine water	Marine water quality monitoring
Major Fire	The presence of fuel, in contact with oxygen, and fire ignition will produce fire. If it happens in storage area,	• Proper arrangement of fire emergency response system with the competence team/fire fighters • Fire prevention, by follow the proper procedure of operating system • Provide adequate fire equipment system in the project area • Proper fire evacuation route	Daily record on the accident

	in case major spill, the major fire could occur		
Groundwater Sustainability	Pumping of groundwater that greater than the sustainable capacity of aquifer	• Monitor and control the water consumption • Monitor the pumping well (drawdown) to know the maximum drawdown in the aquifer • Substitute with water needs such as fire or irrigation from rain harvesting during the rainy season • Alternative water source from the upper catchment system	Groundwater monitoring well and pumping rate
Groundwater Contaminant	Oil spill in the project site to move downward to the shallow groundwater aquifer	• Monitor the well to control the contaminant transport downward • Treatment of the spill of oil within the project facility	Contaminant measurement
Wastewater from storm water	Spill in the ground surface that will be washed by the rainwater	• Treatment via oil – water separator • Reduce the spill/minimize • Cleaning the spill locally	Marine water quality monitoring
Solid waste and hazardous material	Solid waste that will be produced by the project	• Proper collection and disposal • Proper treatment of hazmat	
OHS	Various risk related to job of fuel storage operation from jetty, storage, and distribution system	Application of proper approach to mitigate the impact. Use of PPE for instance and other method will be elaborated in the EIS and EMP	Incident report/record

10.4 EMP during Decommission phase of Phase 1 –A

Although the project owner is highly committed to operate the fuel terminal, there is always a possibility that the project may need to be decommissioned. The rule of thumb is that, anytime when the business case in that location is no longer justified, then the project owner should decide to stop the project and decommission all the facilities that already operated. There are many factors that can contribute the termination of the project in that location. Regardless the reasons of termination, the project owner are responsible to decommission the operation of fuel storage terminal by demolishing all the facilities that shall be constructed. During the decommission and dismantling the equipment, the environmental and social impacts as have identified need to be managed and offset.

Table 10: 3 Summary of Impacts and Mitigation Measures of Decommission Stage at Phase 1 A

Stages of Project Implementation	Causes of Impact	Description of Impact	Mitigation/Preventive Measures/Offset	Proposed Monitoring Measures
Decommission of all the facility part	Demolish Storage Tanks	Noise and vibration	1. Proper work scheduling 2. Use equipment that produce less noise and vibration 3. Use proper PPE to the workers 4. Proper fencing the working space area	Visual inspection in the project site
		Hazardous material trap inside the storage	• Collection of solid waste and separation of hazardous from the regular waste • Dispose into the proper final disposal • Treat the hazardous material prior to disposal	Monitoring for complaints from workers and nearby residents
		Solid waste and metal scrape	• Sale and send the metal scraper to the buyer • Non-economic waste should be collected and disposed in the designated area	Visual inspection and monitoring
		Oil and lubricant spill	• Proper collection and treatment system • Dispose to the designated location	Minor and can be managed locally
		OSH (VoCs, etc.)	• PEE • Follow proper operating procedure	Visual inspection and monitoring
		Temporary air quality degradation	• PPE • Frequent Water spraying	Visual inspection and monitoring

	Demolish office facility and piping system	Solid waste and hazardous material	• Collection of solid waste and separation of hazardous from the regular waste • Dispose into the proper final disposal • Treat the hazardous material prior to disposal	Visual inspection and monitoring
		Air quality degradation	• PPE • Frequent Water spraying	Complain from the community
		OSH	• PEE • Follow proper operating procedure	Record keeping and monitor any incident rate
	Social Economic Impacts	Losing opportunity by the project owner	• Find and pursue other business opportunity or move other location/country	
		Unemployment	• Proper compensation and transfer of workers to the similar type of business • Social security should help in covering workers who have already pay the social security	Internal by Global Fuel
		Disturbance of fuel supply	• Similar business will emerge • Government to intervene the price of fuel so it will not escalate too much in the marker	No Monitoring required
		Losing tax income by the government	GotL to diversify the economy and income tax from other source	Serve Registration office

11. Monitoring Plans

The objective of monitoring plan is to detect the magnitude of impacts (qualitative and quantitative) and compare with the baseline information that was collected as part of the study. The implementation of the environmental management plan (EMP) only is being assured with proper monitoring program.

- Monitoring of groundwater
- Marine water quality Monitoring system
- Air quality observation
- Monitoring of OHS

Further detail of monitoring program will be elaborated in the EIS and EMP documents.

12. Public and Community Consultations

As part of the environmental impacts assessment, the consultant team on behalf of project proponent organized public and community consultations in order to collect input from relevant stakeholders and local communities on the proposed development. Community consultations will be conducted in accordance to DL 5/2011 in the following sequence:

1. First consultation on the scope (Terms of Reference) of environmental impacts assessment (EIA). The consultations were conducted for both community where the project will be taking place and to the public entities such as government agencies that overseeing the project implementation.
2. Second consultation on the findings of the EIA which inform the baseline characteristics of the environment and the detailed EMMP. Similar to the consultation of the TOR, the consultation of the draft EIS and EMP will be conducted for community in the project location and the public agencies (both national and municipals level).

This first community consultation for the ToR was held in Lauhata nearby project site on June 22, 2019. Around 30 people, who represented community leader, youth, and communities members who are affected by the project due their houses that very close to the project site. The following tables shows the community concern related to the project, based on the consultation of the first time in Lauhata.

Table 12.1 List of Concern of Community Members in the Aldeia Raukasa

No	Name	Concern/Questions	Respond/Future Follow up
1	Sr. Daniel do Santos: Chief of the Suco of Lauhata	The represent the local leader and the community provide the support for this investment as it will create opportunity for local and bring the revenue for the country as well	The project owner is so happy to hear the support from the local leader and it will give the moral support to the company to continue mobilize the project in the site
2	Sr. Jose do Santos Bareto: Ex Chief the Suco and also the land owner	He raised the concern regarding changing the land use change from the previous arrangement, which was not for fuel storage and distribution. He is asking about the status of his right, as the land owner	The project owner respond that the his right with the Timor Cement, who is the primary holder of the use of this parcel of land would remain the same and any change would be subject to the negotiation between him and Cement Timor, SA. For this part, there will be a follow up meeting between the land owner and the land use right holder (renter)
3	Sr. Gilberto das Silva: Land owner and youth representative	He is happy and support the project but the status of the land use need to be cleared.	
4	Sr. Faustino Xavier- Chief of Aldeia	We support the investment and support the construction. The problem with the land (if any) will be solved with dialogue that involve the local leader	The recommendation will be considered
5	Sr. Filomeno Bareto: Chief of Aldeia Raukasa	He raised the concern related to the impact during the construction and operation, specially related to the public health issue	The study of environmental Impacts assessment will provide the recommendation of the method to minimize the risk to the impacts that will arise from the project during the construction and operation. The result of the study will be presented again in the next meeting
6	Dominggoes Gonsalves Soares: Community members	He raised the concern related to the public health issue, like from VOCs and how to mitigate this impact	
7	Chief Suco:	Local leader will help solving some of remaining issue	
8	Sr. Filomeno Bareto: Chief of Aldeia Raukasa	He raised the concern about the evacuation plan in case of emergency	The study will recommend the emergency response plan and include the evacuation plan and map
9	Sr. Gilberto das Silva: Land owner and youth representative	Asking about the study of river flow and recommend the company to elevate the floor level and river protection to minimize the impact	This is exactly part of the study of EIA to identify the flooding problem and what need to be done in redcuing the flood risk from the river

Figure 12.1. First Consultation to the Community Members in Aldeia Raukasa, Suco Lauhata

In addition to consultation with community members, a separate consultation was conducted with public agencies, especially those that are involved directly in the project, as the regulatory agencies shall involve in the project monitoring to ensure compliance of the project implementation to already established regulations.

The first agency stakeholder consultation was conducted on 25 of June 2019, in Hotel Ramelau, where about 10 government agencies from 30 agencies invited attended the consultation meeting. During the

meeting, project owner, which was represented by PEC – Consulting, LDA, presented the scope of the environmental impact assessment (EIA) that will be carried out prior to the preparation of the EIS and EMP to be submitted to the ANPM for the license approval. Various government agencies that are relevant to the project such as ANPM, Ministry of Agriculture and Forestry (MAF), Ministry of Public Works (MOP), and other agencies, including the representatives of local authority in Liquica, participated in the workshop of the scoping of the environmental impact assessment study.

The detail of the scope of work presentation can be found in the annex 3- Presentation of the TOR. During the meeting, the following question and concerns were raised:

- Water utilization from the groundwater aquifer and the impact to the local people
- Method of risk mitigation and risk management
- Social corporate responsibility from the company to local community
- Impact of oil spill to the sea and protected zones near project location
- Scope of extended oil spill coverage
- How to manage and mitigate fire risk/hazard
- Waste management during the operation (liquid and solid wastes)
- Design and specifications according the standard best practice

Table 12.2 Summary of the Question and Concern Raised during the presentation of TOR in Hotel Ramelau

No	Name	Concern/Questions	Respond/Future Follow up
1	**Sr. Jose Calderas**. Husi Bombeiros, Secretary of State of Civil Protection	• How to manage the waste oil? • How to minimize the risk from the disaster related to the fuel business operation	The risk assessment and mitigation measured will be studies as part of EIA and waste will be managed according the industrial best practice
2	Sr. Jose Representaive from Administrador Liquica	• Any solution for the cultural sensitivity area? • Method of Piping system from jetty to the storage tank • Groundwater utilization and impact to the community well production • How to protect the fish from the impacts such as oil spill • Recommended to the company to support social program for the local community	All the suggestions are very good and will be elaborated in the EIA study and shall be included in the EIS and EMP report
3	Sr. Nelson de Jesus, Director of Downstream, ANPM	• Ask to clarify the 200 m of study from the slide presentation • Why soil investigation only two points? • Design of all the facility should follow the high standard quality according to API so it will ensure the level of safety in the operation of the facility • ANPM will review the document based on the environmental study prior to granting the license • All the operators of fuel related business must have proper insurance to cover the risk • EIS and EMP should be presented according the phases of project implementation (construction, operation, and decommission) • How to manage the larger fire risk, involves several tanks together	• 200 m radius of oil spill modeling was only tentative but the modeling will have result to show the impact of the oil spill up to which extend • Soil investigation only two points as the site is small and also according to the secondary data of hydro-geologic, the single layer of • All other suggestion will be considered in the preparation of EIS and EMP
4	Sr. Abrao - Climate Change Section, Secretariat of State of Environment	• How to manage the waste • Application of best practice in the other place to this business in managing the risk. Example of using foam method for fire risk management	Waste consist of liquid and solid wastes and they all will be managed internally with the method of oil-water separator (liquid waste) and solid waste will be collected and dispose

Figure 12.2. Stakeholder Consultation at Hotel Ramelau

Similar stakeholder engagement will be conducted again as part of the current study of the environmental impacts assessment (EIA) to discuss the result and finding of the environmental impact assessment (EIA) study.

13. Flexibility Statement

This proposed TOR defined the scope of work of environmental impacts assessment and coverage of proposed environmental management plans (EMP) required for the proposed development project. The proposed TOR is designed to be flexible enough to be modified in order to accommodate changes in project design such as scale and capacity of the development although it is expected that principal parameters will remain the same. This is in part due to the unavailability of much of design-related information such as detailed engineering design.

However, this TOR will be used to guide the EIA consultant in assessing potential impacts and proposed mitigation measures based on the plans, modified plans, and final/detailed plans that may be decided at later stages of project development.

14. Annexes

Annex 1: List of Participants during the Public Consultation in Hotel Ramelau at 25th of June 2019

Annex 2: List of Participants during the Community Consultation in Lauhata, at 22th of June 2019

Annex 3: TOR Presented during Stakeholder Consultation

Annex 1: List of Participants during the public consultation in Hotel Ramelau on 25th of June 2019

Annex 2: List of participants during the Community consultation in Lauhata, on 22nd of June 2019

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Annex 4: Proposed Field data Collection