CAITEHU FUEL STORAGE AND JETTY DEVELOPMENT - ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN (EMMP)

This Final Environmental Management Plan (EMP)is prepared by PEC Consulting, Lda on behalf of Global Petroleum, and product trading PTY, Lda. PEC Consulting is a national environmental and engineering consulting company head quartered in Dili. Comments, suggestion and inputs to this draft EIS can be forwarded to pec.dili.consulting@gmail.com

Table of Contents

EXECUTIVE SUMMARY

The fuel storage facility with 125,000m^3 capacity is proposed to be constructed by Global Petroleum, and product trading PTY, Lda in Aldeia Caitehu, SucoMotaulun, PostoBazartete, Municipio of Liquica. The project will take roughly 4.5 ha of land for storage facility and 150 meter offshore for jetty construction.

Pre-construction phase activities mainly consist of site survey and assessment followed by site preparation including clearance and cut and fills (grading). These activities have the potential to create temporary environmentalimpacts such as dust impact to people, solid and liquid waste generated by workers, loss of existing trees and bushes, impact to safety of workers, some degree of traffic disruption to the national road nearby, and minor noise problem.

After site preparation, enter the construction phase during which the following activities may create impacts that affect people and the environment. This includes dust, solid and liquid waste generated by worker, marine water pollution, loss of coastal seagrass and seaweed beds to construct walkway of jetty, sedimentation in the coastal area and occupational health and safety. Main project activity during Pre-Construction, Construction and Operational Phases are presented in the following table.

Table 1.1. Main Project Activity in Phases of Project Implementation

Phase	Activities
Pre-Construction and Construction	➢ Excavation and Foundation Works /Earth Work ➢ Construction of Storage tanks ➢ Construction of office spaces ➢ Installation of piping system ➢ Installation of control system
Operation	➢ Loading of Oil from oil Tanker from the jetty ➢ Transportation of fuel from tanker to storage ➢ Filling the tank ➢ Transportation of fuel from tank to the power plant ➢ Transportation from fuel storage to the consumers via truck tanker or direct filling system ➢ Operator//working ➢ Control system
Decommission	No decommissioning plans have been prepared because project proponent has plans to further develop the site into depot and office complex in the nearby location therefore ensuring a long term viability of the facility.

The potential social and environmental impacts that may arise from the above list of activities can be found in the following table.

Table 1.2. Summary of Project Activities and Potential Impacts

Facility	Phase	Potential Impacts	Source Activities	Impact Classification
Jetty	Pre-construction	1. Water quality 2. Bottom contamination 3. Marine and coastal ecology 4. Occuptational health and safety	1. Compaction and worker activities 2. Compaction and worker activities 3. Compaction and worker activities 4. Worker activities	All classified as minor impacts due to the temporary and localized nature of the impacts
	Construction	1. Water quality 2. Bottom contamination 3. Marine and coastal ecology - negative 4. Marine and coastal ecology – (positive) 5. Coastal hydrology – changes in current pattern, waves and sediment movement 6. Structure inundation 7. Occuptational health and safety 8. Noise and vibration	1. Construction of jetty and worker activities 2. Construction of jetty and worker activities 3. Construction of jetty and worker activities 4. New structure provides attachment place 5. New structure acts as barrier to current, waves and sediment movement 6. Sea level rise 7. From worker activities 8. From equipment operation	All classified as minor impacts due to the temporary and localized nature of the impacts except for impacts from sea level rise
	Operation	1. Water quality problem, bottom contamination and marine/coastal ecology 2. Structural inundation or erosion of structure 3. Noise and vibration 4. Occupational health and safety	1. Oil spill from tanker operation and oil spill from transfer of fuel from tanker to the storage; waste water and solid waste from worker's activities; increased turbidity during jetty maintenance (fixing and part replacement in the water) 2. Sea level rise 3. Ship traffic 4. Worker's activities	1. Potentially major impact depending on the scale of spill (see discussion on different scale of spill in Table 6.6 Scale of Impacts from Oil Spill). 2. Potentially major impact 3. Minor impacts 4. Minor impacts
	Decommissioning	Not taken into consideration		
Storage Facilities	Pre-construction	1. Water quality 2. Bottom contamination 3. Marine and coastal ecology 4. Air quality problem 5. Loss of terrestrial vegetation	1. Increased turbidity as a result of spoil from site grading 2. Same as above 3. Same as above 4. Site grading leads to an increase in	All considered minor impacts due to the temporary and localized nature of the impacts

		6. Noise and vibration impacts 7. Occupational health and safety	level of Particular Matter (PM) in the air 5. Site clearance 6. Equipment operation 7. Worker's activities	
	Construction	1. Water quality 2. Bottom contamination 3. Marine and coastal ecology 4. Structure inundation 5. Air quality problem 6. Soil and groundwater quality 7. Noise and vibration 8. Traffic disruption 9. Occupational health and safety	1. Increased turbidity as a result of spoil from construction activities; spill of oil, cement and other chemicals being used for construction; solid and liquid waste generated from worker's activities 2. Same as above 3. Same as above 4. Sea level rise 5. Construction activities lead to an increase in traffic that leads to the increase of polluting emission as well as an increase of level of PM in the air 6. Spill of oil, cement and other chemicals being used 7. Equipment operation 8. Increased vehicle traffic for supply of construction matterial 9. Worker's activities	All considered minor impacts due to the temporary and localized nature of the impacts except for impacts from sea level rise (structural inundation).
	Operation	1. Water quality 2. Bottom contamination 3. Marine and coastal ecology 4. Soil and groundwater quality 5. Air quality 6. Noise and vibration 7. Occupational health and safety 8. Structure inundation or structure erosion 9. Visual quality	1. Oil spill from transfer of oil into the storage and oil spill from transfer of oil from storage into tanker trucks for distribution to customer; waste water and solid waste from worker's activities 2. Same as above 3. Same as above 4. Spill of oil, cement and other chemicals being used 5. Construction activities lead to an increase in traffic that leads to the increase of polluting emission as well as an increase of level of PM in the air	1. Potentially major impact depending on the scale of spill (see discussion on different scale of spill in Table 6.6 Scale of Impacts from Oil Spill). 2. Minor impact 3. Minor impact 4. Potentially major impact depending on the scale of spill 5. Minor impact 6. Minor impact 7. Potentially major impact that can lead to loss of lives

				6. Equipment operation 7. Increased vehicle traffic for supply of construction matterial 8. Sea level rise 9. Building on an otherwise unbuilt location	8. Potentially major impact due to loss of part of facility 9. Minor impact
	Decommission	Not taken into consideration			

The above mentioned impacts in various project phases should be minimized with the proposed mitigation measures which can be found in the following table.

Table 1.3. Summary of Project Activity, Potential Impacts and Recommended Mitigation Measures

Component	Phase	Potential Impacts	Source Activities	Mitigation Measures	Monitoring Plan
Jetty Development	Pre-Construction	Water quality, bottom contamination and marine and coastal ecology	Compaction	- Limit compaction to areas that will be developed only (footprint of jetty structure with enough buffer area as allowance) - Compaction conducted during low tide to minimize dispersement to other locations	- Monitor for turbidity that last for more than 12 hours.
			Solid and liquid waste from worker activities	- Provision of temporary sanitation facilities with waste disposed off at the Tibar waste water treatment plant - Provision of garbage bins and signs throughout to warn workers not to litter the marine environment - Worker awareness training of the sensitivity of coral reef and its function in fishery production.	- Monitoring for leak of waste water effluent into the environment - Monitoring for solid waste floating in the marine environment or stranded on the beach - Monitoring for behaviour among workers, for example not using proper sanitation facilities.
		Occuptational health and safety	Worker activities	Use of worker's protection apparatus, including: 1. Bright vest for easy identification of workers 2. Ear and eyes protection 3. Helmet 4. Foot protection (safety boot) and wet suit as necessary First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response procedures	- Use of protection apparatus should be monitored by pre-construction operator and SEPFOPE - First aid kid should be monitored for sufficient and usability of stock - Worker's training should be monitored by ANP and SEPFOPE

	Construction of Jetty	Water quality, bottom contamination, marine and coastal ecology - negative	Compaction	- Limit compaction to areas that will be developed only (footprint of jetty structure with enough buffer area as allowance) - Compaction conducted during low tide to minimize dispersement to other locations	- Monitor for turbidity that last for more than 12 hours.
			Worker activities	- Provision of temporary sanitation facilities with waste disposed off at the Tibar waste water treatment plant - Provision of garbage bins and signs throughout to warn workers not to litter the marine environment - Worker awareness training of the sensitivity of coral reef and its function in fishery production.	- Monitoring for leak of waste water effluent into the environment - Monitoring for solid waste floating in the marine environment or stranded on the beach - Monitoring for behaviour among workers, for example not using proper sanitation facilities.
		Marine and coastal ecology – positive	New structure provides attachment place	- The enactment of submerged structures will automatically provide attachment place for soft corals and other marine biota. Proliferation of the biota will depend on several factors, including tide influence and level of sedimentation in the area	- No specific monitoring measures have been proposed for this, however, special care should be given during fixing or part replacement of the jetty structure as not to displace existing bottom biota that have proliferated on the surface of structure
		Coastal hydrology – changes in current pattern, waves and sediment movement	New structure acts as barrier to current, waves and sediment movement	- No specific measures have been proposed since the jetty structure has been designed to be supported with piles rather than a massive wall structure that tend to inhibit long shore drift movement (example: Pertamina's jetty in Pante Kelapa). - Piles support will not restrict much of the waves and current movement	It is actually hard to predict the ultimate impact of alteration to existing coastal hydrology pattern. As such, monitoring should look for evidence of negative impacts of alteration to current, wave and sediment movement. Negative impacts including higher level of sedimentation around the piles and beach erosion on nearby location that threaten the integrity of structure.
			High sediment load going into the bay	- Geomorphology, soil type, climatic condition as well as land cover that make up the watershed lead to naturally high sedimentation load going into the bay. Sediment flush happens especially during the rainy season where load from upper watershed are transported rapidly into the bay. This will likely lead to a frequent need to dredge the area for maintenance purposes. - Recommended measure for this is tree planting in accessible upper watershed areas. This tree planting can be coordinated with local NGOs with experience conducting this type of programs.	- Monitoring for higher than usual sediment loading that leads to more frequent dredging needs.

		Structure inundation	Sea level rise	Several measures are proposed to manage impacts from sea level rise: - Protection from wave action: in the form of fortification of the structure that connects the terrestrial complex and the jetty. Fortification should be designed with sufficient allowance for sea level rise. - Protection from inundation of jetty structure. The jetty has been designed to be 2.60 m from Low Water Spring (LWS) therefore it should be sufficient to withstand potential sea level rise.	- Monitoring for sea level movement especially in reference to jetty structure.
		Occuptational health and safety	From worker activities	Use of worker's protection apparatus, including: Bright vest for easy identification of workers 1. Ear and eyes protection 2. Helmet 3. Foot protection (safety boot) and wet suit as necessary First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response procedures	- Use of protection apparatus should be monitored by pre-construction operator and SEPFOPE - First aid kid should be monitored for sufficient and usability of stock - Worker's training should be monitored by ANP and SEPFOPE
		Noise and vibration	From equipment operation	- Use of newer and lower noise equipment - Measures for protection of workers from noise and vibration is the same as the above	- Monitoring for complaints from workers and local community.
	Operation of Jetty	Water quality problem, bottom contamination and marine/coastal ecology	Oil spill from tanker operation and oil spill from transfer of fuel from tanker to the storage	- Use of booms around the connection between tanker ship and jetty - Use of dispersant to minor spill. - For major spill from tanker ship, procedure for response is discussed in the following Section.	- Monitoring for evidence of spill in the marine water (oil film or slick) - Monitor for evidence of spill in the sandy beach and coral nearby - Water testing should be conducted on a regular basis (at least once a year) to understand in more detail level of certain hydrocarbon chemicals as well as toxic heavy metals in the water. Parameters tested should at least be the same as parameters that have been tested for the baseline data collection as reported in Chapter IV, Description of the Environment.
			Waste water and solid waste from worker's activities	- Provision of permanent sanitation facility with on site treatment to prevent highly polluted effluent going into the ground water or marine water. On site treatment typically consists of a septic tank with several "rooms" where waste	- Monitoring for signs of eutrophication - Regular water testing as recommended above. - Monitoring for signs of litter in the marine environment, sandy beach

				water goes through and at the end, the effluent discharged will have less organic compound load. - Provision of permanent garbage bins on strategic locations throughout the facility. - Provision of signs that warn facility workers and visitors not to litter - Regular disposal of garbage to Tibar landfill. Burning of garbage should not be conducted on the site because it potentially release toxic chemicals into the air and marine water.	
			Increased turbidity during jetty maintenance (fixing and part replacement in the water)	- Limit compaction as necessary to areas in need of fixing. - Compaction conducted during low tide to minimize dispersement to other locations	- Monitor for turbidity that last for more than 12 hours.
		Structural inundation or erosion of structure	Sea level rise	Measures recommended for sea level rise have been discussed in the jetty construction section. During O&M, monitoring should be conducted to better anticipate impacts from sea level rise.	Monitoring for sea level movement especially in reference to jetty structure.
		Noise and vibration	Ship traffic and operation	Use of proper isolation on the ship's machinery room.	Monitoring for complaint from local community.
		Occupational health and safety	Worker's activities	Use of worker's protection apparatus, including: 1. Bright vest for easy identification of workers 2. Ear and eye protection 3. Helmet 4. Foot protection (safety boot) and wet suit as necessary First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response procedures	- Monitoring for workers day to day activity to identify potential ways accidents can happen and anticipate before hand. - Monitoring for accidents that occur and adjust protection gears and work procedures as needed.
		Limited access to the beach especially by fishermen	Development of jetty and storage facility	- Find new access point and boat parking space for the fishermen. - Provide assistance in the form of new fishing equipment for those affected - Provide financial assistance to those affected to help ease out the transition from one place to another	- Monitoring for implementation of the management measure. Monitoring should be conducted with active collaboration from local authority (chefi de aldeia and chefi de suco). - Monitoring for resulting effect from moving the fishermen to a new place. How their level of income are affected and whether there are conflict at the new

					place. - Monitoring should be done for at least one year until the fishermen established their new parking space.
	Pre-construction-Storage facility	Water quality	Increased turbidity as a result of spoil from site grading	- Dumping of excavation material unused for grading in the proper place (Tibar landfill). - Grading conducted during dry period to avoid runoff and spoil being transported to the nearby marine water	Monitor for turbidity that last more than 12 hours in the nearby area.
			Solid and liquid waste from worker's activities	- Provision of temporary sanitation facilities with waste disposed off at the Tibar waste water treatment plant - Provision of garbage bins and signs throughout to warn workers not to litter the marine environment - Worker awareness training of the sensitivity of coral reef and its function in fishery production.	- Monitoring for leak of waste water effluent into the environment - Monitoring for solid waste floating in the marine environment or stranded on the beach - Monitoring for behaviour among workers, for example not using proper sanitation facilities.
		Bottom contamination	Same as above	Same as above	Same as above
		Marine and coastal ecology	Same as above	Same as above	Same as above
		Air quality problem	Site grading leads to an increase in level of Particular Matter (PM) in the air	- Spraying broken soil every few hours - Workers and visitors wearing mask to protect from dust - Temporarily pave access road	Monitoring for dust and complaint from the neighbor or users of national road.
		Loss of terrestrial vegetation	Site clearance	- Replanting program in the upper watershed to make up for loss of several trees on the location - Landscaping using grass in the facility	Monitoring for at least one year until trees all grow. Every year, as part of Company Social Responsibility, continuous tree planting can be done.
		Noise and vibration impacts	Equipment operation	- Use of newer equipment to reduce noise - Use of ear muffle or other protection	- Monitoring for complaint from worker
		Occupational health and safety	Worker's activities	Use of worker's protection apparatus, including: 1. Bright vest for easy identification of workers 2. Ear and eye protection 3. Helmet 4. Foot protection (safety boot) and wet suit as necessary First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response procedures	- Monitoring for workers day to day activity to identify potential ways accidents can happen and anticipate before hand. - Monitoring for accidents that occur and adjust protection gears and work procedures as needed.
	Construction-Storage facility	Water quality	Increased turbidity as a result of spoil	- Dumping of excavation material unused for grading in the proper place (Tibar landfill).	Monitor for turbidity that last more than 12 hours in the nearby area.

		from site grading	- Grading conducted during dry period to avoid runoff and spoil being transported to the nearby marine water	
		Solid and waste water from worker's activities	- Provision of temporary sanitation facilities with waste disposed off at the Tibar waste water treatment plant - Provision of garbage bins and signs throughout to warn workers not to litter the marine environment - Worker awareness training of the sensitivity of coral reef and its function in fishery production.	- Monitoring for leak of waste water effluent into the environment - Monitoring for solid waste floating in the marine environment or stranded on the beach - Monitoring for behaviour among workers, for example not using proper sanitation facilities.
	Bottom contamination	Same as above	Same as above	Same as above
	Marine and coastal ecology	Same as above	Same as above	Same as above
	Structure inundation	Sea level rise	- Ground elevation: As previously discussed under the Climate Section and Management Measure Section, it is recommended to elevate the site by 50 cm (based on the predicted rise of sea level in Timor Leste). This recommendation is also consistent with recommendation from the geotechnical study of the project site. - Protection from wave action: in the form of fortification of the structure that connects the terrestrial complex and the jetty. Fortification should be designed with sufficient allowance for sea level rise.	- Monitoring for movement of sea surface and its encroachment to the facility.
	Air quality problem	Construction activities lead to an increase in traffic that leads to the increase of polluting emission as well as an increase of level of PM in the air	- Spraying of construction area every few hours - Workers and visitors wearing mask to protect from dust - Temporarily pave access road	Monitoring for dust and complaint from the neighbor or users of national road.
	Soil and groundwater quality	Spill of oil, cement and other chemicals being used	- Provision of temporary storage with lining on the ground to prevent leaching of oil, cement and other chemicals into the soil - Careful use of application of oil, chemicals and cement to prevent spill into the ground - Swift cleaning action when there is spill - Dumping of used oil and other chemicals to the facility in Tibar.	- Monitoring for evidence of spill of lubricant oil, cement and chemicals on the ground - Monitoring for proper dumping of used oil, cement and other chemicals.

	Noise and vibration	Equipment operation	- Use of newer equipment to reduce noise - Use of ear muffle or other protection	- Monitoring for complaint from worker
	Traffic disruption	Increased vehicle traffic for supply of construction matterial	- Assign a person to watch and direct the traffic every time a fleet of vehicle are in and out of the project area - Transport vehicle or other construction-related vehicle operate at night when possible - Put clear sign for detour or traffic direction within and outside of project location	- Monitoring for large increase of traffic due to construction material transport. - Monitoring for problems due to higher amount of traffic.
	Occupational health and safety	Worker's activities	Use of worker's protection apparatus, including: 1. Bright vest for easy identification of workers 2. Ear and eye protection 3. Helmet 4. Foot protection (safety boot) and wet suit as necessary First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response procedures	- Monitoring for workers day to day activity to identify potential ways accidents can happen and anticipate before hand. - Monitoring for accidents that occur and adjust protection gears and work procedures as needed.
Operation-Storage facility	Water quality	Oil spill from transfer of oil into the storage and oil spill from transfer of oil from storage into tanker trucks for distribution to customer	Management measures for slight to minor impacts: - The use of oil separator (constructed as part of the development). - The use of higher grade oil skimming machine when deemed necessary Management measures for major to extensive impacts: - Routine drill on response plans. There are in general two types of response plans – for spill that makes its way to the water and for spill stranded into the sand or nearby salt marsh.	For slight to minor impacts: - Monitor for evidence of oil in the environment (soil, intertidal coral and sandy beach). Monitoring should be conducted on a daily basis. Clean swiftly when there is evidence of spill in the environment. - Monitor for effectiveness of oil separator basin. When not found to be effective, use higher grade skimming machine. - Periodically (at least once a year) conduct testing of effluent from the separator basin to see whether effluent is within allowable standards for effluent from downstream oil facility. Use applicable standards recommended in this EMP or use other standards as recommended by NDPCEI. For major impacts: - Monitoring should focus on ensuring the integrity of the primary, secondary and tertiary containment methods.

	Waste water and solid waste from worker's activities	- Provision of permanent sanitation facility with on site treatment to prevent highly polluted effluent going into the ground water or marine water. - Provision of permanent garbage bins on strategic locations throughout the facility. - Provision of signs that warn facility workers and visitors not to litter. - Regular disposal of garbage to Tibar landfill. Burning of garbage should not be conducted on the site because it potentially release toxic chemicals into the air and marine water.	- Monitoring for signs of eutrophication - Regular water testing as recommended above. - Monitoring for signs of litter in the marine environment, sandy beach
Bottom contamination	Same as above	Same as above	Same as above
Marine and coastal ecology	Same as above	Same as above	Same as above
Soil and groundwater quality	Spill of oil, cement and other chemicals being used	- Provision of permanent storage with lining on the ground to prevent leaching of oil, cement and other chemicals into the soil - Careful application of oil and other chemicals to prevent spill into the ground - Swift cleaning action when there is spill - Dumping of used oil and other chemicals to the facility in Tibar.	- Monitoring for evidence of spill of lubricant oil, cement and chemicals on the ground - Monitoring for proper dumping of used oil, cement and other chemicals.
Air quality	Tanker trucks delivering fuel out of the facility lead to an increase in traffic that leads to the increase of polluting emission gasses	- Use of newer or well maintained vehicle fleet to curb emission gases	Monitoring for elevated level of air pollution gasses including NO_2, SO_2, CO and CO_2. Air pollution in the area.
Noise and vibration	Equipment operation	- Use of newer equipment to reduce noise - Use of ear muffle or other protection	Monitoring for complaint from worker
Occupational health and safety	Workers activities	Use of worker's protection apparatus, including: 1. Bright vest for easy identification of workers 2. Ear and eye protection 3. Helmet 4. Foot protection (safety boot) and wet suit as necessary First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response	- Monitoring for workers day to day activity to identify potential ways accidents can happen and anticipate before hand. - Monitoring for accidents that occur and adjust protection gears and work procedures as needed.

			procedures	
	Structure inundation or structure erosion	Sea level rise	- Protection from wave action: in the form of fortification of the structure that face the coastal areay. Fortification should be designed with sufficient allowance for sea level rise.	- Monitoring for movement of sea surface and its encroachment to the facility. - Monitoring of the health of coral reef ecosystem by engaging expert that collect the data on coverage every year and survey to see sign of distress of coral reef.
	Visual quality	Building on an otherwise unbuilt location	- Landscaping with grass in spaces between the facility and the fence	- Monitoring for complaints from passersby

In order to ensure the implementation of the proposed Environmental Management Plan (EMP), a monitoring plan should be required. During the monitoring activities, important parameters to control are:

- Water quality parameters in terms of turbidity, DO, BOD, heavy metal in the marine water
- Wastewater quality parameters in term of turbidity, DO, BOD, various heavy metals
- Air quality especially in terms of PM10, PM25, SO_x and NO_x
- Impacted coral reef and sea grass area
- Traffic count
- Fire incident
- Noise control
- Emergency and evacuation plan

Table 1.4 shows monitoring plans during all three phases in project implementation as well as agencies responsible for monitoring.

Table 1.4. Monitoring Program and Agency Responsible for Activities

Parameters to be monitored	Method	Frequency	Agency Responsible
Water quality	Sampling and Insitu measurement	Every 6 month	Project owner, NDPCEI, MOH
Air quality	Sampling and Insitu measurement	Every 6 month	Project owner, NDPCEI, MOH
Coral	Visual inspection	Every year	Project owner,NDPCEI Biodiversity Directorate, Fishery
Solid waste and liquid waste	Visual inspection	Every 6 month	Project owner, NDPCEI, Dili District Administration, local authority
Fire and incident report	Instrument detection and visual inspection	Every 6 month	Project Owner, NDPCEI, Dili District Administration, Civil Protection, Police
Occupational health and safety	Visual inspection	Every year	Project Owner, NDPCEI, SEFOPE, MOH
Leak detection	Insitu measurement	Every 6 month	Project Owner, NDPCEI, ANP, MOH
Loading of fuel from tanker	Visual inspection	During each loading	Project owner

The implementation schedule of the EMP can be seen from the following table.

Table 1.5 Implementation Schedule of the proposed EMP during Pre-Construction, Construction and Operation

Activity of EMP	Year1				Year2				Year 3	
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
	Pre-Construction		Construction						Operation	
Dust Management	v	v	v	v	v	v	v	v		
Solid and Liquid waste Management	v	v	v	v	v	v	v	v	Constinouus	
Occupattional heath and Safety	v	v	v	v	v	v	v	v		
Noise Management	v	v	v	v	v	v	v	v		
Inccident management	v	v	v	v	v	v	v	v	Constinouus	
Traffic Management	v				v				Constinouus	
Fire Control and Management									Constinouus	
Oil spill detection and management									Constinouus	
Occupational health and Safety	v				v				Constinouus	
Storm runoff and sedimentation										
Solid and Liquid waste Management	v	v	v	v	v	v	v	v	Constinouus	
Air quality monitoring	v				v				Constinouus	
Water quality monitoring			v		v				Constinouus	

Q = quater, where each quater is defined as three months

The total cost required by Global Petroleum to implement the proposed EMP is about USD 195,000 during the pre-construction and construction phases. During the O&M phase, the total cost for mitigation measures is predicted to be about USD 85,000. A detail breakdown of the costs is provided in the following table.

Table 1.6. Total Cost of the Management Measures

Phase	Group of Activities	Activities	Quantity	Unit	Unit Cost ($)	Total Cost ($)
Pre-Construction	Excavation Material from Grading of Fuel Storage Site	Dumping of excavation material in proper dumping station (Tibar)	2	dumping trip	600	1200
	Air Quality	Spraying of grading site	120	work days	35	4200
	Loss of Terrestrial Vegetation	Replanting program in the upper watershed (to be conducted during O&M phase)		See O&M phase		
	Sanitation	Provision of temporary sanitation facilities	3	temporary toilets for 120 days	200	600
		Routine disposal of liquid waste	24	dumping trip	50	1200
		Garbage bins	10	bins	20	200
		Routine disposal of solid waste	24	dumping trip	25	600

		Worker awareness training	1	event	150	150
	Occupational Health and Safety & Noise and Vibration	Workers protection gears (boots, ear muffle, goggle, bright vest, etc.)	40	protection kit	60	2400
		Total Pre-Construction Cost during the 6 months				**$ 10,550.00**
Construction	Sea Level Rise	Fortification of structure that connects the complex to the jetty	1	structure	150000	150000
		Site elevation	1	time	10000	10000
		Coral reef survey		See Monitoring Measure Costing		
	Air Quality	Spraying of grading site	360	time	35	12600
	Soil and Groundwater Protection	Provision of temporary storage with lining on the ground	1	storage	5000	5000
		Routine dumping of used oil and other chemicals to Tibar	15	dumping trip	35	525
	Traffic Disruption	One personel to direct traffic	1	personel	2700	2700
		Provision of signage	4	signs	10	40
	Occupational Health and Safety & Noise and Vibration	Workers protection gears	40	protection kit	60	2400
		Total Construction Cost during 1.5 years				**$ 183,265.00**
Operation	Oil transfer from jetty to storage	Provision of booms and dispersant	5	units	5000	25000
	Oil filling into trucks for distribution to customer	Provision of oil-water separator basin or higher grade separator machine (optional)	1	structure	5000	5000
	Sanitation	Provision of permanent sanitation facilities	4	units	600	2400
		Routine disposal of liquid waste	1	dumping trip	35	35
		Provision of permanent solid waste facilities	10	units	20	200
		Routine disposal of solid waste	26	dumping trip	25	650
		Provision of "No Littering" signs throughout facilities and in the beach areas	15	signs	20	300
	Tree Planting in the upper watershed	Tree Planting in the upper watershed	1	event	1000	1000
	Air Quality	Spraying of facility site	180	days	35	6300
	Occupational Health and Safety & Noise and vibration from equipment operation	Workers protection gears	24	kit	60	1440
	Beach Access by Fishermen	Finding new access points	1	event	40000	40000
		Provide assistance to the fishermen				
		Total Operation and Maintenance Cost per Year				**$ 82,325.00**

For monitoring purposes, total cost is estimated at USD 11,000 for pre-construction and construction phases. For the O&M phase, the total monitoring cost is estimated at USD 28,000. A detail breakdown of the monitoring cost is provided in the following table.

Table 1.7. Cost Figure of the EMP Implementation during Operation of the Facility

Phase	Monitoring Measures	Remarks	Quantity	Unit	Unit Cost ($)	Total Cost ($)
Pre-Construction & Construction	Monitoring for turbidity that lasts long	Facility operator, daily basis	720	days	10	7200
	Monitoring for leak of waste water and solid waste into the beach and marine environment, monitoring for signs of eutrophication	Facility operator,daily basis	720	days		
	Monitoring of worker's behavior related to solid and liquid waste, related to the use of personal safety protection	Facility operator, daily basis	720	days		
	Provision of First Aid kit	Facility operator	5	first aid kit	35	175
	Monitoring for negative effect of changes in coastal hydrology to the integrity of the development	Facility operator, daily basis, require data collection and keeping of record	720	days	5	3600
	TOTAL for Pre-Construction and Construction for two years					**$ 10,975.00**
Operation	Monitoring for leak of waste water and solid waste into the beach and marine environment, monitoring for signs of eutrophication	Facility operator, daily basis	365	days	10	3650
	Monitoring of worker's behavior related to solid and liquid waste, related to the use of personal safety protection	Facility operator, daily basis	365	days		
	Provision of grievance redress procedure to allow for monitoring of complaints from local community and workers	Facility operator	365	days		
	Monitoring for proper dumping of liquid waste, solid waste and used oil and other chemicals	Facility operator, monthly basis	12	days	5	60
	Provision of First Aid kit	Facility operator	5	first aid kit	35	175
	Monitoring for negative effect of changes in coastal hydrology to the integrity of the development	Facility operator, daily basis, require data collection and keeping of record	720	days	5	3600
	Monitoring of sea level movement					

	Monitoring of coral's health	Engage local environmental NGO, initial and yearly study can be conducted for 1 month	30	days	50	1500
	Outreach to local community, local authority and fishermen group	Facility operator and representative of upper management, can be conducted once a year during christmas time, anniversary of facility or other proper time	1	per year	5000	5000
	Marine water quality test	Engage a laboratory	1	per year	6000	6000
	Marine ecological integrity test (benthic communities stability)	Engage a laboratory				
	Monitoring for oil spill on a daily basis and monitoring to the effectiveness of oil separator basin	To determine needs for higher grade oil-water separator	365	days	5	1825
	Monitoring for dust pollution on a daily basis	Facility operator				
	Air quality test	Engage a laboratory	1	per year	5000	5000
	Monitoring for tree planting program	Engage local environmental NGO, conduct three planting during rainy season once a year	20	days	25	500
	Monitoring for integrity of primary, secondary and tertiary containment measures	Internal inspection by operator, require data collection and record keeping, conduct at least weekly	52	per yer	10	520
		TOTAL for Operation and Maintenance				**$ 27,830.00**

Note that the project proponent is fully responsible for the implementation of the proposed Environmental Management Plan (EMP) with close consultation with relevant regulatory bodies within the government of Timor Leste. Regular monitoring and testing of the above parameters should be conducted and results must be reported to relevant authorities. Relevant government body should conduct site inspection even its own data collection as necessary to ensure that project proponent implement the EMP effectively.

Project proponent is obligated to take necessary actions if parameters values of the measurable indicators are higher than the ambient environmental quality standards. For instance, wastewater disposal from the facility to the nearest water bodies must not trigger eutrophication or any elevated standard. If ambient water quality does not meet the standards, than assessment of the source of elevated parameters should be conducted. If it is later found out that business as usual will not be effective to keep runoff from the

facility from breaking the ambient water quality standards, then provision of more advanced equipment should be considered. Cost for the provision should be paid by project proponent.

CHAPTER I: PROJECT PROPONENT AND CONSULTANT FOR THE PREPARATION OF EIS

1.1 Project Proponent

The project is proposed by Global Petroleum Lda, the company devoted mainly to import, distribution and sales of fuels. Company's contact detail is provided as follows:

Mr. Julian Chiang (Director)
JL. Rua Pertamina (Pantai Kelapa) Dili, Timor Leste
Telephone: +670 331 0440 (TL)
Mobile: +670 7715 2835 (TL)
Email: Julian.chiang@globalsgp.com

The Global Group Company has entered into a binding agreement with Global Petroleum and Singapore-based Hing Leong Holdings Capital Pte Ltd to design, construct and operate Universal Global Terminal, a full-service petroleum terminal in Liquica, Timor-Leste. The Company is planning to build a terminal with the storage capacity of more than 100,000 CBM of petroleum products.

The Global Group of Timor-Leste operation started off its business activities with only 5 heavy equipment for lease under Global Equipment Trading Pty Lda in late 2012. The one stop, full-service hired equipment has grown steadily and ever since, the company own over 100 equipment operating across the country and efficient berthing facilities capable of handling larger vessels. The terminal's storage tanks range in size from 3,000 CBM to 20,000 CBM.

The proposed project is meant to provide the nation with commercial and strategic needs of fuel and other petroleum products considering the company has a fully integrated system consisting of trading, sourcing, marine and onshore transport facilities.

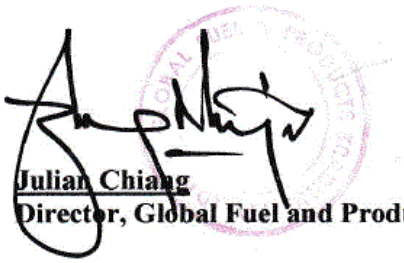
Table1.1. Global Petroleum Capital Expenditure (At Full Capacity)

Item	Proposed Cost (US$)
Feasibility Studies	500,000
Land Preparation and Compensation	9,500,000
Construction of Tanks	35,000,000
Construction of Marine Berth	10,000,000
Construction of Terminal Building/Office for Operators, Laboratories, Emergency Response Units, Spares Warehoues, etc.	5,000,000
Total	**60,000,000**

1.2 Proponent Endorsement

There have been discussions with the proponent regarding the contents of the EIS and hereby, the proponent endorses the EIS and EMP.

Project owner, Global Petroleum, and product trading PTY, Lda .



Julian Chiang
Director, Global Fuel and Products Trading Pty, Lda.

1.3 Consultant for EIS Preparation

The EIS and EMP have been prepared by PEC Consulting, Lda., a Timorese-own planning and engineering consulting company headquartered in Dili. PEC Consulting team consists of several specialists who contribute to the different parts of the analysis. In addition to the national specialists, the team also engaged international specialists from Indonesia who performed marine water and air quality testing. Technicians from local water quality laboratory (DNSA) were also engaged to test for fresh water quality.

A summary of consultant staff expertise are presented in the following table.

Table 2.5. Summary of Consultant Staff Expertise

No	Staff	Expertise
	CONSULTANT STAFF	
1	Sr. Krispin Fernandes, PhD	Trained in Chemical Engineering and Hydrology, Krispin has substantial experience in environmental analysis and engineering.
2	Sr. Mario Marques Cabral, S.Si, M.Sc	Trained in Marine and Environmental Science, Mario has experience working in marine, fishery, coastal management and food security area.
3	Sra. LeonizaLobato, S. Hut, D. Env.	Trained in forestry science, Leoniza has experience as both regulator and consultant in the environmental impact assessment field.
4	Sra. Rosalyn Fernandes, S.T. MURP	Trained in Chemical Engineering and Urban and Regional Planning, Rosalyn has experience working in infrastructure, land use, environmental and community

		consultation areas.
5	Sr. Livio da Conceicao Matos, S. KM, MPH	Trained in Public Health, Livio has experience working as Environmental Health officer and Public Health promoter for malaria, dengue and mother and child health.
6	Sr. VenancioRego 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
7	Crisanto dos Santos	Graduated with a diploma in computer engineering, Crisanto serves as a logistic officer in the project.
	OTHER SPECIALIST	
8	Dr. Mont KaniaDewi, S.T., M.T.	Head of Air Quality Laboratory,Faculty of Civil and Environmental Engineering, InstitutTeknologi Bandung (ITB).

The following are detailed qualifications of the above experts.

Krispin Fernandes, PhD

CURRICULUM VITAE

A. Personal Data

Name	: Krispin Rego Fernandes, PhD
Date of birth	: 10 May 1976
Place of birth	: Lospalos, Lautem, Timor Leste
Gender	: Male
Citizenship	: Timorense
Countries of Working Experience	: Timor Leste, USA

B. Employment record

1. **Consultant for Aurecon, Pty., Ltd. On Water and Wastewater Treatment Design in F-FDTL Training Center, Metinaro, Timor Leste,***April 2013 – July 2013*

Primary duties:

- Coordinate for field data collection (pumping test, well monitoring, soil testing)
- Environmental data collection for preparation of environmental licensing document (IEE)
- Liaise with the stakeholders of the programs (Australian Departnment of Defence and FFDTL) and other sub-consultants that will conduct field work for data collection
- Conduct meeting with the stakeholders and consultant team members from Darwin and Melbourne
- Collaborate for final report delivery with consultants from Darwin and Melbourne

2. **Consultant for Japan International Cooperation Agency (JICA) on Irrigation Rehabilitation and Improvement Project, Laleia, Manatuto,** *November 2012 – July 2013*

Primary duties:

- Hydrological survey and data collection
- Team leader of agriculture survey and data collection
- Assessment of irrigation system and standard practice in Timor Leste
- Baseline data collection of environmental condition in Timor Leste and project area (climate, topography, land uses, coral reef, and other socio - economic data)

3. **Environmental Specialist for Preparation of IEE document for Cement Packing Plant in Liquica,** *December 2012 – January 2013*

Preparation of the IEE based on secondary data such as topography, land cover, social economic and community consultation. Produced the "IEE for the Development of Cement Packing Plant with 180000 tons/year Capacity and a Small Tanker Jetty." IEE was submitted to the National Directorate for Environmental (DNMA – Portuguese acronym) for final approved. Document was approved and license granted in February 2013.

4. **Trainer for Drainage Modelling and Engineering Estimation to Ministry of Public Work Staff**, *September – November 2012*

Training and Capacity Building for staff from National Directorate for Basic Sanitation and National Directorate for Roads, Bridges and Flood Control, all under the Ministry of Public Works. Training covered GIS-based modeling for drainage assessment, drainage improvement plans and flood plain mapping.

5. **Drainage Specialist for SKM Consulting ,** *October 2011 –July 2012*

Primary duties:

- Hydrologic and hydraulic modeling
- Flood plain mapping; conceptual designing
- Preliminary costing of drainage infrastructure improvement
- Development of field rainfall data collection system
- Master plan writing
- GIS database, hydraulic and hydrologic modeling training.

Reports produced:

- Dili Urban Flooding and Drainage Management Strategies
- Dili Drainage Master Plans (technical components)
- Dili Drainage Improvement Plans (priority area, conceptual design, and preliminary cost estimation)
- Dili drainage database system

6. Drainage Engineer with Melbourne Water Corporation , *February 2011 – October 2011:*

Primary duties:

- Field survey of drainage channels utilizing differential GPS equipment
- GIS database development
- Hydrologic modeling of Dili drainage system
- Hydraulic modeling of river systems in Dili
- Report on hydrologic modeling and analysis of Dili drainage system.

Report produced:

- Dili contour mapping, catchment definition, and catchment capacity estimation

7. Post-Doctoral Research Scholar at Water Resource Research University of Hawaii at Manoa, *June- December 2010*

Project: Survey and modeling analysis of Municipal Separate Storm Sewer System (MS4) at highway storm runoff network on Oahu, Hawaii, USA.

Duties: Designed and installed field monitoring network for stream flow and stream water quality; field data collection; hydrologic modeling development and calibration; report writing.

Report produced:

Liu, C.C.K., Moravcik, P, **Fernandes, K**., and Card, B.J. 2011. Survey and Modeling Analysis of HDOT MS4 Highway Storm Runoff on Oahu, Hawaii, *Project Report PR-2012-01, Water Resources Research Center,* University of Hawaii, Honolulu

8. Research Assistant at Water Resource Research Center, University of Hawaii at Manoa, *July 2006 – August 2010*

Projects:

1. Modeling and Drainage Infrastructure Designing for Kaloi Gulch Watershed in Southern Oahu, Hawaii, USA
2. Hydrologic Analysis of Hawaii Watershed for Flood Control and Environmental Conservation
3. Wind-Powered Reverse Osmosis Desalination for Pacific Islands and Remote Coastal Communities
4. Agriculture Rehabilitation Project in Seical basins, Timor Leste, Funded by the United States Agency for International Development (USAID)

Duties: Data collection, experiment design, field data collection, literature review, report writing.

9. **Climate and Information System Project Intern, National Oceanographic and Atmospheric Administration (NOAA), Office of GlobaI Program (OGP), Silver Spring, Maryland, USA,** *Summer 2002 and Summer 2003*

Project: Application of Radio and Internet (RANET) to disseminate climate and weather information in developing nations.

Duties: Researched and tested RANET equipment for potential application in Timor Leste

10. **Staff at Oxfam International Australia in Timor Leste,** *November 1999 – January 2000*

Project: Water supply and sanitation improvement project in Dili, Liquica, and Bobonaro

Primary Duties: Worked in the team to assess existing drinking water distribution network, including assessing damage caused by 1999 turmoil; developed inventory of material required for repair and construction of new water distribution system.

C. University Education

No	*University*	*Main Course of Study*	*Place*
1.	University of Hawaii at Manoa	Civil and Environmental Engineering (Completed Doctor of Philosophy)	Honolulu, Hawaii, USA
2.	University of Hawaii at Manoa	Civil and Environmental Engineering (Completed Master Degree)	Honolulu, Hawaii, USA
3.	GadjahMada University	Chemical Engineering (Completed Bachelor Degree)	Jogjakarta, Indonesia

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Mario Marques Cabral, S.Si, M.Sc

CURRICULUM VITAE

A. Personal Data:

Name	:	Mario Marques Cabral
Date of birth	:	23 November 1974
Place of birth	:	Maina II, Lospalos
Gender	:	Male
Marital status	:	Married
Citizenship	:	Timorense

B. Employment record:

1. **Agriculture Specialist/Consultant,***November – December 2012:*
   Contract service with JICA Study Team for the Project for Rehabilitation and Improvement of Buluto Irrigation Scheme (Laleia and Vemase) in Baucau and Manatuto Districts.Agriculture survey, interview to government and farmers, interpretation, reporting.

2. **Marine Biology Specialist/Consultant,** *July – August 2012:*
   Contracted service at Ministry of Marine Affairs and Fisheries, Directorate General of Marine, Coastal and Small Islands (Indonesia). Review and Profiling the Potential of Ecological and Social Economical for Marine Protected Area inGunungkidul and Bantul Districts of Yogyakarta Province.

3. **Natural Resources Management Specialist/Consultant,** *October – December 2011:*
   Contracted service at Forestry Ministry, Directorate General of Watershed Management Building and Social Forestry, Watershed Management Center of BenainNoelmina, Strengthening Community-Based Forest and Watershed Management (SCBFWM) Project Region of East Nusa Tenggara. Cooperation among Ministry of Forestry (Indonesia), UNDP and GEF.

   - ReviewBesiam Sub Watershed condition by involving other counterparts, other sectors and other relevant stakeholders;
   - Record related stakeholders data (key and primary stakeholders) and their roles inTTS and Kupang Districts level for Besiam Sub Watershed management of Noelmina Watershed;
   - Formulate the integrated strategic among stakeholders in TTS and Kupang Districts level for Besiam Sub Watershed management of Noelmina Watershed;
   - Integrated program compilation among stakeholders in the regional of TTS and Kupang Districts for Besiam Sub Watershed management; and
   - Communicate the result of study to others stakeholders for feedback and agreement.

4. **Extra ordinary lecturer,** *September 2011 – August 2012:*
   Employed as extra odinary lecturer at Faculty of Fisheries and Marine Science of ArthaWacana Christian University Kupang (East Nusa Tenggara Province-Indonesia).

   - Teach subject of Law and Fishery Regulation;
   - Teach subject of Fishery Management; and
   - Teach subject of Fishery extension.

5. **Coastal and marine resources management specialist**, *August - December 2011:*
   Act as volunteer service at fish hatchery unit of Marine Affairs and Fisheries Services of East Nusa Tenggara Province (Indonesia).

   - Provide technical assistance and reporting guidance for fisheries legislation reviewed and amendments drafted;
   - Facilitate and assist for the project implementation on training and provision of supporting material and tools for catfish farming in Kupang Municipality and Kupang District.

6. **Manager Program,** *August 2011– until now:*
   Founder and member of Talitawan (a local NGO with core development mission in agriculture, forestry, marine affairs and fisheries), coverage areas of East Nusa Tenggara Province (Indonesia).

   - Prepare technical specification needed as input for NGO forming and registration;
   - Provide guidance of statutes/rules of organization, organization regulation and work plan design of Talitawan;
   - Prepare Terms of Reference (ToR) for staff recruited in project implementation;
   - Design company profile of Talitawan and build partnership to government institution, local/international NGOs, and other relevant stakeholders with core business areas in natural resources management.

7. **Natural resources management specialist, volunteer**, *July - December 2011:*
   - Provide technical guidance of sustainable agriculture management to the marketing bureau region of Timor, Alor, Rote Ndao and SabuRaijua for liquid organic fertilizer M-8;
   - Act as facilitator of bureau region marketing to liaise with government official of agriculture department East Nusa Tenggara Province;
   - Provide technical guidance of the initial forming for association of sustainable forestry for people of Indonesia, East Nusa Tenggara Province.

8. **Natural resources management specialist, volunteer,** *February –July 2011:*
   - Provide and organize consultation to Indonesian Fishers Union of Kupang District, East Nusa Tenggara Province ;
   - Facilitate a floating net cage management for mouse grouper (mariculture) between fishers community in Kupang District and Kupang Municipality with PT. Karamba and Fish Hatchery Unit of Marine and Fisheries Services of East Nusa Tenggara Province;
   - Prepare proposal for salt industry development-community based management project by applying concrete construction method with CV. PHEDCO and PT. DecontMitraConsulindo in Kupang District;
   - Facilitate compiling data and proposal processing for the cattle breeding intensification and controlled, a project with focus on productivity, sustainability and economical value and strategic for creating community entrepreneurship opportunity of East Nusa Tenggara Province.

9. **National Project Manager,** *January – December 2010:*
   Personnel service agreement at Regional Fisheries Livelihoods Programme (RFLP) for South and South East Asia (GCP/RAS/237SPA), FAO Indonesia. Project location: Kupang Municipality, Kupang District, Alor District and Rote Ndao District of East Nusa Tenggara Province. Cooperation between FAO and AECID.

   - Liaise with the Senior Officer nominated by the implementing agency, partner organizations and FAO Representation;
   - Guide and supervise all other national project personnel;
   - Prepare Terms of Reference for national consultants in consultation with the national counterparts and FAO Representation, for approval by Project Management Office (PMO);
   - Prepare technical specifications for services needed under Letters of Agreement;

- Identify training needs of the target beneficiaries and partner organizations and assist in organizing training events;
- Prepare specifications of equipment and materials needed as input for project activities;
- Monitor project expenditures under the national component;
- Provide guidance and technical support to implementing agency partner organizations;
- Provide guidance to the Monitoring and Evaluation Officer (National Consultant) in collecting and analyzing all monitoring information related to performance and process indicators;
- Be responsible monitoring risks to project performance;
- Act as secretary of the National Coordinating Committee (NCC) together with implementing agency;
- Represent the project in relevant meetings and workshops as required;
- Prepare national component work plans in communication with local stakeholders;
- Prepare the monthly summary reports on progress of work, six (6) monthly reports and the project final report, and submit them to PMO and FAO for their approval; and
- Perform other related duties as required.

C. University Education

No	*University*	*Attended from/to*	*Main Course of Study*	*Place*
1.	University of GadjahMada	2000 – 2003	Environmental Science (Post graduated – S2)	Yogyakarta (Indonesia)
2.	University of Diponegoro	1992 – 1999	Marine Science (Bachelor graduated – S1)	Semarang (Indonesia)

LEONIZA DOS SANTOS LOBATO

Fatuhada Comoro, Dili, Timor-Leste
Mobile: +670 7731 0881
Email: leonizalobato@hotmail.com

QUALIFICATIONS

2008 **Diploma of Environmental Science**
Canberra Institute of Technology, Australia

1997 **Degree of Forest Management**
University Nusa Bangsa, Bogor, Indonesia

1993 **Diploma of Forest Management**

Institute of Forestry,Bandung, Indonesia

Short Courses

2010	Energy for Sustainable Development Course, The International Institute for Industrial Environmental Economics at Lund University, Sweden (Online Course).
2005	Certificate I in Work Skills, Sydney Institute
2004	Study Tour to Norway on Petroleum Management and Environment
2003	Environment and Export Processing Zone, China
2003	Environmental Management Plan and Impact Assessment, Japan
2000	Environmental Protection and Management by Research Institute for Asia and the Pacific (RIAP), University of Sydney.

Nov 2012-Dec 2014 - Technical Assistant to OASIS, Environmental Consultancy

(OEC) on Sustainable Projects, Dili, Timor-Leste

- supporting the OEC in the preparation of OASIS's technical assistance to ILO and the Road for Development (R4D) Programme, by analysing relevant bibliography

  and documentationand preparing a work program according to the R4D TOR requirements;

- supporting the OEC in reviewing, analysing and reporting on existing environmental legislation and regulations relevant to the project and assessing

  overall institutional and private sector compliance;

- Performing desk reviews and reporting to the OEC on relevant climate change and environmental issues in Timor-Leste;

- supporting the OEC in the design and presentation of practical and realistic operational ESF and guidelines/instructions/procedures for R4D;

- Investigation and presentation of realistic mitigation measures for the ESF activities relevant to the R4D Project;

- supporting the OEC in the preparation of all the necessary workshops, consultations and training activities for the ESF drafts;

- Supporting the OEC in the analysis of and proposal to introduce relevant ESF elements into key R4D documents;

- Supporting the OEC in the preparation of Initial Environmental Examination (IEE) to the ADB Water Supply Sector Project in Dili;
- Assist OEC in the preparation of technical proposal to be submitted to the clients;
- Assist OEC in the environmental diagnostic for private sectors such as Timor Block Building Industry's (TBBI) and Mira Mar Block's (MMB) activities;
- Analyse and diagnose environmental impacts associated with Cement Block Making Plant and compiled it in an assessment report.
- Prepare and produce Project Document for categorisation of private sectors activities in order to obtain Environmental License.
- Arrange meetings and established networking with clients;
- Other activities as required by the OEC.
- Other activities as required by the OEC.

March 2009 to September 2009Project Manager for National Adaptation Programme of Action (NAPA) to Climate ChangeUnited Nation Development Programme (UNDP), Timor-Leste.

- Secured high level of government support for the National Adaptation Program of Action (NAPA) programme
- Arranged meetings with overseas mission and other agencies and government officials
- Identified and set-up Sector Working Groups (SWGs) for NAPA programme
- Identified and set-up Project Working Committee (PWGs) for NAPA programme
- Identified and set-up Project Steering Committee (PSC) for NAPA project
- Prepared speech for the Secretary of State, Vice Minister and the Minister
- Organized and administer meetings and workshops to raise awareness on the impact of climate change
- Assisted in the preparation of logistics and material for the meetings
- Liaised with donor agencies, academics, government and communities
- Lease with the donors on the NAPA progress
- Built and maintained support and cooperation with key stakeholders including NGOs, donor agencies, government bodies, private sectors and civil society
- Built networking with International NGOs who help East Timorese in poor villages get access to sustainable solar system with government stakeholders and civil society.
- Prepared NAPA's annual workplan
- Prepared Terms of Reference for SWGs
- Conducted regular meetings with the SWGs, PWCs and the PSC
- Conducted interviews for Project Manager Position
- Prepared reports and minutes of meetings as well as translated them into English
- General administration tasks

Oct 2000 – Oct 2004 Deputy Director and Acting Director - Directorate of Environmental Services, Timor-Leste

Overall responsibility for environmental agency functions of Timor-Leste Government

- Estimated project costing and managed the budget project
- Directed, coordinated and supervised technical and professional staff
- Liaised with academics, government bodies and communities
- Solved problems in different scenarios and managed planning process
- Estimated annual budget for the Directorate and presented in the Budget Committee meeting
- Managed budget of the Directorate
- Prepared annual report through consultative process with staff to the Ministry
- Worked with Environmental Impact assessment team in Environmental assessment and auditing of development proposals
- Supervised Pollution Control team in investigating various sources of pollution
- Monitored and evaluated activities of the Directorate
- Prepared Annual Action Plan for the Directorate
- Liaised with government bodies and local communities in order to stop illegal sand mining
- Part of a team in the recruitment process of staff for permanent and temporary positions
- Conducted interviews for International positions
- Direct management of donor funded project.
- General office administration work

Dec 1999 –Aug 2000 Member of District Council, Liquisa

- Worked with other members to discussed any issues related to the development including environmental, agricultural and forestry, and infrastructure in Liquisa District
- Provide suggestions to the UNTAET administration regarding any progress on the current and proposed future development for Liquisa District.
- Conduct workshops and meetings with the local community

Apr 1997 - Sep 1999 Forest Production and Rehabilitation Officer

Forestry Department East Timor

- Worked with community groups, businesses and the Department to control the quality of timber for export and eco-labelling
- Worked with the community on replanting native trees in the country
- Selected and marked trees for harvesting
- Recommended species for reforestation in areas that require special rehabilitation and management
- Selected trees to be removed, relocated or treated
- Ensured compliance with environmental regulations, terms of contract and occupational health and safety measurements

- Analyzed transpiration from trees and decomposition rates of organic waste

Rosalyn Fernandes, S.T., MURP

CURRICULUM VITAE

A. Personal Data

Name	: Rosalyn Fernandes
Date of birth	: 25 October 1977
Place of birth	: Poso, Central Sulawesi, Indonesia
Gender	: Female
Citizenship	: Indonesian
Countries of Working Experience	: Timor Leste, USA

B. Employment record

1. **Environmental Specialist,***January 2014 – Present*
   Working on Simplified Environmental Impact Statement (SEIS) and full scale EIS under contract from PEC Consulting.Responsibility including desk review of relevant document, field investigation, document write ups, presentation and coordination of other specialist.

2. **Consultant for Timor Leste Greenhouse Gas (GHG) Inventory,** *October 2012– October 2013*
   Contracted service at UNDP Timor Leste for the national GHG Inventory and Mitigation Options Analysis. Duties include conducting research, analysis, workshop and training for stakeholders from different agencies. Stakeholders include ALGIS, SOL, DNMA, DNAAI, Forestry, Fisheries, DNSSB, EDTL, and others.

3. **Environmental Specialist,** *June – July 2012*
   Part of the team that put together the Environmental Impact Assessment document for development of UNTL Hera facility on 365 ha land. Responsible for baseline write up on socio-economic condition and waste management. Responsibilities include report writing, analysis, map making, community consultation, client liaison.Contracted service by Oasis, Sustainable Projects.

4. **Community Engagement Specialist**, *January – May 2012*
   Contracted by SKM International, coordinated and implemented Sanitation Willingness to Pay Survey (600 samples), coordinated and implemented Flooding Damage Survey (50 samples), and coordinated and implemented community consultation (qualitative survey) covering topics: environmental cleanliness, sanitation, hygiene, solid waste, flooding, and kangkung management.

5. **Consultant for State Secretary for the Environment,** *February – June 2012*
   Consultant for Timor Leste State Secretary for the Environment (SEMA) working on compilation and analysis of SEMA's activities between 2007 – 2012 to articulate achievements and recommend ways to improve weaknesses. Purpose of project was preparation of three documents – SEMA activities 2011, SEMA activities 2007-2012 for the government, SEMA activities 2007 – 2012 for the general

public. The documents concluded on SEMA achievements as well as opportunities for future improvements towards environmental sustainability in Timor Leste. Works included interviewing with SEMA employees, desk review of documents, and report writing.

6. **National Environmental and Safeguard Specialist**, *July - December 2011:*
   Contracted by ADB Timor Leste, working as the national environmental and safeguard specialist for the district capital water supply specialist. The project includes three components – rehabilitation of the DeboLehumo Lake weirs, rehabilitation of the water supply system in Pante Makassar, Oecusse and rehabilitation of the water supply system in Manatuto. Engaged by Aurecon, Inc., the main contractor for the PPTA. Responsible for:

   - Project and site description on geography, geology and climatology, water resources, biological and human environment.
   - Primary data collection (sampling) on quality of water supply sources. Information dissemination, public consultation, stakeholder engagement.

7. **Environmental Specialist/Planner for Preparation of KoolauPoko Watershed Management Plan,** *2008 -2010*
   Staff planner at Townscape, Inc. in Hawaii, USA, working on the preparation of a Watershed Management Plan with focus on environmental protection and water sources development plan. Responsible for:

   - Write ups on site description: climate, geology and water resources
   - Provides analysis on existing water demand, future demand projection based on population increase, foreseeable development plans and available agricultural acreages
   - Coordinated community and stakeholder consultation
   - Production of GIS maps and final planning document.

8. **Natural Resource Planner for PupukeaPaumalu State Parks,***2008 – 2010*
   One of the assignments at Townscape, Inc. The PupukeaPaumalu Natural Resource Management Plan is developed for a natural park owned by State of Hawaii and City of Honolulu. Responsible for:

   - Data collection and analysis of natural, physical, and social environment of PupukeaPaumalu property and the surrounding areas.
   - Preparation and implementation of an intensive community participation process that included three major public events and approx. 15 steering community meeting.

9. **GIS Specialist for Ala Wai Drainage Project,** *2008-2010*
   The Ala Wai Drainage Project was an urban drainage upgrade with two main thrusts: flood control and improvements to the natural conditions of Honolulu urban streams. Responsible for:

- Creation of database and a digital mapping system for community and stakeholder input related to flooding and other drainage issues. The map was especially useful for the multi-agency planning team to identify areas where there were a lot of complaints as well as areas potential for locating future projects.
- Produced a simple mannual on how to use the "Ala Wai Watershed Comment and Issue Map."

11. Graduate Assistant for Community Consultation for the Transit Oriented Development Project, *2006-2008*

Contracted as a graduate assistant to contribute to the TOD project in a Honolulu neighborhood. The project was a community readiness project in anticipation of the development of a train system and the respective train stations in Honolulu.Activities performed include:

- Data collection and creation of thematic maps of community resources and demographic profiles Analysis of development potential in the neighborhood areas within the project boundaries
- Identification of proper community outreach strategies for future community involvement, community consultation.

D. University Education

No	*University*	*Main Course of Study*	*Place*
1.	University of Hawaii	Urban and Regional Planning (Completed Master Degree)	Honolulu, Hawaii
2.	University of GadjahMada	Chemical Engineering (Completed undergraduate level)	Jogjakarta, Indonesia

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Livio da Conceicao Matos

CURRICULUM VITAE

A. Personal Data

Name	: Livio da Conceicao Matos
Date of birth	: 10 Agustus 1976
Place of birth	: Lospalos, Lautem, Timor Leste
Gender	: Male
Citizenship	: Timorense
Countries of Working Experience	: Timor Leste

B. Employment record

1. **Monitoring and Evaluation Advisor,***February 2013 – December 2013*
   Contracted by USAID to provide service as follows:

- Leadership and technical assistance in consultation processes, surveys, data gathering disaggregated by gender, demographics and physical and economic circumstances, and analysis of data from each of the project technical areas and the use of data for decision making
- Guided team in the implementation of the project Monitoring and Evaluation plan
- Provided technical assistance to MOH staff to build their M&E capabilities
- Developed clinic and community based M&E system, indicators for baseline comparison and health promotion
- Oversee the project M&E database and ensure timely data entry.

2. **Monitoring and Evaluation Advisor,** *March 2012 - January 2013*
   Contracted service at UNDP Timor Leste to provide service as follows:

- Assisted in development of an overall M&E framework for the programme and Ministry of State Administration and Territorial Management (MSATM) in collaboration with short-term technical assistance, including consultation, data gathering and surveys;
- Ensured that the information necessary for regular M&E of project activities is collected and analyzed, in accordance with LGSP (Local Government Support Program) and donors' needs;
- Assisted the Ministry and local authorities in tracking their performance and public service delivery activities;
- Regularly update the program's Monitoring and Information System (MIS);
- Contribute to regular reporting on LGSP progress;
- Regular field visits to pilot district;
- Perform other tasks as required by the CTA (Chief Technical Advisor) and PM (Program Manager).

3. **Head of Division of Biomedical and Pharmaceutical Research and Development, Department of Public Health, Dili University,** *March 2011 - January 2012*
   Also lecturer on Introductory and Advance Epidemiology at the Department of Public Health.

4. **Biostatistics Lecturer at the Midwifery Division, Universidade National Timor Lorosa'e,** 2010 – Present

5. **Officer at the Ministry of Health, Timor Leste**
   - Part of the team that roll out Basic Services Package (BSP) – June 2007 to January 2008
   - Member of Technical Working Group of the National Task Force of Avian Influenza Preparedness and Response – 2005 to 2010
   - Surveillance Officer – 2004 to 2010
   - EPI Officer – January 2004 to September 2004. Responsible for:
   - Developed plan for the implementation, consultation, monitoring, and evaluation of Immunization Program
   - Supervised the technical implementation to ensure adequate quality of immunization services
   - Supervised the technical implementation to ensure adequate cold chain of vaccine for immunization
   - Managed and oversee the overall implementation of immunization program including public awareness campaigns
   - Established Coordination network on Immunization activities with other stakeholders
   - Performed immunization data analysis and distribute to the decision makers and other stake holders
   - Moro Public Health Center Officer, 1995 -1999. Conducted field survey, monitoring of:
   - Rural water supply
   - Rural waste disposal
   - Disease prevention program
   - Conducted sanitation inspection by soil and water specimen collection
   - Provided technical assistance, consultation and advice for community on: household latrines, household water closets, community water supply

6. **Lecturer at Universidade da Paz, Dili,** 2006 – 2007
   Member of team and lecturer on Surveillance Epidemiology, Transmitted Diseases Epidemiology and Non-transmitted disease epidemiology in Faculty of Public Health.

   As part of lecturing activities, the following tasks were performed, both inside and outside of campus:

   - Providing syllabus for lecturing
   - Providing technical assistance to the students on scientific paper writing
   - Providing data processing assistance for students in their scientific paper writing
   - Leading group discussion on social and community health problems, identification and solutions
   - Coordinating with relevant lecturer for central issues on health sector for creating research topics
   - Facilitating the students on results interpretation on their research writing
   - Guiding the students on epidemiological analysis on social and health related issues in the community.

C. University Education

No	*University*	*Main Course of Study*	*Place*
1.	University of GadjahMada	Epidemiology (Completed Master Degree)	Jogjakarta, Indonesia
2.	University Respati Indonesia	Public Health (Completed	Jakarta, Indonesia

3.	Environmental Health Academy	undergraduate level) 2-year Diploma	Purwokerto, Indonesia

Venancio Fernandes, S.T.

CURRICULUM VITAE

A. Personal Data

Name	: Venancio Fernandes, S.T.
Date of birth	: 2 January 1982
Place of birth	: Lospalos, Lautem, Timor Leste
Gender	: Male
Citizenship	: Timorense
Countries of Working Experience	: Indonesia, Timor Leste

B. Employment record

1. **Project Engineer, Timor Leste,** *February 2014 – Present*
   Contracted by PEC Consulting to provide services as follows:

- Planning, design and installation of automatic meteorological data collection equipment
- Through PEC Consulting, contracted by Seeds of Life (SOL) to repair and maintain SOL's automatic meteorological data collection equipment already in the field
- Manage a team of 4 personnel for field installation, equipment checking and data collection monitoring
- Coordinate for recruitment of field assistants at each thirteen locations of weather station installation. Recruitment was conducted through consultation and close collaboration with *chefi de suco*and/or *chefi de aldeia*.
- Responsible for payment of services to district field assistants.

2. **Agricultural Census Coordinator, Indonesia,** *March 2011 –December 2011*
   Contracted service at P.T. TanjungBuyu Perkasa Timur in East Kalimantan, Indonesia to coordinate for palm tree census at TanjungBuyu's plantation. Responsible for:

- Coordination of field assistance
- Random sampling of palm fruit trees about to be harvested. Sampling was conducted for each block of the palm fruit trees.

3. **Foreman, Indonesia,** *January 2010 – December 2012*
   Contracted service at P.T. TanjungBuyu Perkasa Timur.Responsible for checking employees' presence and work quality.

4. **Administrative Staff at Ticketing Agency in Timor Leste,** 2009
   Staff at a local ticketing agency (LGX Tour and Travel) in Timor Leste.Responsible for keeping of reservation document and delivering deposit money to the bank.

5. **Distribution Staff at P.T. Diamond Ice Cream, Jogjakarta,** 2006 – 2007

Staff at P.T. Diamond Ice Cream in Jogjakarta, Indonesia. P.T. Diamond Ice Cream is a supplier of ice cream to McDonalds Indonesia as well as a large processed food producer in the country with products ranging from frozen meat to frozen vegetables. Previously recruited as intern in the company branch in Jogjakarta and later on recruited as permanent staff. Responsible for delivering frozen food to hotels and restaurants including to McDonald's in Jogjakarta.

6. **Assistant Trainer at Computer Laboratory at Akprind College in Jogajakarta,** 2006
   Professionally paid as lab assistant at the Computer Laboratory at Akprind College in Jogjakarta, Indonesia.Responsible for preparation of computers, student organization and filling in for the lecturer when he is absent.

C. Education

No	*University*	*Main Course of Study*	*Place*
1.	Institute of Science and Technology Akprind	Industrial Engineering (Completed Bachelor Degree)	Jogjakarta, Indonesia
2.	Escola Vocational de Dom BoscoFatumaka, Baucau	Majoring in Mechanical Engineering	Baucau, Timor Leste

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Crisanto dos Santos

CURRICULUM VITAE

A. Personal Data

Name	: Crisanto dos Santos
Date of birth	: 03 March 1983
Place of birth	: Lospalos, Lautem, Timor Leste
Gender	: Male
Citizenship	: Timorense
Countries of Working Experience	: Timor Leste

B. Employment record

1. **Logistic Support,***February 2013 – December 2013*
   For the JICA funded Buluto Irrigation System data collection. Contracted through PEC Consulting. Responsible for river flow data collection, equipment purchase and assisting of the Japanese team members.

2. **Logistic Support for Dili Drainage System Survey,** *January – April 2012*
   Field assistant to the Australian and Timor Leste team.Equipment purchase at stores in Dili for use in project.

3. **Enumerator for Sanitation Willingness to Pay Survey,** *May 2012*
   Survey to several neighborhoods around Dili to ask about their existing sanitation system in their house and how much fee money they are willing to pay for new sanitation system. Followed training to survey people and businesses, do survey by questionnaire to people and enter data to Excel.

4. **Intern at Ministry of Economic Development,** January – June 2011
   Internship part of school Instituto Professional de Canossa. Enter data to computer, type letter, checking absent, photo copy, etc.

5. **Assistant Trainer at Computer Laboratory,** 2009
   Assistant trainer in laboratory computer.Training for youth as program of Baucau Diocese.Training students for making graphic for letter, header of letters, making invitation, etc.

C. University Education

	University	***Main Course of Study***	***Place***
1.	Instituto Professional de Canossa (IPdC)	Computer Engineering Department	Dili, Timor Leste

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Dr. montKaniaDewi, ST MT

Current Occupation

- **Lecturer**, Department of Environmental Engineering, Faculty of Civil and Environmental Engineering, InstitutTeknologi Bandung, 1999-present, **http://www.ftsl.itb.ac.id/**
  Teaching in the following programs:

  - Undergraduate program (Subjects: Air Pollution Control, Environmental Engineering, Engineering Mathematics)
  - Graduate Program (Subjects: Advanced Air Pollution Modeling, Advanced Numerical Mathematics)
  - PhD Program (Subjects: Developing of Dissertation Proposal)
- **Head of Air Quality Laboratory**, Faculty of Civil and Environmental Engineering, InstitutTeknologi Bandung, 2007-present

Membership

- Member of Editorial Board of ASEAN Engineering Journal (ASEAN E.J), 2011- Present
- Member of Technical Support for Research and Development Centre of Infrastructure Settlement, Ministry of Public Work, 2009-Present
- Member of Association of Sanitary and Environmental Engineer - IkatanAhliTeknikPenyehatandanLingkungan (IATPI)

Education

- *Dr. mont, Doctoral Degree (2001-2004)*
  InstitutfürVerfahrenstechnik des IndustriellenUmweltschutzes, MontanuniversitätLeoben Austria, Dissertation title: Mass Transfer Investigation in Suspension Droplets in Flue Gas Desulphurization, **http://www.unileoben.ac.at/**,**http://www.vtiu.com/**

- *MT, Master Degree (1997 - 2000)*
  Post Graduate Program, ITB, Environmental Engineering, ITB, Cum Laude

- *ST, Bachelor Degree (1991 – 1996)*
  Department of Environmental Engineering, Faculty of Civil and Environmental Engineering, ITB Indonesia

Training connected to Environmental Protection Control Manajer for Air Pollution (EPCM)

- *Training for Trainers, Environmental Pollution Control Management for Air Pollution, Yokohama Japan, November 2010*

Professional Experiences

Environmental Impact Assessment

- Air Quality Expert, Environmental Impact Assessment - Timor Leste Cement - Baucau, Worley Parsons - BITA Consultant, 2015
- Air Quality Baseline, Dili Drainage Project, Dili, Worley Parsons BITA Consultant, 2014
- Air Quality Expert, Improvement of Production Capacity of Coal Mining – Adaro Indonesia, PT LAPI, 2014
- Air Quality Expert, Development of Coal Fired Power Plant – SerangBanten, Environmental Resource Management, 2014
- Air Quality Expert, Development of Morowali Industrial Park, PSLH ITB, 2014
- Air Quality Expert, Development of Environmental Baseline Assessment Oil and Gas Exploration - Madura, PT LAPI, 2014
- Air Quality Expert, Improvement of production Capacity of Cement Plant - PT Indocement Tunggal Prakarsa TbkCiteureup Bogor, Yayasan LAPI ITB, 2012-2013
- Air Quality Expert, Improvement of production Capacity of Cement Plant - PT Indocement Tunggal Prakarsa TbkPalimanan, Yayasan LAPI ITB, 2012-2013
- Air Quality Expert, Reclamation of G Island North Jakarta, PT MuaraWisesaSamudera- Yayasan LAPI ITB, 2012-2013
- Air Quality Expert, Construction of Industrial and Warehousing Estate KutaiKartanegara East Kalimantan, PT Sprint Consultant, 2012-2013
- Air Quality Expert, Construction of ITB Campus Jatinangor, PSLH ITB, 2012-2013
- Air Quality Expert, Improvement of Production Capacity of BP Berrau Papua, ERM, 2012
- Air Quality and Noise Expert, Development of Industrial Complex – JABABEKA Stage VI of PT GrahabuanaCikarang, PT INOA, 2012
- Air Quality and Noise Expert, Development of Industrial Complex – JABABEKA Stage V of PT GrahabuanaCikarang, PT INOA, 2012

- Air Quality Expert, Improvement of Coal Production Capacity up to 70 million ton/year in Sengata and Bengalon East Kalimantan, PT Kaltim Prima Coal- LAPI ITB, 2009
- Air Quality Expert, Nickel Mining in Halmahera North Maluku, Weda Bay Nickel-PT ERM, 2009
- Air Quality Expert, Landfill of BlangbintangNangro Aceh Darussalam, PT GFI Agendi, 2008
- Air Quality Expert, Base Iron and Steel Industry in Banten, PT Indoferro-PT Inoa Enviro Consultant, 2008
- Air Quality Expert, Coal Fired Power Plant AnyerBanten, PT Inoa Enviro Consultant, 2007-2008
- Air Quality Expert, Gas Piping Installment from Cilegon to Bojonegoro, PT CandraAsri-PT InoaEnviroConsultan, 2005-2006
- Air Quality Expert, Expansion of Offshore Oil and Gas Exploration, PT Kodeco-PT InoaEnviro Consultant, 2005
- Air Quality Expert, Improvement of Coal Boiler Capacity in Textile Industry, PT Tifico- PT InoaEnviro Consultant, 2005
- Air Quality Expert, Sulfur Recovery Unit in Oil Refinery, PT Pertamina-PT SRPINT, 2001 - 2002
- Air Quality Expert, Improvement of Production Capacity of Riau Pulp and Paper Industry, PT Riau Pulp and Paper Industry (RAPP)-PT SPRINT, 2001 - 2002

Environmental Quality Management

- Environmental Quality Expert, Development of Technical Guideline for Port Emission Inventory, Indonesian Ministry of Environment, 2014
- Environmental Quality Expert, Development of Technical Guideline for Airport Emission Inventory, Indonesian Ministry of Environment, 2014
- Environmental Quality Expert, Emission Inventory in Coal Mining of Adaro Energy, PT LAPI ITB, 2014
- Environmental Quality Expert, Dili Drainage Project – Development of Air Quality Baseline Data, Dili – Environmental Ministry – BITA Consultant, 2014
- Environmental Quality Expert, Inventory of Mercury Using UNEP Toolkit Level 1, Balifokus and US Department of State, 2013
- Environmental Quality Expert, Development of Technical Guideline for Air Pollution Control in Water Transportation in Indonesia, Indonesian Ministry of Environment, 2013
- Air Quality Expert, Development of Technical Guideline for Industry-Coal Based Energy Source, Ministry of Industry, 2012
- Environmental Quality Expert, Development of Policy Concept in Water Transportation in Indonesia, Indonesian Ministry of Environment, 2011
- Environmental Quality Expert, Development of Environmental Sustainable Transport in Indonesia, United Nation Development Programme, 2011
- Air Quality Expert, Inventory of Green House Gases Emission from Oil and Gas Production PertaminaPrabumulih Palembang - CDM Project, LAPI ITB, 2011
- Environmental Quality Expert, Energy Audit for PertaminaDepoPadalarang and Ujungberung, PT LAPI ITB, 2011
- Air Quality Expert, CO_2 Emission from Municipal Solid Waste Handling, Research and Development Center for Housing and Infrastructure Settlement, Ministry of Public Work, 2011
- Air Quality Expert, Inventory of Green House Gases Emission from Oil and Gas Production UBEP TanjungPertamina - CDM Project, LAPI ITB, 2010
- Air Quality Expert, Development of Academic Paper and Legal Drafter of Air Quality Management in Banten Province, Ecotas Indonesia, 2009

- Air Quality Expert, Development of Emission Factor Determination Method in Indonesia, Ministry of Environment-PT LAPI ITB, 2008-2009
- Air Pollution Control, Development of Handbook of Environmental Pollution Control Manager, LAPI ITB, 2008
- Air Quality Expert, Indonesian Ministry of Environment, Study on Gap Analysis of Co-Processing in Cement Industry, Indonesian Ministry of Environment-Ecotas Indonesia, 2008
- Air Quality Expert, Emission Limit Determination for Air Emission in Textile and Ceramic Industry, Indonesian Ministry of Environment, 2005

Air Quality Modeling

- Modeling Expert, Modeling of Emission from Nickel Mining Weda Bay, ERM, 2013
- Modeling Expert, Modeling of Gases and Particulate from Coal Fired Power Plant in Indramayu, PT SPRINT, 2013
- Modeling Expert, Modeling of Gases from Gas Power Plant Batam, ERM, 2012
- Modeling Expert, Modeling of Gas Exploration and Production of BP Berrau West Papua, LAPI ITB, 2011
- Modeling Expert, Pollutant Dispersion Model from Improvement of Production Activity of PertaminaDumai, LIPI, 2011
- Modeling Expert, Gas Dispersion Model of Pilang Exploration Well, Mobil Cepu Limited, 2010
- Modeling Expert, Modeling of TSP, CO, NO_2, and SO_2 from Holcym Cement Plant Narogong Before and After Co processing using AFR, SubCon-ERM, 2009
- Modeling Expert, Modeling of H_2S Dispersion from Sarulla Geothermal Plant North Sumatra, Medco Geopower-PT LAPI ITB, 2009
- Modeling Expert, Modeling of Gas Dispersion from Oil Exploration Wells in Kandangan and Giyanti, Exxon Mobil-PT LAPI ITB, 2009
- Modeling Expert, Modeling of Air Pollutant Dispersion from Nickel Mine Activities, Baseline Study of Air Quality Management of Nickel Mining in Halmahera North Maluku, Weda Bay Nickel-PT ERM, 2008
- Modeling Expert, Modeling of H_2S and SO_2 from Oil Exploration Wells in CepuBojonegoro, Exxon Mobil-PT LAPI ITB, 2007
- Modeling Expert, Modeling for Prediction of Air Quality in Environmental Impact Assessment for Coal Fired Power Plants, Chemical Industries, Textile Industries, Landfills, Minings, and Airports, 1999-present

Environmental Quality Monitoring

- Air Quality Expert, Monitoring of Air Quality for Operational Stage of Paiton Coal Fired Power unit 7 & 8 in Situbondo East Java, PT SPRINT, 2006-present
- Air Quality Expert, Monitoring of Air Quality for Construction Stage of Paiton Coal Fired Power unit 9 in Situbondo East Java, PT SPRINT, 2008-present
- Air Quality Expert, Monitoring of Air Quality for Construction Stage of Paiton Coal Fired Power unit 3 in Situbondo East Java, PT SPRINT, 2008-present
- Air Quality Expert, Monitoring of Air Quality for Operation Stage of Offshore Oil and Gas Production in Oyong and Maleo Field Madura, SANTOS- PT SPRINT, 2008-2009
- Air Quality Expert, Monitoring of Air Quality for Operation Stage of Pertamina Oil and Gas SorongIrian Jaya, PT Pertamina-PT SPRINT, 1999

Air Pollution Control

- Air Quality Expert, Green House Gases Reduction Projects, LAPI ITB, 2006- 2007
- Air Quality Expert, Gas Measurement Activities for Air Emission Handling Project in Central Gathering Stations 1-3-4-5 Duri Field, PT Chevron Pacific Indonesia-PT LAPI ITB, 2006-2007
- Air Quality Expert, Technology Selection for Air Emission Mitigation in Central Gathering Station 4 Duri Riau, PT Chevron Pacific Indonesia- LPPM ITB, 2005

CHAPTER II PROJECT DESCRIPTION

2.1 Project Overview

The Caitehu Fuel Storage and Jetty Plan is a proposed development from Global Petroleum, and product trading PTY, Lda . The development consists of the construction of two main components – (1) fuel storage and the associated water storage complex on approximately 4.5 ha land in SucoMotaulun, Liquisa District and (2) a tanker jetty or a long concrete structure stretched from the fuel storage to 150 meters off the coast.

2.2 Structure of the EMP

The EMP has been developed in accordance with the guidelines provided by the National Directorate of Pollution Control and Environmental Impact (NDPCEI). The structure of the EMP starts with the description of the project then description of the project proponent followed by the main content which are – (i) description of the mitigation measures; (ii) description of the monitoring program. The EMP then discusses reporting requirement and responsibility for mitigation and monitoring. Relevant emergency plans, capacity development and training as well as cost estimate and implementation schedule are also included.

2.3 Project Category

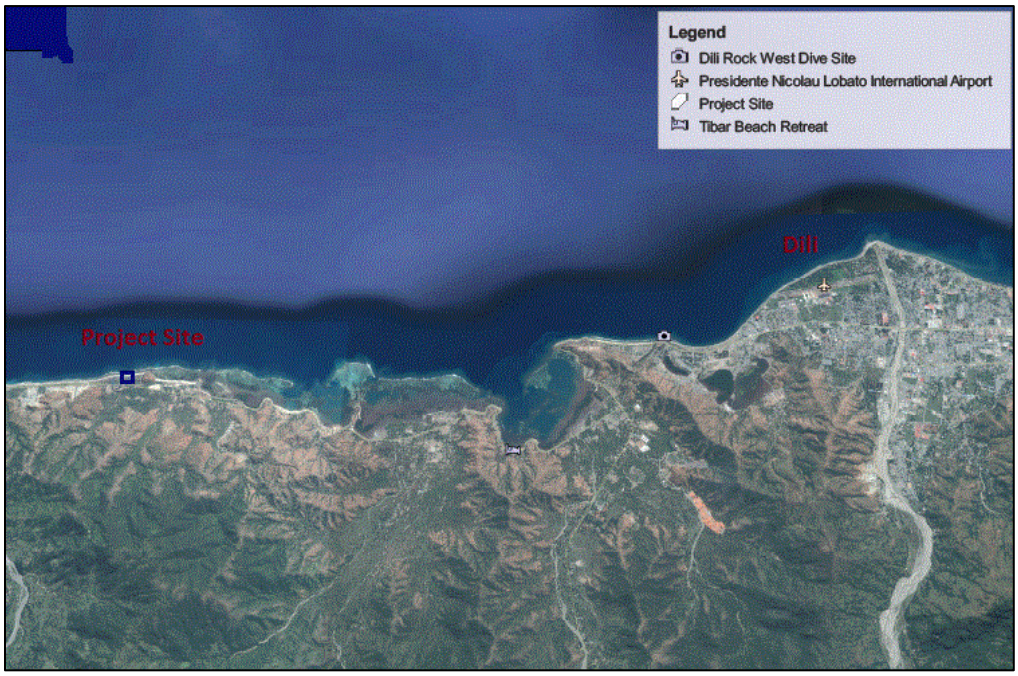
As a fuel storage and marine berthing facility located near the coast, community housings and public road, the development has potential devastating impacts from day to day operation (cumulative impacts) as well as from large scale spill or fire accidents. Based on this categorization, there is a need to develop a full scale Environmental Impact Statement (EIS).

Based on the above as well as based on the scale factor (capacity of the storage facility > 100,000 m3), the project has been classified by the National Directorate of Pollution Control and Environmental Impact (NDPCEI), as Category A project in reference to the Decree Law no.5/2011 – Environmental Licensing, article 4 and Annex I.

2.4 Project Location

The proposed construction is located along the national road connecting Dili to Liquica. Administratively, the project is located within Aldeia Caitehu, SucoMotaulun, Sub-district Bazartete, District of Liquica. Project location can be reached by about half an hour driving from Dili town center. The following figure is the location of the development in reference to the national road connecting Dili and Liquica. GPS coordinates of the project location are 125.688696o/-8.537717o (longitude/latitude).

Figure 2.1. Location of Development Relative to Dili



In order to build the plant, the 4.5ha land has been secured by Global Petroleum, and product trading PTY, Lda . through a long term lease with the Government of Timor-Leste. The project consists of facilities such as above ground fuel storage and water cooling storages and it will occupy 3ha of land from the actual size.

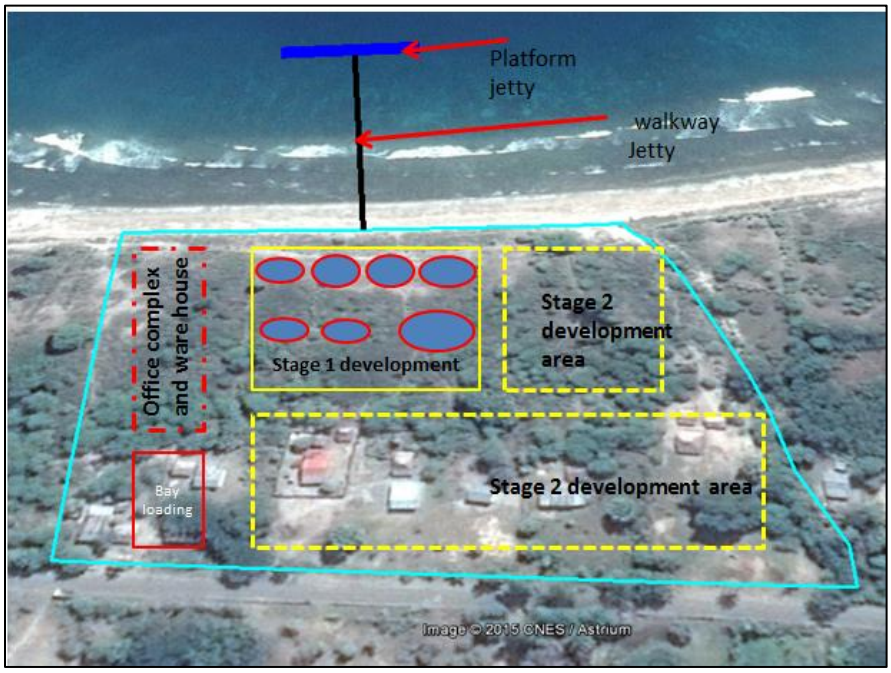
2.5 Project Boundary and Main Components

The development consists of two major components:

1. Jetty development, consisted of a jetty with the size of 12 x40 m with 140 m catwalk from shorelines;
2. Fuel storage development consisted of twenty one tanks with the size of 20,000 (3 tanks), 15,000 CBM (4 tanks), 5,000 CBM (4 tanks), 3,000 CBM (11 tanks) and 2,000 (2 tanks).

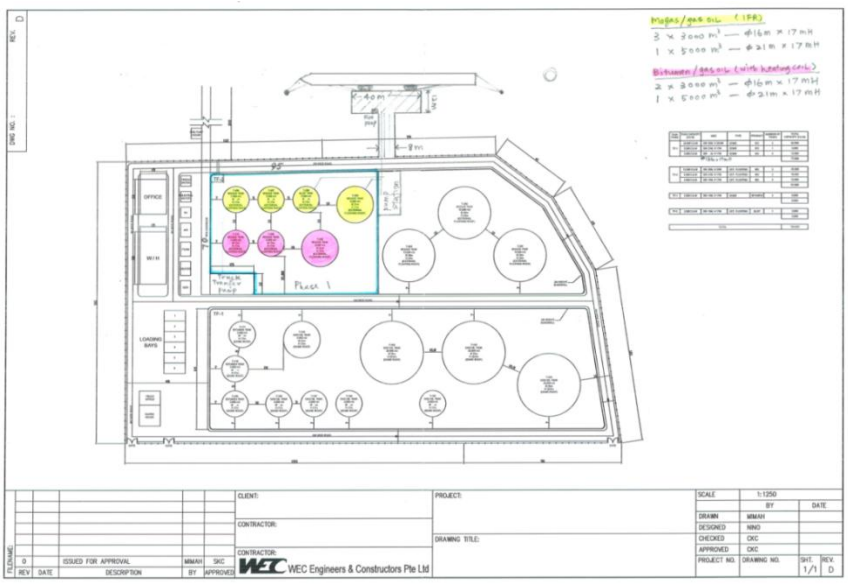
Following figure contains project boundary superimposed on satellite imagery and major components of the project.

Figure 2.2 Project Boundary and Major Components of Project



Technical drawing of project main components are presented in the following figure.

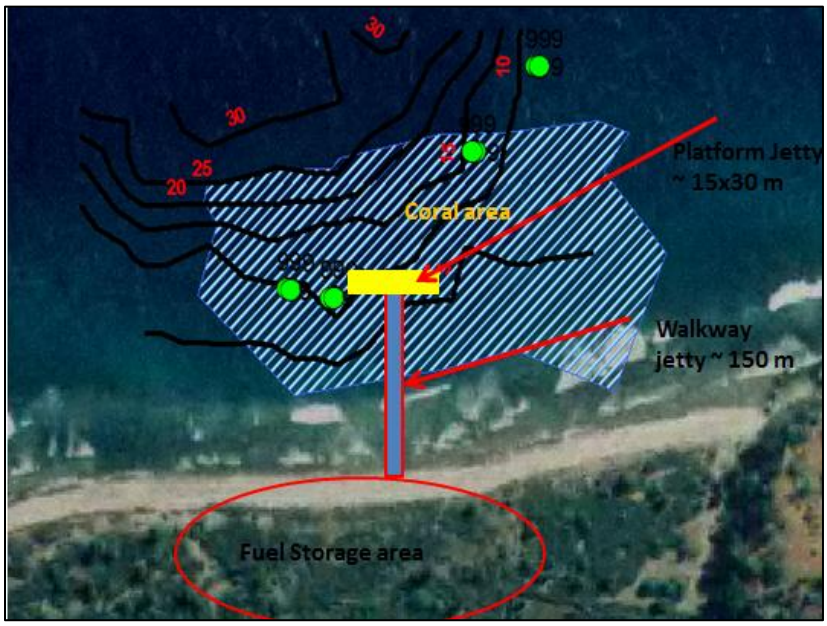
Figure 2.3 Major Components of Project



2.4.1 Jetty

Construction of jetty is also one of the important components of the project as the tanker only land successfully to feed the storage facility. The following map shows the location of jetty and bathymetry survey result.

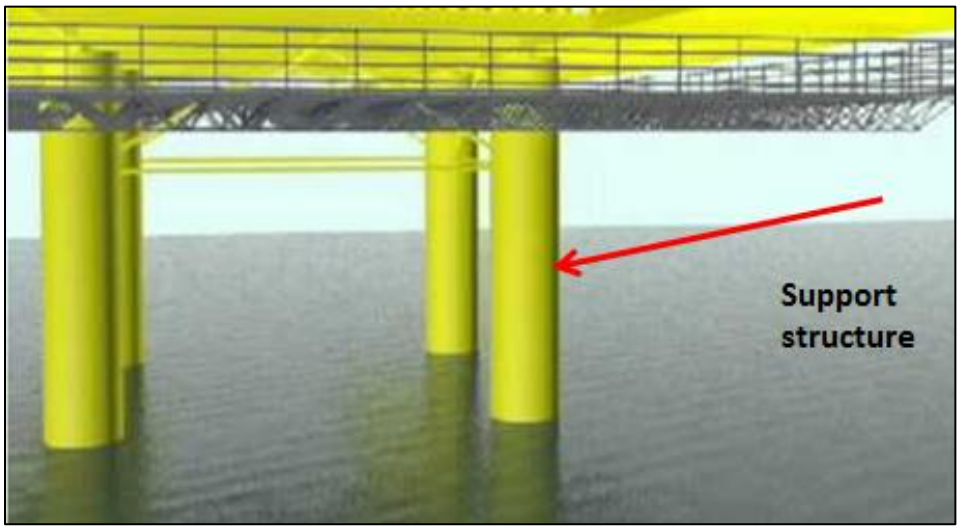
Figure 2.4Conceptual drawing of Location of Jetty Relative to Fuel Storage Location



The jetty will be located at the water draft of 8-10 meter, which is about 150 meter from the shoreline. In principle, there are two important works in the jetty structural development, which is the landing jetty and walkway from shoreline to the jetty. The landing jetty is the platform that is like rectangular to support the operational of jetty such as loading and unloading the fuel to the storage.

Figure 2.5Example of Jetty and its Component

Figure2.6Typical Support Structure of Jetty or Above Water Platform



The dimension of the platform jetty is roughly 15-30 meter that has supporting structures that will be constructed within the depth of 8-10 meter of sea draft. The mentioned depth was based on the average tide that was measured based on 24 hours of observation. To be conservative, itmay best to consider the tidal effect of 1.5 m, which means that the platform of jetty will be at 1.5 meter above sea draft to ensure that the platform will not sink during the high tide.

The actual detail technical drawing however is not available yet as design is being developed with environmental impacts and regulatory parameters that have recently been collected through the EIS process. Nevertheless, the supporting structure could be reinforced concrete but could also from non-corrosive metal such as stainless steel that will be placed under the water. For the coral protection purpose, it may be helpful to pre-fabricated material as supports structures. For the walkway structure on the other hand, can be constructed by using several method such as using rubble-stone, reinforce concrete material, or noncorrosive steel material.

The project owner will be determined the select type of construction method and construction material by considering the cost (capital cost and maintenance cost) and minimum environmental damage.

In addition to Jetty, the piping system with the automatic detection control mechanism will also be installed from landing jetty to the storage tanks for the re-fueling activities. The detail of pipeline and technical drawing will be provided by the project owner.

2.4.2 Storage Tanks

Total twenty one (21) storage tanks with various sizes will be constructed throughout the first and second phase of the development to store and hold the mentioned fuel, temporarily and distributed to the end-users. As for the first stage development, 7 fuel storages will be constructed to store and distribute two kinds of fuel (gasoline and diesel fuel). The dimension of tanks are presented in the table 2.1

Table 2.1. General Specification of Fuel Storage System

Tank	Number	Volume, KL
Gasoline	3	3000
High Speed Diesel Fuel (HSD)	3	3000
Gasoline	1	5000
High Speed Diesel Fuel (HSD)	1	5000

The common shape of storage tank is cylindrical as it is easy to fabricate and has great structural strength. Various engineering design criteria were considered in order to come up with the ratio of height (H) and the diameter of tank (D). As the ratio of height and diameter is a selected design parameter, the height and diameter of storage tank were calculated from the above volume. The following table presents the dimension of each storage tank.

Table 2.2 Summary of Tanks Dimension

Tank	Volume, KL	D, m	H, m	Standard
1	3000	16	17	1
2	5000	17	21	1

The location and space between each tank will be arranged according the standard required by the American Petroleum Institute 2610 (API, 2005). The layout of the fuel storage system can be seen from the following figure.

Figure2.7Bundwall Design

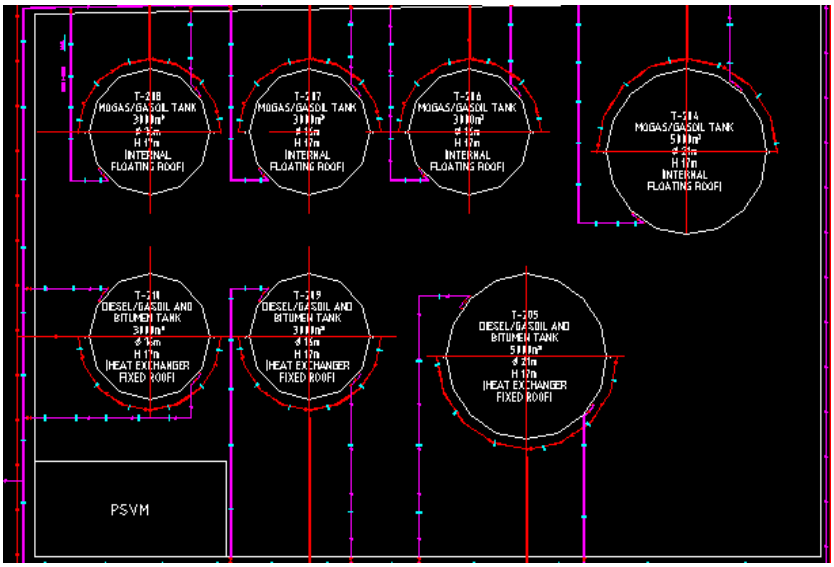
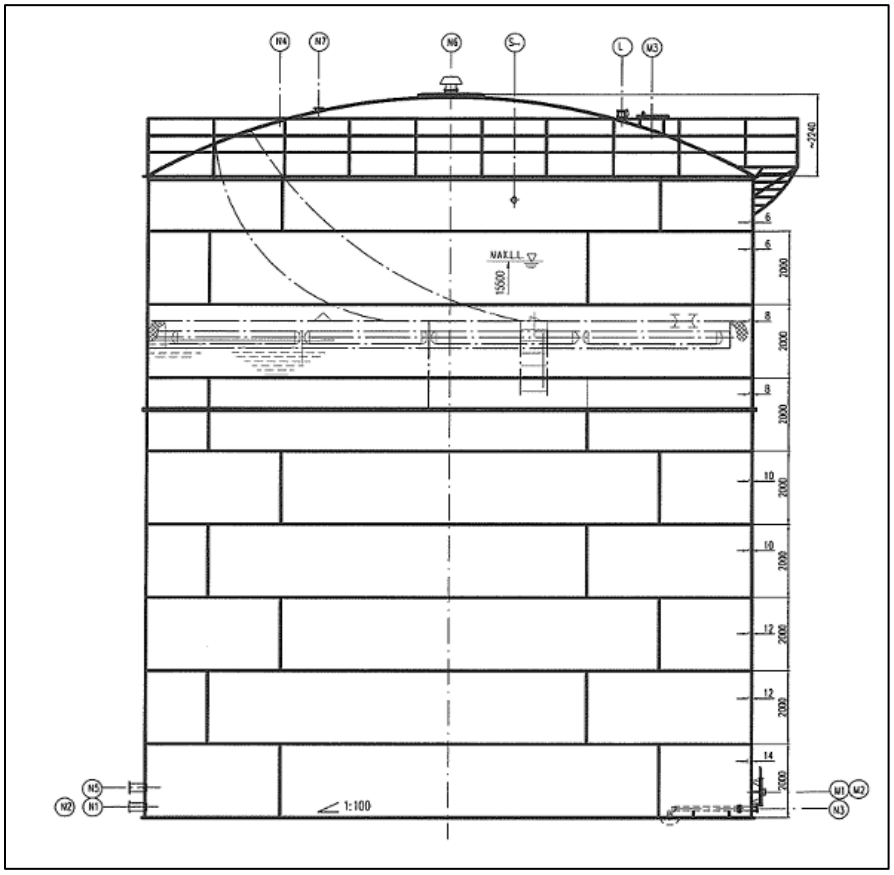


Figure 2.8A Typical Tank Design



The material selection should follow the standard best practice recommended by American Petroleum Institute. Over engineering design should be taken in order to ensure the durability and to reduce the risk of system failure, particularly the increase temperature by 1.5 degree C should be added to the design of the thickness of the tank.

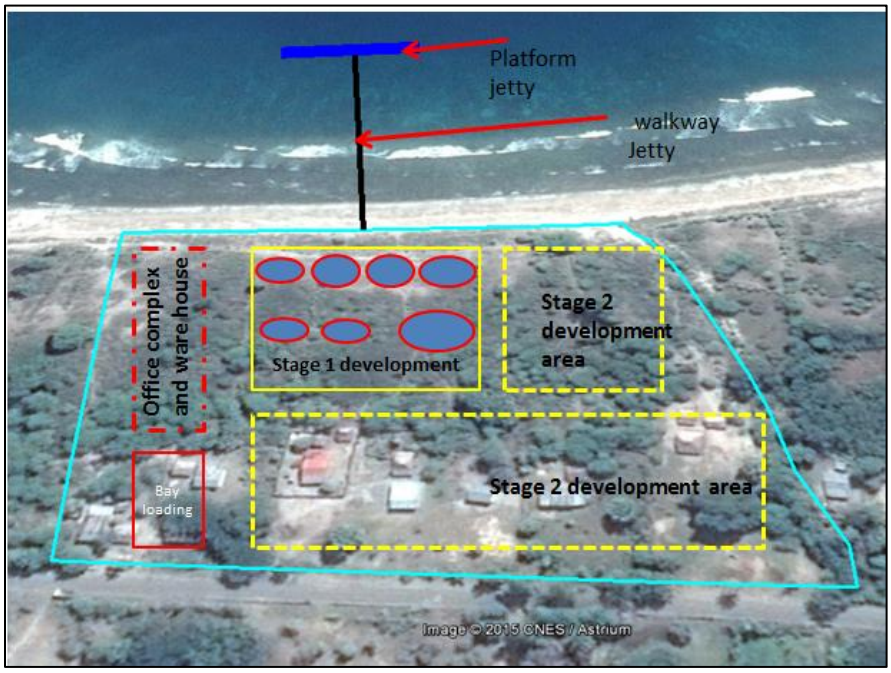
2.4.3 Supporting Offices and Utilities

The fuel storage operation will require supporting facilities such as office for workers and utility such as water, electricity, warehouse, control mechanism, and other equipment to support the unit operation of the system.

Office Complex

The detail layout of office building at this stage of project development is not ready yet and only conceptual drawing of the office space within the facility has been proposed. The following figure shows the proposal of office space and other supporting facilities to program.

Figure 2.9General Layout of Office Area



Office buildings will be used for staff, workers, and guest who visit the project site for various reasons. There are four main buildings that will be constructed to response the current need and future expansion of the storage facility. Additional minor building facility will be constructed near the gateway entrance of the storage facility for the security.

Utilities

The utilities requirement for the proposed fuel storage facility to support the operation and maintenance of the system consist of water, electricity, and fine sand. The power needs to the system will be supplied mainly from the public power line that is available in the site. In addition, the backup power generator is made available to this project in order to supply the power in case of power shutoff, which is always the case in Timor Leste.

The water utility requirement to support the operational of the storage facility consists of domestic need (drinking, bathing, washing, and irrigation) and for the fire fighter purpose. The water consumption for domestic utilization is relatively small, which can be fulfilling by water tanker delivery to the small reservoir unit within the system. The water needs for firefighting on the other could be huge if the fire does occur. The water need for this purpose is from both fresh water and salt water. 330 kilo liter of storage will be constructed to store fresh water for the firefighting purpose. Additional need for firefighting need is to utilize the sea water in case the fresh water reserve is not sufficient. For this purpose the piping and installation should be considered. The water from the reservoir or seawater should be properly connected to the fire hose and hydrant so that in the fire event, the fire hose and pump shall be operated to supply the water to where the requirement is.

Instrumentation and Control Room

Automatic instrumentation controls are very important in any system operation, particularly in the oil industry such as refinery and storage system where manual inspection and control mechanism is not possible due to large scale of operation. The instrument is installed in the key component of the operating system in order to detect variable overtime to ensure that the system will always in the operating condition. Through the automatic control system, the unexpected event/condition will be detected as early as possible so that proper preventive action would be taken in order to minimize the occurrence of the negative impact.

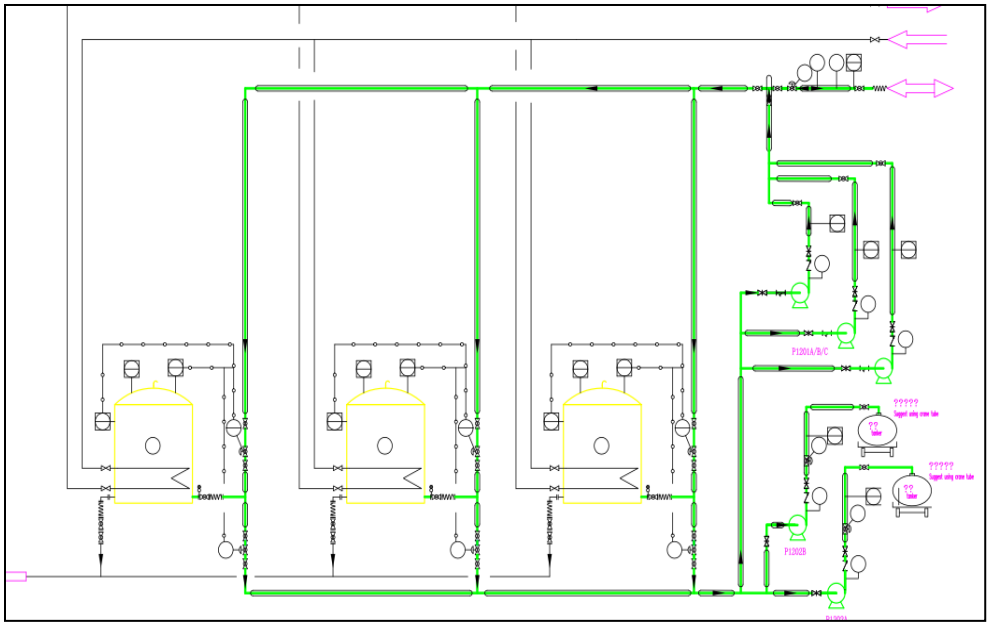
For the fuel storage system, variable to control may vary from flow rate, level indicator in the tank, leakage, smoke/fire, temperature, pressure and others. The control room is constructed as part of this proposed program so that all the control instrumentation will be placed to control the system to operate as desire.

The detail system instrumentation and control parameters should be defined later as the controller and instruments are not available at the stage of planning and design of the system.

Piping System

Piping system is one of the important components of the program to move the fluid material from one location to the other. For the current proposed fuel storage system, the piping system consists of water and fuel pipe. The piping installation will be one of the major works to be completed as the piping system will start from Jetty and will be end at fuel tanks reservoir. The following layout of propose program shows the fuel piping from Jetty to the storage system.

Figure 2.10 Piping System Layout



There are three different pipes that will convey three different products (Gasoline and diesel fuel). The proposed technical drawing in the appendix suggested that various pipes sizes range from 4 to 1.5 inches of galvanize pipe will be used in the installation. The choice of using the galvanize pipe is good as this type of pipe is resilience to various climate and weather condition and also the human vandalism. The proper maintenance of the piping system such as regularly painting may be required to prong the life time of the pipe as the corrosion may occur due to natural exposure to the sea water.

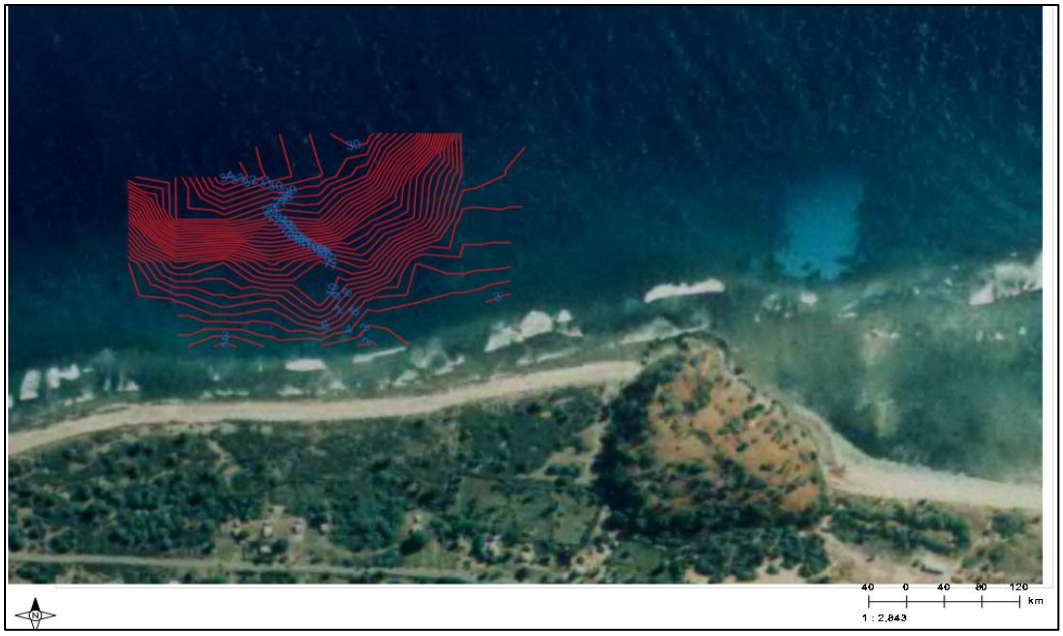
2.7 Area Affected by Development

Areas affected by the proposed development consist of:

1. Marine/coastal water
2. Sensitive environmental receptors nearby includes coral beds immediate by the project site, marine water quality and other marine flora and fauna such as bottom fauna, fish, phytoplankton and zooplankton.
3. Surface and groundwater
4. Local communities in Aldeia Caitehu
5. National government properties
6. Existing and future expansion of infrastructure

Impacts of the development will be discussed in more detailed in Impact Assessment Chapter.

Figure 2.11. Affected Area of Project



2.8 Construction Activities

Table 2.3 contains a list of project activities during Construction Stage for both jetty and storage facility.

Table 2.3List of Project Activities during the Construction stage

Jetty	Construction Activities (Stage 1 & 2)	Fuel Storage Construction Activities	
1	Construction of steel pile, pile cap	1	Construction of site drainage
2	Construction of concrete beam	2	Construction of fencing
3	Construction of floor	3	Construction of tank farm
4	Construction of fender, bollard	4	Construction of tank farm bundwall
5	Construction of catwalk	5	Construction of offices, fire house & water tank, power house, pump station, driver shelter, security post, officer's housing.
6	Construction of jetty	6	Construction of offices, fire house & water tank, power house, pump station, driver shelter, security post, officer's housing.
7	Construction of PV system	7	Construction of pavement
8	Material: pre-fabricated plates, steel piles, concrete and stones	8	Construction of fire hydrant network, lightning protection and earthing,
		9	Construction of piping network, valve and joints.
		10	Construction of electrical system

Material: pre-fabricated plates, steel piles, concrete and stones

CHAPTER III: LEGAL AND INSTITUTIONAL FRAMEWORK

Timor Leste legislation framework related to environmental and social aspect of the proposed project area presented and discussed. The best practice of environment and social impact and mitigation measures in Timor Leste and other international best practice are elaborated.

3.1 Environmental Legislation in Timor Leste

Timor Leste Constitution provides a strong foundation for the protection of the environment. Article 6(f) states that one of the objectives of the State is to protect the environment and preserve the natural resources. Moreover, two other articles, i.e. Articles 61 and 139 stipulated conditions for the use and preservation of the environment and natural resources respectively with the purpose of ensuring an ecologically balanced and sustainable development approaches.

Decree law 5/2011- Environmental Licensing contains procedures and other requirements related to securing environmental permit to start development activities. As of lately, guidelines for the formulation of required documents to prepare for environmental license have been developed through the Expert101 system that contains checklist and other necessary documents for the preparation of Project Document, Environmental Impact Statement (EIS) for category A projects and Simplified EIS for category B projects.

Other relevant environmental laws and their objectives are listed in Table 3.1.

Table 3.1. Relevant Laws and Regulations

Agency	Relevant Laws
State Secretary of the Environment	Decree Law No.5/2011
	Decree Law No. 26/2012 on Environmental Base Law
	(Draft) Law on Biodiversity (March 2012)
	(Draft) Law on Protected Area (May 2013)
	UNTAET Law No. 19/2000 on Protected Area
State Secretary of Forestry and Protection of the Nature	(Draft) Law on Protected Area (May 2013)
	UNTAET Law No. 19/2000 on Protected Area
State Secretary of Fisheries and Aquaculture	Law No. 12/2004 on Crimes Related to Fisheries
	Law No.6/2004 on Legal Basis for Management and Regulation of Fisheries and Aquaculture

National Petroleum Authority	(Draft) Regulation on Installation and Operation of Fuel Depot
International	Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Dumping Protocol) United Nations Convention on Biological Diversity (UNCBD) United Nations Framework Convention on Climate Change (UNFCCC)

3.1 Institutional Roles and Responsibilities

The roles and responsibilities of various agencies in the implementation of the EMP are identified. The roles and responsibilities include all roles and responsibilities assigned to all relevant actors be it the project proponent, national agencies and local authority.

The project proponent (developer) will be responsible for monitoring of day to day pre-construction and construction activities, assisted by an HSE coordinator on a day to day basis. The HSE coordinator will be responsible for regular day to day monitoring and inspection of activities and the implementation of the mitigation measures.

The National Directorate of Pollution Control and Environmental Impact (NDPCEI) will carry out spot checks to ensure compliance with the mitigation measures and regulatory standards in general. Other relevant institutions such as the National Directorate of Fishery and SEPFOPE will provide support as needed coordinated by NDPCEI.

During the Operation and Management phase, the developer will continue as the main party responsible for implementation of the EMP and monitoring of the environmental impacts. The project owner is required to appoint a permanent HSE manager that will ensure compliance with regulatory standards. NDPCEI with support from relevant government agencies will continue to be the main agency that will control the implementation of the mitigation measures.

3.2 Standard and Best Practices in Environmental and Social Assessment

Standards and best practices for environmental quality in Timor Leste are still limited. However, in the absence of local regulation, the government of Timor Leste always refers to the best international practices. The following are standard best practices that Timor Leste has derived from various international best practices are provided in Table 3.2. No standard have been provided for sedimentation as the project will actually reduce sedimentation from the compacting and sealing of the surface.

Table3.2. 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

3.3 Guidelines in Measurement and Monitoring

Several guidelines are applicable for measurement and monitoring of the environmental and social parameters. These guidelines included those guidelines published by NDPCEI such as the Expert101 Guidelines as well as applicable international guidelines such as the Head of BAPEDAL Diploma No. 113/2000 on General and Technical Guidelines for Environmental Laboratory tests.

CHAPTER IV: CONTRACTUAL AND CORPORATE OBLIGATIONS

The proposed development is 100% private sector-funded, therefore, there is limited contractual and corporate obligations in relation to the natural environment and social impacts related to the development. Decree Law No.5/2011 in Articles 15 and 16 established the Impacts and Benefit Agreement procedure to allow for project proponent and affected communities around Category A projects to enter into a legal agreement for the community's benefit (Table 4.1.). While there have been no clear guidelines on how to enter into these types of agreement, it is prudent to say that most project proponents are willing to enter into this type of agreement as far as the agreements are reasonable and within the scale of the potential impacts identified in the EIS.

For this particular project, during the final stakeholder consultation and the presentation of the draft EIS, it was clear that local community residing near the project potentially be affected by the development. Potential impacts to local community range from negative as well as positive impacts. Potential negative impacts can be direct and indirect impacts that will be felt during the pre-construction, construction and operation and maintenance phases of the project. During the pre-construction and construction phases, direct impacts can be in the form of social disruption from workers present in the construction site while during operation and maintenance phase, impacts can come in the form of restricted access to the coastal area adjacent to the project site where local community usually gather shrimp and other delicacies. Potentially significant negative impacts could come from large scale spill and fire/explosion accident in the facility. Potential positive impacts are related to job provision in every phase of the project, be it pre-construction, construction and operation and maintenance impacts.

As part of the development process, project proponent has entered into agreements with several members of the community that are being resettled out of project site. These contractual agreements are related to compensation payment to the community member to move out of their houses to a new location. 11 members of the community signed the agreement and have since moved out of their houses. The contracts for compensation payment are provided in Annex A.

Table 4.1. Impacts and Benefits Agreement in Decree Law No. 5/2011

Chapter	Article	Article Title	Main Point
V	15	Impacts and Benefits Agreement (IBA)	Establishment of the IBA as the legal instrument for communities around or near the proposed Category A projects to enter into an agreement that defines rights and obligations between the community and project proponent in relation to traditional land use, customs and community rights to the scale of potential impacts identified in the EIS.
	16	Negotiation of the IBA	Timing of the IBA negotiation, process, facilitation, conflict resolution and status of the IBA as a "statute."

CHAPTER V: SUMMARY OF IMPACTS

Likely environmental impacts are associated with activities conducted for the construction of two components of the project that will alter or put negative influence to the existing biophysical environment. Impacts from the activities are assessed within the context of existing environmental, climate change and socio-economic characteristics of the site and surrounding areas.

5.1 Impacts from Jetty Structure

The following table presents all potential impacts from the development of the jetty structure grouped based on the activities that generate the impacts – i.e. site preparation (Pre-Construction), Construction and Operation and Management (After Construction).

5.1.1 Impacts during Pre-Construction

Impacts during the Pre-Construction stage include all impacts that will occur during site clearance and grading activities (cut and fill). The impacts will mostly be localized, direct, long term, and unavoidable. Because the impacts are localized, they are mostly not significant due to the absence of sensitive habitats around the site. The pre-construction impacts are limited to the activities as follows: limited marine and coastal ecology from loss of habitats, and water quality and bottom contamination due to compaction from jetty footprint preparation.

5.1.2 Impacts during Construction

Impacts during the Construction stage of jetty include all impacts that will occur during development of the catwalk of the jetty and the jetty structure itself. One of the most important impacts at this stage is the climate change impact where there is a potential for sea level rise as discuss clearly under section 5.3 “Potential Climate Change Impacts.” Other impacts include water quality, bottom contamination and marine and coastal ecology disturbance due to increased turbidity from construction activities. Moreover, construction of a large jetty structure will induce changes in current, wave and sediment movement pattern albeit limited due to the limited footprint of the jetty.

5.1.3 Impacts during Operation and Maintenance

During Operation and Maintenance phase, there are potential impacts from oil spill during transfer of fuel from the ship through the jetty. Oil might spill and could be dispersed to larger area. Depending on the scale, oil spill can lead to long term and significant impacts although it is avoidable through implementation of high standards of Health, Safety and the Environment. The following table contains the type, nature, indicator and methodology to assess impacts from jetty development.

Table 5.1. Type, Nature, Indicator and Methodology to Assess Impacts

Type of Impact	Nature of Impact	Scope of Impact	Impact Indicator	Design and Methodology to Assess Impacts
		Impacts during Site Preparation		
Water quality From increased turbidity due to compaction	Localized, direct, short term (temporary), negative but not Significant, unavoidable	Near coast water especially in the embayment area	Turbidity level, temperature, DO, chemical test	Visual, on-site and laboratory test designed to measure important water quality parameters
Bottom contamination From resettlement of sediment due to compaction	Localized, direct, could be medium term, negative but not significant, unavoidable	Areas immediate along the footprint of the jetty, some impacts to the embayment	Areas covered by sediment settlement, areas cleared out	Visual assessment
Marine and coastal ecology From loss of coral reef habitat	Direct and indirect, cumulative, Could be medium term, Not significant, unavoidable	The embayment area, close-by coral communities	Area of coral loss Benthic macrofauna	Laboratory test designed to measure stability of benthic macrofauna community.
		Impacts during Construction		
Water quality, Bottom contamination, Marine and Coastal Ecology	Same as during Site Preparation, related to increased turbidity			
Marine and Coastal ecology New structure as "attachment place"	Localized esp. on structures in the water, long term, **positive**, not significant, unavoidable	Submerged structure only	Colonization of submerged structure	Visual
Coastal Hydrology from enactment of large structure in marine environment**:**				
Changes in current pattern, wave and sediment movement that could lead to higher sedimentation rate or erosion	Localized, indirect, Long term, negative and could be significant, unavoidable	Areas immediate to the jetty structure, coral reef, impact could extend to the embayment	Beach erosion (loss of sandy area along the beach) or coastal erosion (loss of sediment from the bottom of the coastal area).	Actually impacts will directly be felt by the facility in terms of the frequent need to dredge from the high rate of sedimentation. What should be closely assessed are impacts of changes in sediment movement pattern to the health of the nearby coral beds.

Stagnant pool of water may be formed behind structures	Localized especially around Jetty structure, long term, negative but not significant, unavoidable	Areas immediate to the jetty structure	Formation of stagnant water	Visual
Noise and vibration From equipment operation	Localized, short term, negative, not significant, unavoidable	Only up to areas 100 meters away from the source of the noise. See detailed explanation on noise impacts in Section 6.1.3	Community complain	On site test
Water quality, bottom contamination and marine ecology from waste generation From worker activities	Localized, short term, negative, not significant, avoidable	Affecting area immediate to the jetty structure and the embayment. Solid waste could travel a long distance in the marine environment.	Concentration of solid waste along the beach, solid waste floating in the beach area and around the project area, evidence of eutrophication in the water	Visual
Impacts during Operation and Maintenance				
From Ship Traffic				
Water quality, Bottom contamination, Marine and Coastal Ecology:				
Oil spill	(Depending on scale of spill) Could be dispersed to larger area, long term and significant although avoidable	Area immediate to the jetty structure, the embayment including sensitive receptor nearby. Large scale oil spill could travel to larger marine environment	Thin or thick layer of oil on the water surface (oil slick), toxic soluble material in the water originated from oil spill	Visual, laboratory testing designed to measure oil spill impacts including level of toxicology. At the very least, laboratory testing of marine water should cover parameters tested in the baseline information data collection.

Waste water	Localized, could be significant to sensitive flora and fauna, avoidable	Area immediate to jetty structure up to the embayment	Eutrophication, bacterial count	Visual, laboratory testing
Garbage (solid waste)	Could be dispersed to larger marine environment, could be significant to sensitive flora and fauna, avoidable	Area immediate to jetty structure, the embayment and potentially dispersed to the larger marine water	Concentration of solid waste along the beach, solid waste floating in the beach area and around the project area	Visual
Noise and Vibration from ship traffic	Localized, not significant, happened several times in a month during the time ship is coming	Most likely affecting workers on the ship and jetty structure only	Noise level, complain from surrounding resident	Site testing or nuisance level
From Maintenance of Jetty				
Water quality, Bottom contamination, Marine and Coastal Ecology From increased turbidity related to fixing and parts replacement	Same as during Site Preparation above			

5.2 Impacts from Fuel Storage

Major impacts from fuel storage development are related especially to oil spill and fire hazard. Magnitude of impacts will depend on the scale of the spill and fire with impacts range from slight to extensive impacts (Table 5.2) that can lead to long term alteration to ecosystem function and permanent species or asset loss. The following table contains potential environmental impacts from fuel storage development.

Table 5.2. Type, Nature, Indicator and Methodology to Assess Impacts

Type of Impact	Nature of Impact	Impact Indicator	Methodology to Assess Impacts
Impacts during Site Preparation			
Surface and Marine Water quality, bottom contamination	Localized, direct, short term (temporary), negative	Turbidity level, temperature,	Visual, on-site and laboratory test

and marine/coastal ecology From increased turbidity due to spoil from site preparation	but not Significant, unavoidable	DO, chemical test	
Terrestrial Ecology	Direct, long term, not significant, unavoidable	Loss of habitat	Site survey
Impacts during Construction			
Surface and marine water quality, Bottom contamination, Marine and Coastal Ecology from increased turbidity due to spoil from site preparation	Same as during Site Preparation, related to increased turbidity due to spoil from construction activities		
Soil and ground water quality from spill of oil and other chemicals used	Direct, cumulative, Could be medium term, Could be significant depending on the scale, avoidable	Evidence of oil spill on the soil, amount of hydrocarbon compound in the soil	Visual, on site and laboratory test
Air Quality from traffic during construction	Direct, short term, not significant, unavoidable	Level of NO_2, SO_2, PM_{10}, $PM_{2.5}$	Visual, on site test
Noise and vibration from operation of equipment	Direct, short term, not significant, unavoidable	Level of noise and vibration	Site testing or complaints for nuisance from local community
Impacts during Operation and Maintenance			
Surface water quality, marine water quality, bottom contamination, marine and coastal ecology from:			
Oil spill	(Depending on scale of spill) Could be dispersed to larger area, long term and significant although avoidable	Thin or thick layer of oil on the water surface (oil slick), toxic soluble material in the water originated from oil spill	Visual, laboratory testing
Liquid and solid waste	Localized, could be significant to sensitive flora and fauna, avoidable	Solid waste floatingin the beach area and around the project area, bacterial contamination, level of nutrients in the water	Visual, laboratory testing
Soil and ground water quality from spill of oil and other chemicals used	Direct, cumulative, Could be long term, Could be significant depending on the scale, avoidable	Evidence of oil spill on the soil, amount of hydrocarbon compound in the soil	Visual, on site and laboratory test
Air Quality from traffic during construction	Direct, long term, not significant, unavoidable	Level of NO_2, SO_2, PM_{10}, $PM_{2.5}$	Visual, on site test
Noise and vibration from operation of equipment	Direct, long term, not significant, unavoidable	Level of noise and vibration	Site testing or complaints for nuisance from local community
Visual quality	Direct, long term, not significant, unavoidable	Visual stimulation	Visual

5.3 Potential Climate Change Impacts

The most relevant climate change-related impacts to fuel storage facilities development in the coastal locations are sea level rise and changes in climatic parameters especially rainfall and temperature. Climate change is an important factor in Health, Safety and Environment (HSE) because it has the potential to exacerbate existing impacts. Moreover, climate change might induce unexpected and costly failure of the facility itself due to direct impacts from sea level rise especially during storm surge, increase of extreme weather events that induce erosion, flooding, changes in groundwater profile, and prolong the dry weather seasons that can affect the water source availability.

To understand better how climate change potentially impact the facility, it is important to be familiar with expert projections on the changing climate in Timor Leste. The International Climate Change Adaptation Initiative, Pacific Climate Change Science Program (ICCAI PCCSP) has concluded that for Timor Leste, air temperature has increased by a comparable amount to the increase in sea surface temperature (between 0.15-0.2^{0}C) per decade over the period of 1950-2009. In terms of rainfall, the ICCAI PCCSP noted that there is a decrease in annual and dry season rainfall from 1952 to 2009. In the future, rainfall has been projected to shift toward the wet season with dry season rainfall projected to decrease although not much change is expected in the annual mean rainfall. Confidence in rainfall projection is low because 10 years of historic data is missing. As for intensity and frequency of days of extreme rainfall it is confidently projected that the intensity and frequency of days of extremely high rainfall will increase with not much change projected in the incidence of drought.

Study of satellite data and nearest tidal gauge and concluded that sea level has risen near Timor Leste by about 9mm per year since 1993 and that the rise is larger than the global average of 2.8-3.6mm per year. A higher rate of rise in Timor Leste may be related to natural periodic fluctuations caused by phenomena such as the El Niño-Southern Oscillation. It is confidently projected that this trend in sea level rise will continue.

The following table shows the indicative figure of various measurable climate parameters that may change in the future.

Table 5.3. Summary of Climate Variation in the future in Timor Leste

Variable	Season	2030	2055	2090	Confidence
Surface air temperature (°C)	Annual	+0.7 ± 0.4 +0.8 ± 0.4 +0.7 ± 0.3	+1.1 ± 0.6 +1.5 ± 0.6 +1.4 ± 0.4	+1.5 ± 0.7 +2.3 ± 0.9 +2.8 ± 0.7	High
Maximum temperature (°C)	1-in-20-year event	N/A	+1.0 ± 0.6 +1.4 ± 0.6 +1.5 ± 0.5	+1.4 ± 0.8 +2.2 ± 1.1 +2.8 ± 1.5	Low
Minimum temperature (°C)	1-in-20-year event	N/A	+1.3 ± 1.6 +1.6 ± 1.8 +1.6 ± 1.7	+1.7 ± 1.6 +2.2 ± 1.8 +2.5 ± 1.8	Low
Total rainfall (%)*	Annual	+1 ± 9 +1 ± 8 0 ± 11	0 ± 15 -1 ± 18 0 ± 16	0 ± 13 0 ± 19 +1 ± 23	Low
Wet season rainfall (%)*	November-April	+1 ± 7 +1 ± 7 0 ± 8	+1 ± 10 +1± 14 +3 ± 10	+2 ± 9 +2 ± 15 +5 ± 16	Moderate
Dry season rainfall (%)*	May-October	+1 ± 20 +3 ± 18 0 ± 23	-2 ± 31 -4 ± 35 -3 ± 31	-4 ± 28 -3 ± 40 -4 ± 51	Moderate
Sea-surface temperature (°C)	Annual	+0.6 ± 0.4 +0.7 ± 0.4 +0.6 ± 0.4	+1.0 ± 0.5 +1.3 ± 0.6 +1.2 ± 0.4	+1.4 ± 0.7 +2.1 ± 0.8 +2.5 ± 0.7	High
Aragonite saturation state (Ωar)	Annual maximum	+3.3 ± 0.2 +3.2 ± 0.1 +3.2 ± 0.2	+3.0 ± 0.2 +2.9 ± 0.2 +2.8 ± 0.2	+2.8 ± 0.2 +2.5 ± 0.2 +2.3 ± 0.2	Moderate
Mean sea level (cm)	Annual	+10 (6–15) +11 (6–15) +10 (6–15)	+18 (10–27) +21 (12–30) +20 (12–29)	+32 (17–47) +40 (21–59) +42 (22–62)	Moderate

Source: SoL Research Program, 2011

Risk from Sea Level Rise

To assess the risk of a facility in the coastal location from sea level rise, one has to know distance of the facility from the coastline and the elevation of the facility. In Timor Leste, it is generally accepted that those facilities (especially the national roads) that are located within 100m distance and 2m altitude from mean average sea level are deemed vulnerable to the effect of sea level rise.

The proposed fuel storage facility and jetty developments are particularly start at coastline (0 meter) with the elevation around 6 meter (see the topographic map) for the tank farm and from 0-150 meter of the coast. Therefore, it is generally vulnerable to the sea level rise in both jetty and storage facility. The design of both jetty and floor level in storage yard need to consider the sea level rise as recommended in the above table.

Risk from Changing Rainfall Pattern

The project is located is relatively dry region with mean average annual rainfall at 1300 mm. Historic rainfall data between 1957 and 1974 presented in Table 3.1 show that the area has a prolonged dry period that lasts between May l and November. Rainfall pattern has been projected to shift the rain from dry to wet season with relatively consistent mean average annual rainfall. Intensity and frequency of days of extremely high rainfall will increase with not much change projected in the incidence of drought. The change of the rainfall pattern particularly affect the groundwater resources in the area as the type of aquifer is localize high, where the vulnerability of sea water intrusion could increase due to the change of the rainfall pattern. It is therefore very important to prepare in finding an alternative ways in finding the fresh water sources such as storage and other sea water conversion.

Other climate change parameter to be considered in the design of the system is the rainfall change. As indicated in the above table that, the change of annual rainfall volume (increase) is relatively small, which presented in the following figures.

Figure 5.1 Existing rainfall Map describe the year of 2000

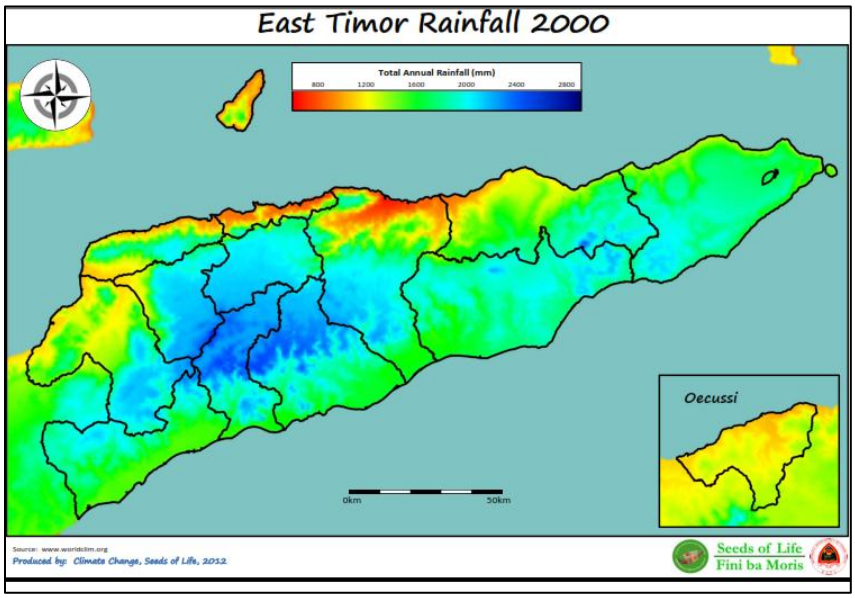
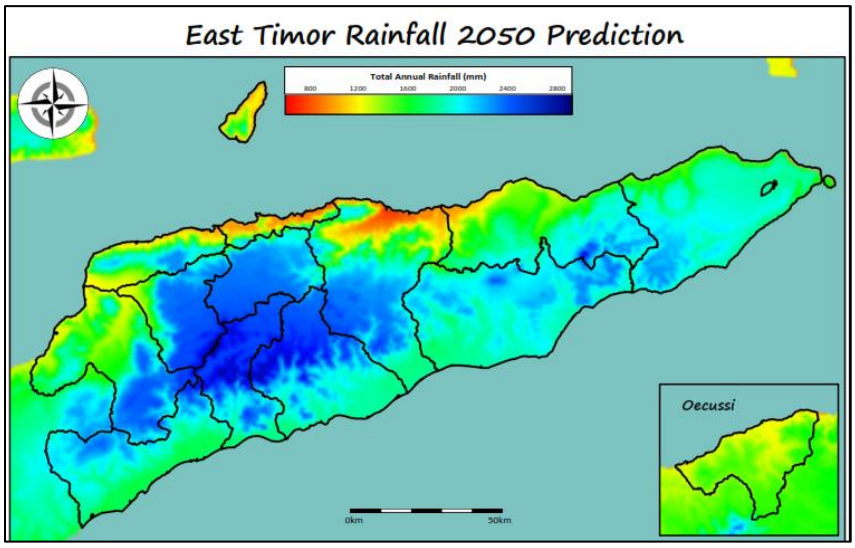


Figure 5.2 Existing rainfall Map Describe the Rainfall Prediction for the Year of 2050



According the prediction, by year 2050, the annual rainfall in the proposed project location will increase by 10% (from 1170 mm to roughly 1280 mm). This change may be considered small. However, the change may be significant from storm, as the rainfall may occur more frequent and the intensity may increase that will affect the coastal flooding and cropping in the agriculture production. The variation of storm rainfall should be considered in the drainage system design, as the project is located in the coastal area, so that the flashflood impact due to storm could be anticipated.

The national road of Dili-Liquica has been upgraded to 1 meter above the surrounding ground and the large culvert, has been constructed to convey large amount of storm water flow.

Risk from Changing Temperature

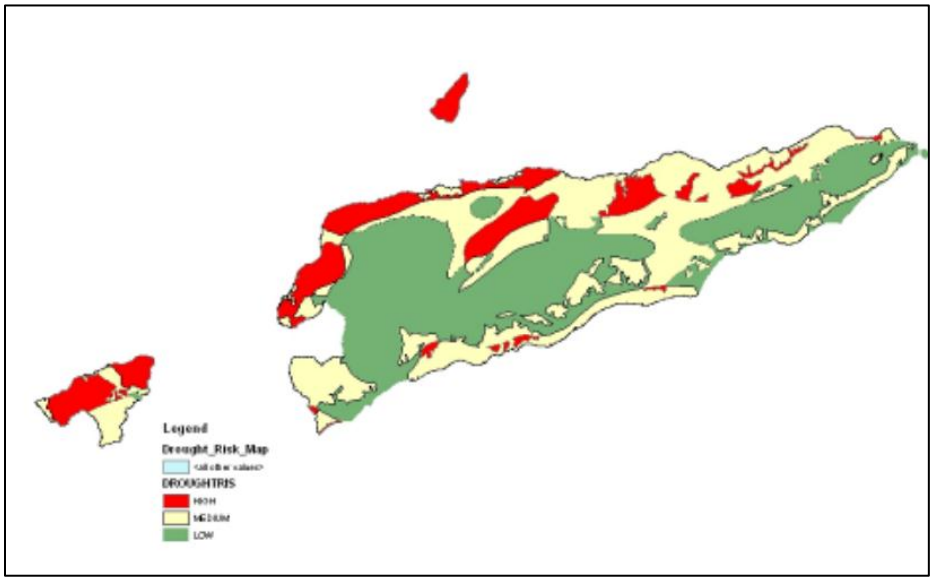
Recent data available suggested that the annual average temperature is 27.3^{0}C with highest monthly average recorded at 34^{0}C. Relative humidity is approximately 80%, making the weather humid but still generally pleasant. Temperature projections noted that temperature in the country is going to increase comparable to the increase in sea surface temperature. A temperature of 34^{0}C is generally considered a moderate to high mid-day temperature. Given the profile for relative humidity of 80%, the mid-day temperature in the region can be considered moderate to high with some effect to the health and safety of workers working in the open area.

Figure 5.3 Box Culvert Placed under the National Road

The drainage improvement should be conducted in order to avoid the future flooding in the project area. By elevating the floor level at the proposed project area, the future flooding and inundation could be minimized.

Other potential hazard that may occur due to climate change is drought hazard due to prolong dry season that will affect the fresh water availability. The following map shows the study produced by the UNDP in 2010 that indicated that the project location is prone to the drought hazard.

Figure 5.4 Drought Hazard Map (produced by UNDP, 2010)



Therefore, the project owner should take necessary measured in constructing sufficient water storage and other preparedness methods to avoid the water crisis.

5.4 Potential Social Impacts

This social impact assessment has the objective of analyzing potential social consequences of the development to nearby community and being able to come up with recommendations to prevent or mitigate negative social consequences from the development. The scope of the social assessment is the community in which the development is taking place, that is,AldeiaCaitehu and SucoMotaulun. Workers in the facility whether they come from Motaulun or other places are also included in the analysis because the social consequences of the development will also be felt by them.

Desk review and field interview conducted for the project found several key social issues in the affected community that are relevant to the development. The key social issues are:

1. Relatively high unemployment level in Suco Motaulun: based on Census 2010 data, it was found that the unemployment rate in the Suco 9. 98% or about one in ten persons that are available for work do not find job.
2. The community health status is still a reflection of rural Timor Leste's health status where there is a need for improvement on the number of children receiving immunization, nutrition status of children and the prevalence of malaria. Health facility remains basic in the community.
3. In terms of educational attainment, Suco Motaulun has about 68% of population 5 years old and over with some schooling (Census 2010). This relatively higher number, however, is not reflected

in the educational attainment at the secondary level, where there is only 1.59% of the population actually finished tertiary/diploma or university level of education (Census 2010).

4. Educational facility only covers primary to junior high school level. High school students have to commute to Liquica or Dili for continued education.
5. Gender equality in general is improving, however, there are more work to be done as indicated by the presence of less girls in the university level education (83 girls for every 100 boys enrolled). In the employment sector, data from the United Nations Development Programme (UNDP) also pointed to the traditional male dominance in the non-agricultural emplyment sector.
6. An analysis of potential social stress and shocks from the proposed development to vulnerable groups in the community is especially relevant to affected population near the development. As noted in the previously mentioned Sections, fishing is the main occupation reported by a significant number of the population (50%). The fishermen group, however, will not be directly impacted from the development as they do not launch their boat from near the project area and will not be directly impacted from any damage to the coral reef. No direct impact will also be directed to the mangrove forest nearby therefore, ecosystem services provided by the mangrove community will not be directly impacted from the development.
7. Direct impact will be mostly felt by local communities in Aldeia Caitehu, especially those living across the road and on the eastern side of the proposed facility.

Per the above findings, several recommendations have been put forward for the development to help contribute to the improvement of social condition as well as to ease the impacts on affected community. The recommendations are:

1. Absorption of local labor into the facility: this should start right from the beginning phase of the development/site preparation to construction and operation and management.
2. Preference to women labor: it is believed that certain percentage of labor in the facility should be made open for women, preferably for permanent position. Permanent position carries with it more benefits in the form of opportunities for education and training that not only increase the skill level but provide with positive learning and working experience.
3. Education and training for facility's employees: this should be pursued in a continuous basis with tangible results. For example, upper level management that will be filled with foreign employees at the start of the employment should be filled with Timor Leste citizens within several years.
4. Social contribution: routine social contribution should be made to local community and should contribute to meeting long term social needs of the community. For example, contribution into local schools and health care center, scholarship for students in need and others. This routine social contribution can be coordinated with the church and local authority as the prominent social institutions in the community.

5.5 Potential Economic Impacts

The potential economic impacts section focus on several points: the cost and benefits of several important mitigation measures and potential cost incurred due to environmental damage.

The total cost required by project proponent to implement the proposed EMP is amounted to USD 780,000 with annual operating cost of $ 104,700.

The above cost of the mitigation measures can be further classified into capital cost or one-time cost at the beginning of the development and recurring cost that require routine expenditure every six months, every one year or so. The capital cost is estimated at a total of USD 780,000 while the expenditure is estimated at a total of USD 100,000 per year.

Several important benefits will be able to be realized by investment in the mitigation measures. The benefits are as follows:

1. Protection of the coral ecosystem nearby. Losses due to the loss of coral bed from jetty development has been predicted to be between USD 40 and USD 302/year (from loss of fishery and coastal protection) and between USD 46 and USD 540/year (from loss of fishery, coastal protection and tourism potential). There is a potential for much greater losses than the above numbers should larger scale spill occur.
2. Rehabilitation of the environment. In addition to protection benefits, other benefits that should be taken into consideration is the benefits in terms of the avoidance of conducting rehabilitation should large scale spill and fire/explosion occur.
3. Protection of nearby infrastructure. Should any major accident happen, most likely, not all of the infrastructure will be damaged, however, at least a part of it will be affected such as the national road and electricity lines. Economic loss due to disruption of national road access could be significant because nearby road is an regional, national and international access to Indonesia.
4. Protection of workers. It is hard to put a price on the protection of human being from injury or loss of life. It should also be noted that not only workers in the facility will be affected. Should a major accident happen, there is a high possibility that nearby community might be affected.

CHAPTER VI: PROPOSED MITIGATION MEASURES

In the section 5 of this report has discussed extensively on the potential environmental, climate change and socio-economic impacts resulted from the development. Several types of potential impacts can lead to significant damage to the environment and existing infrastructure near the development site, not to mention the potential for loss of lives should any large accident happen on the site. Additionally, several potential socio-economic impacts are also significant to local community and the national economy. These potentially significant impacts are listed in Table 6.1.

Table6.1. Potentially Significant Environmental and Socio-Economic Impacts

No	Significant Impacts	Source Activity	Phase in the Development
Environmental			
1	Marine Water Quality	Especially from oil spill and associated toxic substances present in the product	Risks from significant impacts are especially during O&M phase.
2	Bottom Contamination		
3	Coastal and Marine Ecology		
4	Surface Water Quality		
5	Soil and Ground Water Quality		
Socio Economic			
1	Loss of lives and potentially significant economic loss from explosion and fire	Spill, overfill or other loss of containment that leads to explosion or fire	Especially during O&M phase

Due to the potential scale of damage from the above impacts, it is deemed important to discuss management and monitoring measures that are relevant to these impacts in more detail.

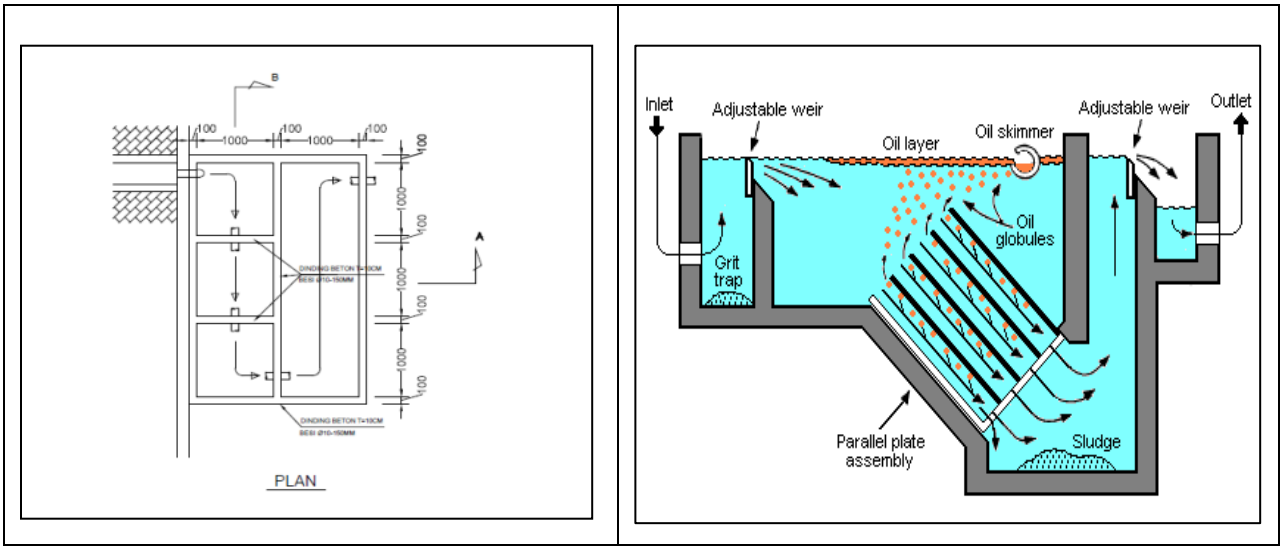
6.1 Management Plans for Major Impacts

As noted in Table 5.1 Scale of Impacts from Oil Spill (under Section V.1.5 Water Quality, Bottom Contamination and Marine/Coastal Ecology from Oil Spill), there are five scales of impacts from oil spill. The first three scales of impacts – slight to local impacts – are impacts from relatively small spill that can cause severe damage when happen repeatedly while the later impacts – major to extensive impacts – are impacts from large enough spills that only need to happen once to cause severe impacts. Management measures for both groups of impacts are discussed as follows.

6.1.1 Management Measures for Slight to Local Impacts

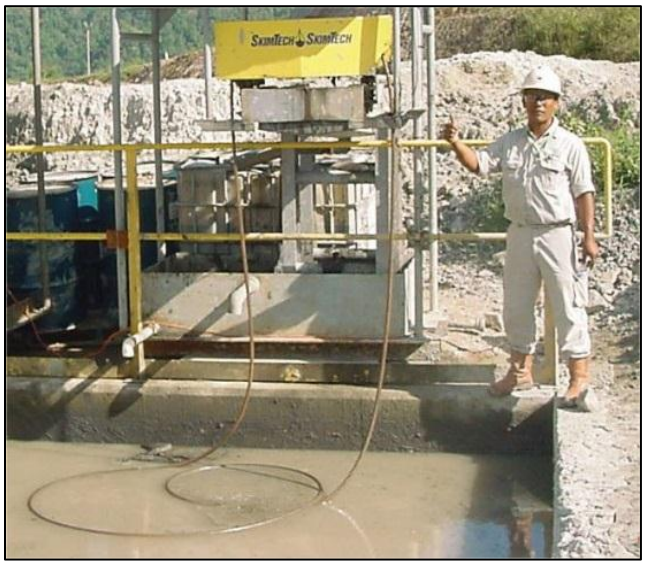
To prevent small spills from reaching nearby environment, a physical measure in the form of oil separator will be put in place (Figure 6.1). This oil separator will intercept drainage lines coming out of the bundwall, catching the runoff. When operators observe oil in the water, the oil will be skimmed and disposed-off properly.

Figure 6.1. Water-Oil Separator



When deemed necessary (determination will be done by professional operator and relevant authority), further clean-up of drainage water can be done using a skimming machinery similar to the one depicted in the illustrative figure below.

Figure 6.2. Higher-Grade Skimming Machine (Cost US$ 15,000 – US$ 35,000)



As for potential for small spills from tanker ship during the transfer of products from ship to storage tank, several steps should be taken:

1. The use of boom around tanker ship to prevent spill from spreading to the surrounding location.
2. Application of dispersant (detergent) into spill that will reduce the oil/water interfacial tension, making it easier for waves to break up oil into larger numbers of smaller particles. Dispersant also prevents dispersed particles from recoalescing and forming bigger, more buoyant droplets that float to the surface.

6.1.2 Management Measures for Major to Extensive Impacts

Large Scale Oil Spill from Tanker Ship

No large scale oil handling facility plan to have an accident. This statement was echoed during the first stakeholder consultation meeting with relevant agencies in March 2014. Yet, accidents happen whether it is a result of human error, mechanical failure or catastrophic natural events beyond human control. Therefore it is important to establish a Response Plan that would become handy in the event of a large scale accidental oil spill.

Overall Goal

Goals of the Response Plans should be (in order of significance):

1. Ensure safety of workers, nearby community and other people around the site
2. Contain and stabilize the situation so it does not progressively worsen
3. Minimize adverse environmental and socio-economic impact

Objectives

Objectives are different than overall goals. Objectives are specific response outcomes that are based on the unique characteristics of the spill. Head of the response team has to be able to define proper objectives in every situation based on the overall goals as state above.

Several possible objectives in different spill scenarios are presented in the following table.

Table 6.2. Example of Specific Objectives

No	Spill Scenario	Example of Specific Objectives
1	Tanker has an accident, spill started to occur on water.	- Prevent fire from happening - Prevent fishermen nearby from spill or fire effect - Stop the spill from tanker - Prevent spill from reaching the shoreline, mangrove

		communities on the eastern side of facility.
2	There is a failure in tank filling control system. Spill started at one of the tanks.	- Prevent fire from happening - Stop the spill from tanks - Evacuate nearby community - Prevent spill from reaching the drainage system

Windows of Opportunity

It is important for the response manager to define available window of opportunity or the period during which rapid response actions are viable. Changes in weather, for example, will limit the viability of certain types of action. Therefore, the action has to be carried out as soon as possible and those carrying out the response actions has to watch for certain changes in weather or other physical parameters (current, wave, etc.)

Cleaning Methodology

Various techniques and technologies are available for cleaning large scale oil spill. These methods have their advantages and disadvantages and should be employed with caution because some methods could actually exacerbate the situation and lead to unnecessary impacts to the surrounding communities and the environment. Lessons learned from study of previous emergency response have even suggested that in some situation, leaving the environment as it is and allowing for natural recovery from weathering, wave and biological actions are actually best.

General Principles for Oil Spill Cleaning

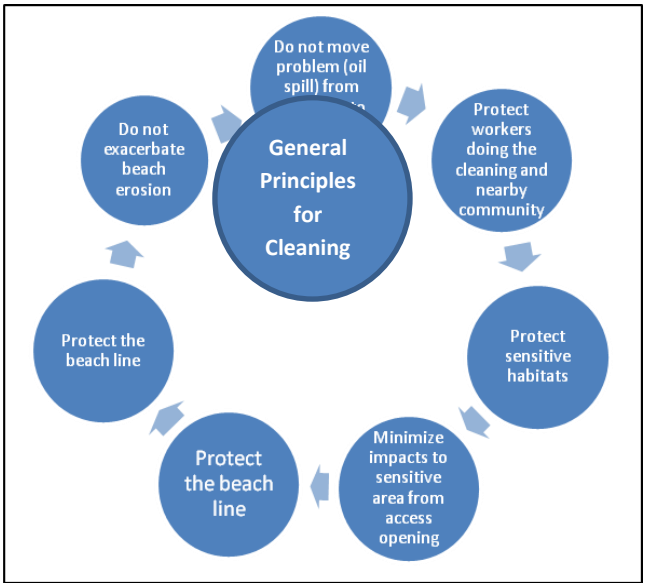


Table 6.3 contains a list of clean up methodologies, its affectivity and potential impacts to the environment.

However, General Principles on Implementing Certain Cleaning Method is summarized in the following figure.

Deciding on Which Methodologies to Use (Strategies)

Being clear on the window of opportunity and having specific objectives help tremendously in Being clear on the window of opportunity and having specific objectives help tremendously in developing appropriate strategies from a variety of response actions available. Information on the different types of response methodologies, their advantages and potential biological constraints are also helpful in deciding how to proceed with the spill response. Developing best strategies to employ, however, should be based on accurate information on the nature of the spill, human environment and other physical factor. The following are some basic information that needs to be collected before developing the strategies categorized based on location of affected area, i.e. on water or along the shoreline.

Table 6.3. Different Cleaning Methodology

No	Method	Description	Objective	Suitable Habitat	When to Use	Biological Constraints	Environmental Effect	Waste Generation
1	Natural Recovery	No action is taken, except monitoring of contaminated areas	Oil is left in place to degrade naturally.	All	When natural removal rate is fast (e.g. for gasoline spill); when degree of oiling is light; when cleanup actions will do more harm than natural recovery	May be inappropriate for areas used by high numbers of people, mobile animals (birds, marine mammals) or endangered species	Same as from the oil alone.	None
2	Booming	A boom is a floating physical barrier, placed on the water to contain or exclude oil. Booms must be properly deployed and kept clean from debris and re-adjusted to changing water flow directions, water levels, and wave conditions. Proper deployment involves use of mooring systems (e.g., anchors, land lines) and skilled teams. Tidal-seal boom is a special type of boom designed to be deployed in the intertidal zone.	To prevent oil from contacting resources at risk, and to facilitate oil removal	Can be used on all water environments (weather permitting). Booms begin to fail by entrainment when the effective current or towing speed exceeds 0.7 knots perpendicular to the boom	Most responses to spills on water involve deploying boom. Containment booming of gasoline spills is usually not attempted, because of fire, explosion, and inhalation hazards. However, when public health is at risk, gasoline can be boomed if foam is applied and extreme safety procedures are used.	Placing and maintaining boom and anchoring points should not cause excessive physical disruption to the environment and booms in very shallow water should be monitored so they do not trap wildlife (such as fish coming in at high tide).	Minimal	Cleaning booms will generate contaminated wastewater that must be collected, treated, and disposed of appropriately. Discarded booms will need to be disposed of according to appropriate waste disposal regulations.
3	Skimming	There are numerous types of skimming devices, described in the annually published World Catalog of Oil Spill Response Products (SL Ross 2008): brush, disc, drum, paddle, belt, rope mop, sorbent belt, submersion plan, suction, and weir. They are placed at the oil/water interface to recover, or skim, oil from the water's surface and may be operated independently from shore, be mounted on vessels, or be completely self-propelled.	To recover floating oil from the water surface using mechanized equipment.	Can be used on all water environments (weather and visibility permitting).	When sufficient amounts of floating oil can be accessed. Skimming spilled gasoline is usually not feasible however, when public health is at risk, gasoline can be skimmed if foam is applied and extreme safety procedures used.	Vehicle and foot traffic to and from skimming sites should not disturb wildlife unreasonably	Minimal	Free-floating oil can be recycled. Emulsions formed during the process must be treated (broken) before recycling. Oil-contaminated waste from the treatment phase should be treated as wastewater.
4	Barriers/Berms	A physical barrier (other than a boom) is placed across an area to prevent oil from passing. Barriers can consist of earthen berms, trenching, or filter fences. When it is necessary for water to pass because of water volume, underflow or overflow dams are used.	To prevent entry of oil into a sensitive area or to divert oil to a collection area	At the mouths of creeks or streams to prevent oil from entering, or to prevent oil in the creek from being released into offshore waters	When the oil threatens sensitive habitats and other barrier options are not feasible	Responders must minimize disturbance to bird nesting areas, beaver dams, or other sensitive areas. Placement of dams and filter fences could cause excessive physical disruptions, particularly in wetlands.	May disrupt or contaminate sediments and adjacent vegetation.	Sediment barriers will become contaminated on the oil side and filter fence materials will have to be disposed of as oily wastes
5	Physical Herding	Plunging water jets, water or air hoses, and propeller wash can be used to dislodge trapped oil and divert or herd it to containment and recovery areas. May emulsify the oil.	To free any oil trapped in debris or vegetation on water; to direct floating oil towards containment and recovery devices; or to divert oil from sensitive areas	In nearshore areas where there are little or no currents, and in and around man-made structures such as wharves and piers.	In low-current or stagnant water bodies, to herd oil toward recovery devices. In high-current situations to divert floating oil away from sensitive areas.	When used nearshore and in shallow water, must be careful not to disrupt bottom sediments or submerged aquatic vegetation.	May generate high levels of suspended sediments and mix them with the oil, resulting in deposition of contaminated sediments in benthic habitats.	None
6	Manual Oil Removal	Removal of surface oil using hands, rakes, shovels, buckets, scrapers, sorbents, pitchforks, etc., and placing in containers. No mechanized equipment is used except for transport of collected oil and debris.	To remove oil with hand tools and manual labor	Can be used on all habitat types	Light to moderate oiling conditions for stranded oil, or heavy oils on water or submerged on the bottom that have formed semi-solid or solid masses and that can be picked up manually	Foot traffic over sensitive areas (marshes, tidal pools, etc.) should be restricted or prevented. There may be periods when shoreline access should be avoided, such as during bird nesting	Minimal	May generate significant quantities of oil mixed with sediment and debris that must be properly disposed of or treated.

7	Mechanical Oil Removal	Oil and oiled sediments are collected and removed using mechanical equipment not specifically designed for pollution response, such as backhoes, graders, bulldozers, dredges, draglines, etc. Requires systems for temporary storage, transportation, and final treatment and disposal of collected material.	To remove oil from shorelines, and bottom sediments using mechanical equipment	On land, possible wherever surface sediments are both amenable to, and accessible by, heavy equipment. For submerged oil, used in sheltered areas where oil accumulates. On water, used on viscous or solid contained oil.	When large amounts of oiled materials must be removed. Care should be taken to remove sediments only to the depth of oil penetration, which can be difficult with heavy equipment. Should be used carefully where excessive sediment removal may cause erosion of the beach or shore.	Heavy equipment use may be restricted in sensitive habitats (e.g., marshes, soft substrates) or areas used by protected species.	The equipment is heavy, with many support personnel required. May be detrimental if excessive sediments are removed without replacement (beach erosion risk).	Can generate significant quantities of contaminated sediment and debris that must be treated or landfilled.
8	Sorbents	Organic, inorganic, and synthetic materials that remove oil through absorption (uptake into the sorbent material, like a sponge) or through adsorption (coating of the sorbent's surface). Sorbents are placed on the floating oil or water surface, allowing them to sorb oil, or are used to wipe or dab stranded oil.	To remove surface oil by using oleophilic (oil-attracting) material placed in water or at the waterline.	Can be used on any habitat or environment type.	When oil is free-floating close to shore, or stranded on shore; the oil must be able to be released from the substrate and sorbed by the sorbent. Sorbents can be used as a secondary treatment method after gross oil removal in sensitive areas where access is restricted. Selection of sorbent varies by oil type: heavy oils only coat surfaces, requiring use of sorbents with high surface areas to be effective; lighter oils can penetrate sorbent material.	Access for deploying and retrieving sorbents should not 1) adversely affect wildlife; 2) be through soft or sensitive habitats	Physical disturbance of habitat during deployment and retrieval.	In most cases, sorbents must eventually be collected for proper disposal so care should be taken to select and use sorbents properly, and prevent overuse and generation of large amounts of lightly oiled sorbents. Because large amounts of waste may be generated, recycling should be emphasized over disposal.
9	Vacuum	A vacuum unit is attached via a flexible hose to a suction head that recovers free oil. The equipment can range from small, portable units that fill individual 55-gallon drums to large supersuckers that are truck- or vessel-mounted and can generate enough suction to lift large rocks.	To remove oil pooled on a shoreline substrate or sub-tidal sediments	Any accessible habitat type.	When oil is stranded on the substrate, pooled against a shoreline, concentrated in trenches, or trapped in vegetation.	Special restrictions should be established for areas where foot traffic and equipment operation may be damaging, such as soft substrates. Operations in vegetated areas must be very closely monitored, and a site-specific list of procedures and restrictions developed to prevent damage to vegetation.	Minimal, if access is controlled.	Collected oil and/or oil/water mix will need to be stored temporarily before recycling or disposal.
10	Debris Removal	Manual or mechanical removal of debris (driftwood, seaweed, trash, wreckage) from the shore or water surface.	To remove debris in the path of a spill before oiling, and to remove contaminated debris from the shoreline and water surface.	Can be used on any habitat or environment type where access is safe	When debris is heavily contaminated and provides a potential source of secondary oil release;	Foot traffic over sensitive areas (wetlands, spawning grounds) must be restricted	Physical disruption of substrate, especially when mechanized equipment must be deployed to recover a large quantity of debris	Will generate contaminated debris
11	Sediment Reworking /Tilling	The oiled sediments are roto-tilled, disked, or otherwise mixed using mechanical equipment or manual tools. Along beaches, oiled sediments may also be pushed to the water's edge to enhance natural cleanup by wave activity (surf washing).	To break up oily sediments and surface oil deposits, increasing their surface area, and mixing deeper subsurface oil layers, thus enhancing the rate of degradation through aeration	On any sedimentary substrate (sand, mud, etc.) that can support mechanical equipment or foot traffic and hand tilling.	On sand to gravel beaches with subsurface oil, where sediment removal is not feasible (due to erosion or disposal problems).	Avoid use on shores near sensitive wildlife habitats, such as fish-spawning areas or bird-nesting or concentration areas because of the potential for release of oil and oiled sediments into adjacent bodies of water. Should not be used in shellfish beds or vegetated habitats.	Mixing of oil into sediments could further expose organisms that live below the original layer of oil.	None

12	Vegetation Cutting/Removal	Oiled vegetation is cut with weed trimmers, blades, etc.	To remove portions of oiled vegetation or to access oil trapped in vegetation to prevent oiling of wildlife or secondary oil releases.	Habitats composed of vegetation, such as salt marsh, sea grass beds, etc.	When the risk of oiled vegetation contaminating wildlife is greater than the value of the vegetation that is to be cut,	Operations must be strictly monitored to minimize the degree of root destruction and mixing of oil deeper into the sediments. Access in bird-nesting areas should be restricted during nesting seasons. Cutting only the oiled portions of the plants and leaving roots and as much of the stem as possible minimizes impacts to plants.	Vegetation removal will destroy habitat for many animals. Cut areas will have reduced plant growth and, in some instances, plants may be killed.	Cut portions of oiled plants must be collected and disposed
13	Flooding	A perforated header pipe or hose is placed above the oiled shore or bank. Ambient-temperature water is pumped through the header pipe at low pressure and flows downslope to the water where any oil released is trapped by booms and recovered by skimmers or other suitable equipment.	To wash oil stranded on land to the water's edge for collection.	All shoreline types where the equipment can be effectively deployed.	In heavily oiled areas when the oil is still fluid and adheres loosely to the substrate, and where oil has penetrated into gravel sediments. This method is frequently used with other washing techniques (low- or high-pressure, cold- to hot-water flushing).	May need to restrict use so that the oil/water effluent does not drain across sensitive intertidal habitats. Not appropriate for muddy substrates.	Habitat may be physically disturbed by foot traffic during operations and smothered by sediments washed down the slope. Flooding may cause sediment loss and erosion of the shoreline and shallow rooted vegetation.	Depends on the effectiveness of the collection method
14	Low-pressure, Ambient-Water Flushing	Ambient-temperature water is sprayed at low pressures (<10 psi), usually from hand-held hoses, to lift oil from the substrate and float it to the water's edge for recovery by skimmers, vacuum, or sorbents. Usually used with a flooding system to prevent released oil from re-adhering to the substrate downstream of the treatment area.	To remove fluid oil that has adhered to the substrate or man-made structures, pooled on the surface, or become trapped in vegetation.	On substrates, riprap, and solid, man-made structures, where the oil is still fluid. In wetlands and along vegetated banks where oil is trapped in vegetation.	Where fluid oil is stranded onshore or floating in shallow intertidal areas	May need to restrict use so that the oil/water effluent does not drain across sensitive intertidal habitats, and so that mobilized sediments do not affect rich subtidal communities	If containment methods are not sufficient, oil and oiled sediments may be flushed into adjacent areas.	Depends on the effectiveness of the collection method
15	High-pressure, Ambient-Water Flushing	Similar to low-pressure flushing, except that water pressure is 100–1,000 psi (720–7,200 kpa). High-pressure spray will more effectively remove sticky or viscous oils. If low water volumes are used, sorbents are placed directly below the treatment area to recover oil.	To remove oil that has adhered to hard substrates or man-made structures (e.g. jetty)	On bedrock, man-made structures, and gravel substrates.	When low-pressure flushing is not effective at removing adhered oil, which must be removed to prevent continued oil release or for aesthetic reasons.	May need to restrict flushing so that the oil does not drain across sensitive habitats. Flushed oil must be recovered to prevent further oiling of adjacent areas. Should not be used directly on attached algae nor rich, intertidal areas.	All attached animals and plants in the direct spray zone will be removed, even when used properly. May drive oil deeper into the substrate or erode fine sediments from shorelines if water jet is improperly applied. If containment methods are not sufficient, oil and oiled sediments may be flushed into adjacent areas. Some trampling of substrate and attached biota will occur.	Depends on the effectiveness of the collection method
16	Low-pressure, Hot-Water Flushing	Hot water (90°F [32°C] up to 171°F [77°C]) is sprayed with hoses at low pressures (<10 psi [<72 kpa]) to liquefy and lift oil from the substrate and float it to the water's edge for recovery by skimmers, vacuums, or sorbents. Used with flooding to prevent released oil from re-adhering to the substrate.	To remove non-liquid/non-fluid oil that has adhered to the substrate or man-made structures, or pooled on the surface.	On bedrock, sand to gravel substrates, and man-made structures	Where heavy, but relatively fresh, oil is stranded onshore.	Avoid vegetated areas or rich intertidal communities so that the hot oil/water effluent does not contact sensitive habitats	Hot water contact can kill attached animals and plants. If containment methods are not sufficient, oil may be flushed into adjacent areas.	Depends on the effectiveness of the collection method
17	High-pressure, Hot Water Flushing	Hot water (90°F [32°C] up to 171°F [77°C]) is sprayed with hand-held wands at pressures greater than 100 psi (720 kpa). If used without water flooding, this procedure requires immediate use of vacuum or sorbents to	To mobilize weathered and viscous oil strongly adhered to	Gravel substrates, bedrock, and man-made structures.	When oil has weathered to the point that warm water at low pressure no longer effectively removes oil.	Use should be restricted so that the oil/water effluent does not drain across sensitive habitats (damage can result from exposure to oil, oiled sediments, and hot water). Should not be used directly on	All attached animals and plants in the direct spray zone will be removed or killed, even when used properly.	Depends on the effectiveness of the collection method

		recover the oil/water runoff. When used with a flooding system, the oil is flushed to the water surface for collection by skimmers, vacuum, or sorbents.	surfaces.			attached algae nor rich, intertidal areas.		
18	Steam Cleaning	Steam or very hot water (171°F [77°C] to 212°F [100°C]) is sprayed with hand-held wands at high pressure (2,000+ psi [14,400 kpa]). Water volumes are very low compared to flushing methods.	To remove heavy residual oil from solid substrates or man-made structures	Man-made structures such as seawalls and riprap	When heavy oil residue must be removed for aesthetic reasons, when hot water flushing is not effective, and no living resources are present	Not to be used in areas of soft substrates, vegetation, nor high biological abundance directly on, nor below, the structure	Complete destruction of all organisms in the spray zone	Depends on the effectiveness of the collection method. Usually sorbents are used, generating significant waste volumes
19	Sand Blasting	Use of sandblasting equipment to remove oil from the substrate.	To remove heavy residual oil from solid substrates or man-made structures.	On heavily oiled bedrock, artificial structures	When heavy oil residue must be cleaned for aesthetic reasons, and even steam-cleaning is not effective.	Not to be used in areas of soft substrates, vegetation, nor high biological abundance directly below, nor adjacent to, the structures.	Complete destruction of all organisms in the blast zone.	Will need to recover and dispose of oiled sand used in blasting
20	Dispersants	Dispersants reduce the oil/water interfacial tension, making it easier for waves to break up oil into larger numbers of smaller particles. Also prevents dispersed particles from recoalescing and forming bigger, more buoyant droplets that float to the surface	To reduce impact to sensitive shoreline habitats and animals that use the water surface by chemically dispersing oil into the water column.	Water bodies with sufficient depth and volume for mixing and dilution	When the impact of the floating oil has been determined to be greater than the impact of dispersed oil on the water-column and benthic community	Use in shallow water could affect benthic resources. Consideration should be made to avoid directly spraying any wildlife, especially birds or fur-bearing marine mammals.	Until sufficiently diluted, the dispersed oil can adversely impact organisms in the upper water column. Because dispersion may be only partially effective, some water-surface and shoreline impacts could occur	None
21	Emulsion-treating Agents	Emulsion-treating agents are surfactants that are applied to emulsified oil at low concentrations (0.1–2 percent). They can be injected into skimmer reservoirs to break the emulsion as it is skimmed from the water. They can be sprayed (similar to dispersants) directly onto slicks to break or prevent emulsions, although this type of application has been used only in field trials.	To break or destabilize emulsified oil into separate oil and water phases. Also can be used to prevent emulsion formation, increasing oil recovery rates, extending the window for dispersant application, or making burning possible.	On all water environments	To break emulsions in skimming systems, where storage capacities are very limited. To separate the recovered, emulsified oil and water so that the water can be treated and discharged.	Use in shallow water could affect benthic resources. Responders should avoid directly spraying any wildlife, especially birds or fur-bearing marine mammals.	Environmental concerns include the potential for increased oil content of separated water; whether the oil will be more readily dispersed; and how the treated oil will behave upon contact with skimming equipment, birds, mammals, and shorelines.	May enable recycling of oil/water mixtures by breaking down emulsions
22	Elasticity Modifiers	The liquid product is applied at a rate of 1:13 to 1:150 product:oil, depending on the oil type. Some mixing is required and is usually provided by the water spray during application. Treated oil is gelatinous, or semi-solid, but still fluid; there is no chemical change in the oil. The primary purpose is to increase skimmer efficiency removal rates while minimizing water recovery amounts.	To impart visco-elastic properties to floating oil, thereby increasing skimming rates.	On all water environments where oil can be accessed for skimming. Not suitable for use near wetlands nor debris because of increased adhesive properties of the treated oil.	When skimmer efficiency is low. Must be used with booming or other physical containment. Ideal for thin slicks of No. 2 fuel oil or diesel that are very difficult to recover with mechanical equipment or sorbents.	Not suitable for vegetated shores nor where extensive debris is mixed in the oil. Should be avoided when birds or other wildlife cannot be kept away from the treated oil.	May increase the smothering effect of oil on organisms; therefore, use should be considered only where recovery of the treated oil is likely.	If skimming efficiency is increased, will reduce the volume of water in oil/water collections.
23	Surface Collecting Agents	These agents, which are insoluble surfactants and have a high spreading pressure, are applied in small quantities (1–2 gallons per	To collect or herd oil into a smaller area	On all still-water environments	Potential use for collection and protection. For collection, used to push slicks out from under docks and piers	Not suitable for use in very shallow water nor fish-spawning areas	Direct acute toxicity to surface-layer organisms possible, though available	Same as for manual oil recovery.

		lineal mile) to the clean water surrounding the edge of a fresh oil slick. They contain the oil, prevent spreading, but do not hold the spill in place. Hand-held or vessel-mounted systems can be used. Must be applied early in spill, when oil is still fluid.	and thicker slick in order to increase recovery.		where it has become trapped, or in harbors where the equipment is readily accessible for use early in the spill. For protection in low-current areas, used to push slicks away from sensitive resources such as wetlands. Not effective in fast currents, breaking waves, nor rainfall.		products vary greatly in their aquatic toxicity.	
24	Solidifiers	Chemical agents (polymers) are applied to oil at rates of 10–50 percent or more, solidifying the oil in minutes to hours. Various broadcast systems, such as leaf blowers, water cannons, or fire suppression systems, can be modified to apply the loose granular product over large areas. Can be applied to both floating and stranded oil. Mixing is usually needed, and can be done with a strong water spray. Can be placed in booms, pads, pillows, and socks and used like sorbents.	To change the physical state of spilled oil from a liquid to a solid.	All water environments, bedrock, sediments, and artificial structures.	To immobilize the oil or prevent refloating from a shoreline, penetration into the substrate, or further spreading. However, the oil may not fully solidify unless the product is well mixed with the oil, and may result in a mix of solid and untreated oil. Generally not used on heavy oil spills that are already viscous.	Must be able to recover all treated material	Products are insoluble and have very low aquatic toxicity. Unrecovered solidified oil may have longer impact because of slow weathering rates. Physical disturbance of habitat is likely during application and recovery on land.	If skimming efficiency is increased, solidifiers may reduce the volume of water collected during oil recovery. Oil treated with solidifiers is typically disposed of in landfills.
25	Surface Washing Agents	Special formulations are applied to the substrate, as a presoak and/or flushing solution, to soften or lift weathered or heavy oils from the substrate to enhance flushing methods. The intent is to lower the water temperature and pressure required to mobilize the oil from the substrate during flushing.	To increase the efficiency of oil removal from contaminated substrates.	On any habitat where water flooding and flushing procedures are applicable. Has been used to increase the removal of oil adhered to vegetation.	When the oil has weathered to the point where it cannot be removed using ambient water temperatures and low pressures. This approach may be most applicable where flushing effectiveness decreases as the oil weathers.	When the product does not disperse the oil into the water column, the released oil must be recovered from the water surface. Use should be restricted so that the oil/water effluent does not drain across sensitive habitats	The toxicity and effects on dispersability of treated oil vary widely among products. Selection of a product should consider its toxicity.	Because treated oil must be recovered, waste generation is a function of recovery method, which often includes sorbents.
26	Nutrient Enrichment (Biostimulation)	Liquid products are diluted in water and applied with spray or injection systems. Dry products may be applied by hand or powder spray systems. Oleophilic fertilizers are sprayed neat directly on the oiled surface. The frequency of nutrient addition is determined by monitoring porewater so that nitrate-N concentrations are in the range of ~2–10 mg/L. Regular tilling or other means of aeration may be needed to maintain minimum oxygen levels, break up the oil residues, and provide mixing of the nutrients with the oiled sediments.	To accelerate the rate of hydrocarbon degradation due to natural microbial processes by exploiting ability of microorganisms to convert hydrocarbons to carbon dioxide, water, and innocuous by-products.	Could be used on any shoreline habitat type where access is allowed and nutrients are deficient.	Only when nutrients are limiting the rates of natural biodegradation. On moderate- to heavily-oiled substrates, after other techniques have been used to remove free product; on lightly-oiled shorelines, where other techniques are destructive or ineffective; and where nutrients limit natural attenuation. Most effective on light to medium crude oils and fuel oils. Less effective where oil residues are thick. Not considered for gasoline spills, which evaporate rapidly.	Avoid using ammonium-based fertilizers adjacent to waterbodies because un-ionized ammonia is toxic to aquatic life at very low levels. Nitrate is just as good a nitrogen source without the ecotoxicity. If nutrients are applied properly with adequate monitoring, eutrophication should not be a problem. Only nutrient additives proven to be nontoxic and effective in either the laboratory or the field should be used in the environment. Check fertilizers for their metal content since some common fertilizers contain relatively high levels of metals.	Detrimental effects to shoreline from foot or vehicle traffic caused by workers applying nutrients (unless nutrients are sprayed from a vessel or aircraft).	None
27	In-situ Burning	Oil floating on the water surface is collected into slicks at least 1–2 mm thick and ignited. The oil can be contained in fire-resistant booms, or by natural barriers such as ice or the shore. On land, oil can be burned when it is on a combustible substrate such as vegetation, logs, and other debris. Oil can be burned from non-flammable substrates using a burn promoter. On sedimentary substrates, it may be necessary to dig trenches for oil to accumulate in pools to a thickness that will sustain burning.	To remove oil from the water surface or habitat by burning the oil in place	On most habitats, except dry, muddy substrates where heat may impact the biological productivity of the habitat. May increase oil penetration in permeable substrates. Not suitable for woody vegetation such as mangroves.	On floating slicks, early in the spill event when the oil can be kept thick enough to sustain the burn. On land, where there is heavy oil in sites neither amenable nor accessible to physical removal and the oil must be removed quickly. Removal rates of 50,000 gal/hour can be achieved for a burn area of 10,000 ft2; under prime conditions, removal efficiencies can exceed 90%. In vegetated and mud habitats, a water layer will minimize impacts to sediments and roots. There are many operational and public health limitations.	All biota in the burn area will be impacted. The possible effects of large volumes of smoke on nesting birds and populated areas should be evaluated.	Temperature and air quality effects are likely to be localized and short-lived. Toxicological impacts from burn residues have not been evaluated. On water, burn residues may sink. Recent studies have predicted that about half of international crude oils would tend to sink in seawater, but only after cooling. On land, removal of burn residues is often necessary for crude and heavy oils.	Any residues remaining after burning will need to be collected and landfilled but, with an efficient burn, will be a small fraction of the original oil volume

Table 6.4. Information Needs in the Event of Spill

Category	Location: Spill On Water	Location: Spill Along the Shoreline
	Information Needed	**Information Needed**
Safety	Worker oil exposure	Worker oil exposure
	Fire hazard	Fire hazard
Nature and Amount of Oil	Oil type spilled	Oil type spilled
	Oil volume and area and shape of slick(s) and stranded oil	Stranded oil amount in terms of percent cover, thickness, width
	Variations in oil thickness and distribution	Stranded oil distribution
	Emulsification	
Proximity	Source considerations	Access from water and/or roads
	Water depths	Worker support services
	Shoreline and resources at risk	Staging/deployment sites
	Air and vessel traffic	
	Equipment staging and support locations	
	Special consideration areas	
Timing	Personnel and equipment availability	Timely strategy development
	Logistics support for sustained operations	Rapid cleanup to prevent oil remobilization
	Time until impact	
	Weathering	
Environment	Weather (wind/rain, other precipitation)	Waves
	Water depth	Tides
	Wind and waves	Currents
	Tides and currents	Weather (wind/rain, other precipitation)
	Visibility	Shoreline type
	Temperature	Water depth and sea bottom character
	Ice and floating debris	Vulnerable and threatened/endangered species and habitats
	Vulnerable species and habitats	Human use constraints
	Human use	Cultural constraints
Authorization	Approval to burn and/or apply chemical countermeasures*	Approval to burn and/or apply chemical countermeasures*
	Approval to access restricted areas	Required consultations for protection species and cultural resources
	Transport and disposal of recovered oil or waste	Approval to access restricted areas
	Necessary permits	Transport and disposal of recovered oil or waste
		Necessary permits

As is clear from information on the different methodologies for spill response, implementing a combination of several spill response actions is better than implementing only one or two actions. The

actions complement each other and some planned actions have to have a back-up due to the ever changing weather and other environment condition.

Generally speaking, the sequence of actions that make up the strategy for on water spill is as follows:

1. Spill happen
2. Monitor and collect information immediately. Hold any active response.
3. Assess safety of workers and nearby communities.
4. Implement physical containment and mechanical recovery actions which will remove oil with the least environmental impacts but with limitations due to changing weather, visibility, logistics and others. See Table 7.3 for different physical and mechanical recovery options.
5. Apply dispersant, emulsion treating agent, surface collecting agent or solidifiers depending on the situation.
6. Apply in-situ burning in favorable weather condition, watch for trajectory of black smoke to the surrounding area.
7. Direct the rest of the oil (those unable to be contained treated and/or burned) to the shore. As much as possible protect oil from reaching the intertidal habitat (coral reef) because it will be easier to clean the shore line rather than the muddy intertidal habitat.
8. Apply shore cleaning

On shore cleaning are a little bit different than the on water spill because – (1) oil typically stay in place, (2) land-based operation is less weather dependent, (3) different worker and environmental safety factor to consider.

The main treatment objective for shoreline area is to restore the environment to "clean" condition. Clean condition, however, is not the same as original pre-spill condition and the level of "clean" will be different for each spill. A combination of natural recovery, physical washing, sand removal, in-situ burning, chemical and biological treatment may be used as appropriate. As noted for each cleaning methodology, waste disposal should be incorporated in the action plan.

Large Scale Spill from Fuel Storage

Bulk storage facilities have the potential to cause severe pollution and damage to the nearby receptors through the release of hazardous liquids, explosion and fire. To manage the risks, they are required to have three layers of pollution prevention measures or also known as containment measures. The three layers are – (1) primary containment measures; (2) secondary containment measures; (3) tertiary containment measures. What constitute and the objectives of the containment layers are explained as follows:

1. Primary containment measures

Objective	Prevent release from tank overfilling, rapture and leakage through tank walls, bottom and the pipework
Consists of	Tanks, pipework, valves, gauging and alarm system, corrosion protection

2. Secondary containment measures

Objective	Prevent release to the environment should primary containment fail
Consists of	Bund walls, ground lining and bund /wall seals

3. Tertiary containment measures

Objective	Additional barrier to prevent uncontrolled spread from failure of secondary containment. Tertiary containment should be controlled separately from the secondary containment
Consists of	Drainage ditches and separate basins to contain spill

The proposed development has all the above containment measures with varying degree of completeness and standards. Additionally, the proposed development is also equipped with fire protection capability and an Emergency Response Plan in the event of fire.

1. Primary Containment

Primary containment measures for the proposed development consists of six tanks – 2 with 2,000 kL capacity to store gasoline, 2 with 1,000 kL capacity to store diesel fuel and 2 with 600 kL capacity to store lubricant. The following are technical specifications of the tanks.

Maximum design capacity	2,000 kL or 2,000 m3
Design code	Shall be equivalent to API Standard, 610
Tank bottom design	Single skin bottom
Tank corrosion protection	Yes
Storage fill/empty mode	Ship

To effectively manage risks from failures of the primary containment, several management and monitoring measures has to be put in place. These management and monitoring measures are categorized into five types and range from tank overfill protection and tank maintenance, measures for spill accounting and oil-water separation as well as emergency plans.

Table 6.5. Primary Containment Management and Monitoring Measures

No	Type	Management Measures	Maintenance/Monitoring Measures
1	Tank Overfill Protection	Tank level measurement	Regular (monthly) maintenance
		High Level Alarm (HLA) capable of annunciation and automatic shut down	Regular (monthly) testing
		High High Level Alarm (HHLA) capable of annunciation and automatic shut down	Regular (monthly) testing
2	Tank Maintenance and Inspection	Visual observation of leaks, crack, etc along the wall	Should be conducted at least of a weekly basis. Best if conducted on a daily basis.
		Undertank leak inspection	Should be conducted on a regular basis at least once a week. Best using visual and
3	Pipework and fuel transfer safety	Fire safe shut-off inlet/outlet valves that can be remotely shut off	Testing should be conducted on a weekly basis.
		Clear procedure for transfer control (written procedure)	Training at the beginning of operation and regularly at least once a year. Loading are always supervised.
4	Spill Accounting, Oil & Water Separator	Storage inventory reconciliation meaning input minus output of fuel equals what is left in the storage tanks. If fuel in the storage is less than input minus output, check for spill.	Conducted at least weekly and best if conducted on a daily basis.
		Oil/water separation dike to separate spill from tanks and off-tanks (from valves, joint, etc along the pipeworks). See Technical Drawing in Annex _2.1	Monitor the dike on a daily basis, skim oil leaks
5	Emergency Plan and Equipment	Fire Emergency Response Plan (to be prepared by Operator).	Regular (annual) training and drill
		Spill Response Plan	Regular (annual) training and drill
		Emergency equipment ready for rapid deployment for both spill and fire or spill only emergencies.	Regular (monthly) testing of equipment

2. Secondary Containment Measures

Secondary containment measures for the proposed development consist of bund wall and the size of 3500 kL (more than 110% the volume of largest tank). The primary function of the bund wall is to prevent the

spread of tank contents if the tank overflows or fails structurally (breakdown). If more than one tank is enclosed within a dike, the standard practice was for the dike to contain at least the volume of the largest tank.

Other factors that need to be taken into account in secondary containment are potential for leaks from pipework penetration on the walls. These pipework penetrations have to be sealed properly using fire resistance sealant.

Recommended management and monitoring measures for secondary containment involvesa minimum of weekly inspection of bund floor and wall to check for cracks and failures to the pipework sealant.

3. Tertiary Containment Measures

Tertiary containment consists of impervious lining of the facility and drainage ditch that drain rainwater as well as spill from inside the bund wall. Impervious lining protect oil spill from contaminating soil and reaching ground water while drainage ditches provide means to drain the bund area. Drainage ditches have to be able to be shut off to prevent spill from reaching sensitive receptors around the site.

Management and monitoring measures for tertiary containment include regular inspection to check for cracks and other irregularities to the impervious lining and drainage ditches.

4. Fire Protection Capability and Fire Response Plan

There are several types of fire hazards common to large tanks storing petroleum product. The hazards have different level of severity from simple fire vent fire to full liquid surface tank fire. Several types of fire incidents are more common than others, for example, an overfill ground fire, a vent fire and rim seal fire are more common than other types of fire. Common types of fire hazard are explained below.

Table 6.6 Types of Tank Fire

Type of Tank Fire	Description	Severity
Overfill ground fire	Also known as dike fires, resulting from tanks or pipe leaks. Leakage can be attributed to operator error or equipment malfunction.	Least severe
Vent fire	Usually caused by lightning strike that ignites fugitive vapor present at the vent.	Less severe
Rim seal fire	Usually caused by lightning strike although in certain types of tanks, an induced electrical charge without a direct lightning hit may occur. May lead to explosion.	Less severe
Full liquid surface fire	Very unlikely to occur although have previously occur due to a variety of reason including an overfill accident.	Severe

A complete Fire Response and Evacuation Plans will be prepared by professional operator that will run the facility for the first few months and provide training to the local employees. As a general rule, however, minimum fire-fighting apparatus that need to be provided at the facility include:

- Design and size have to adhere to an international standard (NFPA, OSHAS)
- Fire extinguishers have to be made available in areas with highest risk from fire (around tanks containing gasoline and diesel fuel), two 9 kg tanks have to be available/100 m2 area.
- Fire extinguishers have to be made available in areas with least risk from fire (around lubricant tanks), one 9 kg tank/100m2
- Fire extinguishers in non-risky areas according to guidelines from civil protection
- Sand with volume 1m3/2500 m2 area
- Hydrant system, has to be a separate system from other use of water. Hydrants have to be placed in strategic locations that cover all facility (Figure 8.3).
- Sprinkling water device within tanks
- Foam, has to be high expansion type. Design of the foam system, foam tank and location of tanks has to adhere to guidelines from civil protection.

As part of the design, the facility has incorporated several fire-fighting response apparatus including water tank and hydrant, foam and sand as part of company's Safety Policy.

As for evacuation plan, minimum requirements are:

- Has to be available for different cluster of buildings in the facility.
- Has to be prepared by professional operator and has to be approved by ANP
- Certified evacuation training for manager.
- Training for evacuation and emergency situation has to be provided for all employees
- Training also has to be provided for first aid and personal safety

In addition to the above, there is a need to establish alternative routes in the case of closure of the national road during emergency. The establishment of alternative route can be coordinated by MSS with relevant agencies involved in disaster risk management.

6.2 Management Plans for Other Impacts

Other impacts related to the development can be categorized into environmental, climate change and socio economic impacts (Table 6.7).

Table 6.7. Other Potential Impacts from Proposed Development

No	Less Significant Impacts	Source Activities	Phase in the Development		
			Site Prep.	**Construction**	**O&M**
	Environmental				
1	Water Quality	Waste water and solid waste from worker's activities, dust and other sediment generated during compaction and construction	v	v	v
2	Bottom Contamination		v	v	v
3	Coastal and Marine Ecology		v	v	v
4	Terrestrial Ecology	Clearance of existing terrestrial vegetation	v		
5	Air Pollution	Emission from vehicles coming in and out of the site, ship emission, flying dust	v	v	V
6	Noise and Vibration	From equipment operation	v	v	v
7	Visual Quality	From enactment of tanks and jetty.			v
	Climate Change				
1	Beach Erosion	From enactment of jetty		v	v
2	Loss of coral reef	From pollution and direct clearance			v
	Socio-Economic				
1	Livelihood of Fishermen	Enactment of jetty, limitation to access	v	v	v
2	Worker's Health and Safety	Exposure to fuel fumes, accidents			
3	Job creation and Tax Contribution	Operation activities	v	v	v

Proposed management and monitoring measures to mitigate impacts to the environment are provided as follows.

Table 6.8. Management Measures for Minor Impacts

Component	Phase	Potential Impacts	Source Activities	Mitigation Measures	Responsible Entity
Jetty Development	Pre-Construction	Water quality, bottom contamination and marine and coastal ecology	Compaction	- Limit compaction to areas that will be developed only (footprint of jetty structure with enough buffer area as allowance) - Compaction conducted during low tide to minimize dispersement to other locations	Project Proponent
			Solid and liquid waste from worker activities	- Provision of temporary sanitation facilities with waste disposed off at the Tibar waste water treatment plant - Provision of garbage bins and signs throughout to warn workers not to litter the marine environment - Worker awareness training of the sensitivity of coral reef community and its function in fishery production.	
		Occuptational health and safety	Worker activities	Use of worker's protection apparatus, including: 5. Bright vest for easy identification of workers 6. Ear and eyes protection 7. Helmet 8. Foot protection (safety boot) and wet suit as necessary First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response procedures	
	Construction of Jetty	Water quality, bottom contamination, marine and coastal ecology - negative	Compaction	- Limit compaction to areas that will be developed only (footprint of jetty structure with enough buffer area as allowance) - Compaction conducted during low tide to minimize dispersement to other locations	Project Proponent
			Worker activities	- Provision of temporary sanitation facilities with waste disposed off at the Tibar waste water treatment plant - Provision of garbage bins and signs throughout to warn workers not to litter the marine environment - Worker awareness training of the sensitivity of coral reef community and its function in fishery production.	
		Marine and coastal ecology – positive	New structure provides attachment place	- The enactment of submerged structures will automatically provide attachment place for soft corals and other marine biota. Proliferation of the biota will depend on several factors, including tide influence and level of sedimentation in the area	
		Coastal hydrology – changes in current pattern, waves and sediment movement	New structure acts as barrier to current, waves and sediment movement	- No specific measures have been proposed since the jetty structure has been designed to be supported with piles rather than a massive wall structure that tend to inhibit long shore drift movement (example: Pertamina's jetty in Pante Kelapa). - Piles support will not restrict much of the waves and current movement	
			High	- Geomorphology, soil type, climatic condition as well as land cover that make up the	

			sediment load going into the bay	watershed lead to naturally high sedimentation load going into the bay. Sediment flush happens especially during the rainy season where load from upper watershed are transported rapidly into the bay. This will likely lead to a frequent need to dredge the area for maintenance purposes. - Recommended measure for this is tree planting in accessible upper watershed areas. This tree planting can be coordinated with local NGOs with experience conducting this type of programs.	
		Structure inundation	Sea level rise	Several measures are proposed to manage impacts from sea level rise: - Protection from wave action: in the form of fortification of the structure that connects the terrestrial complex and the jetty. Fortification should be designed with sufficient allowance for sea level rise. - Protection from inundation of jetty structure. The jetty has been designed to be 2.60 m from Low Water Spring (LWS) therefore it should be sufficient to withstand potential sea level rise.	
		Occuptational health and safety	From worker activities	Use of worker's protection apparatus, including: Bright vest for easy identification of workers 3 Ear and eyes protection 4 Helmet 5 Foot protection (safety boot) and wet suit as necessary First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response procedures	
		Noise and vibration	From equipment operation	- Use of newer and lower noise equipment - Measures for protection of workers from noise and vibration is the same as the above	
	Operation of Jetty	Water quality problem, bottom contamination and marine/coastal ecology	Oil spill from tanker operation and oil spill from transfer of fuel from tanker to the storage	- See discussion on Management Measures for Major Impacts above.	Project proponent, ship operator
			Waste water and solid waste from worker's activities	- Provision of permanent sanitation facility with on site treatment to prevent highly polluted effluent going into the ground water or marine water. On site treatment typically consists of a septic tank with several "rooms" where waste water goes through and at the end, the effluent discharged will have less organic compound load. - Provision of permanent garbage bins on strategic locations throughout the facility. - Provision of signs that warn facility workers and visitors not to litter - Regular disposal of garbage to Tibar landfill. Burning of garbage should not be conducted on the site because it potentially release toxic chemicals into the air and	

				marine water.	
			Increased turbidity during jetty maintenance (fixing and part replacement in the water)	- Limit compaction as necessary to areas in need of fixing. - Compaction conducted during low tide to minimize dispersement to other locations	
		Structural inundation or erosion of structure	Sea level rise	Measures recommended for sea level rise have been discussed in the jetty construction section. During O&M, monitoring should be conducted to better anticipate impacts from sea level rise.	
		Noise and vibration	Ship traffic and operation	Use of proper isolation on the ship's machinery room.	
		Occupational health and safety	Worker's activities	Use of worker's protection apparatus, including: 5. Bright vest for easy identification of workers 6. Ear and eye protection 7. Helmet 8. Foot protection (safety boot) and wet suit as necessary First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response procedures	
		Limited access to the beach especially by fishermen	Development of jetty and storage facility	- Find new access point and boat parking space for the fishermen. - Provide assistance in the form of new fishing equipment for those affected - Provide financial assistance to those affected to help ease out the transition from one place to another	
	Pre-construction-Storage facility	Water quality	Increased turbidity as a result of spoil from site grading	- Dumping of excavation material unused for grading in the proper place (Tibar landfill). - Grading conducted during dry period to avoid runoff and spoil being transported to the nearby marine water	Project proponent
			Solid and liquid waste from worker's activities	- Provision of temporary sanitation facilities with waste disposed off at the Tibar waste water treatment plant - Provision of garbage bins and signs throughout to warn workers not to litter the marine environment - Worker awareness training of the sensitivity of coral reef community and its function in fishery production.	

		Bottom contamination	Same as above	Same as above	
		Marine and coastal ecology	Same as above	Same as above	
		Air quality problem	Site grading leads to an increase in level of Particular Matter (PM) in the air	- Spraying broken soil every few hours - Workers and visitors wearing mask to protect from dust - Temporarily pave access road	
		Loss of terrestrial vegetation	Site clearance	- Replanting program in the upper watershed to make up for loss of several trees on the location - Landscaping using grass in the facility	
		Noise and vibration impacts	Equipment operation	- Use of newer equipment to reduce noise - Use of ear muffle or other protection	
		Occupational health and safety	Worker's activities	Use of worker's protection apparatus, including: 5. Bright vest for easy identification of workers 6. Ear and eye protection 7. Helmet 8. Foot protection (safety boot) and wet suit as necessary First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response procedures	
	Construction-Storage facility	Water quality	Increased turbidity as a result of spoil from site grading	- Dumping of excavation material unused for grading in the proper place (Tibar landfill). - Grading conducted during dry period to avoid runoff and spoil being transported to the nearby marine water	Project Proponent
			Solid and waste water from worker's activities	- Provision of temporary sanitation facilities with waste disposed off at the Tibar waste water treatment plant - Provision of garbage bins and signs throughout to warn workers not to litter the marine environment - Worker awareness training of the sensitivity of coral reef community and its function in fishery production.	
		Bottom contamination	Same as above	Same as above	
		Marine and coastal ecology	Same as above	Same as above	

		Structure inundation	Sea level rise	- Ground elevation: As previously discussed under the Climate Section and Management Measure Section, it is recommended to elevate the site by 50 cm (based on the predicted rise of sea level in Timor Leste). This recommendation is also consistent with recommendation from the geotechnical study of the project site. - Protection from wave action: in the form of fortification of the structure that connects the terrestrial complex and the jetty. Fortification should be designed with sufficient allowance for sea level rise.	
		Air quality problem	Construction activities lead to an increase in traffic that leads to the increase of polluting emission as well as an increase of level of PM in the air	- Spraying of construction area every few hours - Workers and visitors wearing mask to protect from dust - Temporarily pave access road	
		Soil and groundwater quality	Spill of oil, cement and other chemicals being used	- Provision of temporary storage with lining on the ground to prevent leaching of oil, cement and other chemicals into the soil - Careful use of application of oil, chemicals and cement to prevent spill into the ground - Swift cleaning action when there is spill - Dumping of used oil and other chemicals to the facility in Tibar.	
		Noise and vibration	Equipment operation	- Use of newer equipment to reduce noise - Use of ear muffle or other protection	
		Traffic disruption	Increased vehicle traffic for supply of construction matterial	- Assign a person to watch and direct the traffic every time a fleet of vehicle are in and out of the project area - Transport vehicle or other construction-related vehicle operate at night when possible - Put clear sign for detour or traffic direction within and outside of project location	
		Occupational health and safety	Worker's activities	Use of worker's protection apparatus, including: 5. Bright vest for easy identification of workers 6. Ear and eye protection 7. Helmet 8. Foot protection (safety boot) and wet suit as necessary	

				First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response procedures	
	Operation-Storage facility	Water quality	Oil spill from transfer of oil into the storage and oil spill from transfer of oil from storage into tanker trucks for distribution to customer	Management measures for slight to minor impacts: - See discussion in Section 7.1 above Management measures for major to extensive impacts: - See discussion in Section 7.1 above	Project Proponent
			Waste water and solid waste from worker's activities	- Provision of permanent sanitation facility with on site treatment to prevent highly polluted effluent going into the ground water or marine water. - Provision of permanent garbage bins on strategic locations throughout the facility. - Provision of signs that warn facility workers and visitors not to litter. - Regular disposal of garbage to Tibar landfill. Burning of garbage should not be conducted on the site because it potentially release toxic chemicals into the air and marine water.	
		Bottom contamination	Same as above	Same as above	
		Marine and coastal ecology	Same as above	Same as above	
		Soil and groundwater quality	Spill of oil, cement and other chemicals being used	- Provision of permanent storage with lining on the ground to prevent leaching of oil, cement and other chemicals into the soil - Careful application of oil and other chemicals to prevent spill into the ground - Swift cleaning action when there is spill - Dumping of used oil and other chemicals to the facility in Tibar.	
		Air quality	Tanker trucks delivering fuel out of the facility lead to an increase in traffic that leads to the increase of polluting emission gasses	- Use of newer or well maintained vehicle fleet to curb emission gases	
		Noise and vibration	Equipment operation	- Use of newer equipment to reduce noise - Use of ear muffle or other protection	

		Occupational health and safety	Workers activities	Use of worker's protection apparatus, including: 5. Bright vest for easy identification of workers 6. Ear and eye protection 7. Helmet 8. Foot protection (safety boot) and wet suit as necessary First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response procedures	
		Structure inundation or structure erosion	Sea level rise	- Protection from wave action: in the form of fortification of the structure that face the coastal areay. Fortification should be designed with sufficient allowance for sea level rise.	
		Visual quality	Building on an otherwise unbuilt location	- Landscaping with grass in spaces between the facility and the fence	

CHAPTER VII: GOVERNING PARAMETERS

The proposed governing parameters are used to quantify measurable environmental quality such that changes in environmental conditions can be compared to the baseline and ambient quality threshold. The following standards could be used as threshold value for environmental evaluation.

(1) Emission

In discussing emission standards, it should be noted that there are no national standards for emission currently in effect in Timor Leste. Therefore, international emission standards from other countries have to be adopted. Several types of emission standards are recommended for the facility as listed in the following table.

Table 7.1. Emission Standards Recommended

No	Element	Source	Recommended Standards
1	Air	Vehicular emission	Indonesian Government's Regulation No. 35/MENLH/10/1993 on Upper Limit for Vehicle Emission
2	Water	Drainage water loading from the facility as a whole	Indonesian Environmental Ministerial Diploma No. 42/MENLH/10/1996 on Wastewater Standards for Oil, Gas, and Geothermal Activities
3	Noise	Pre-construction, construction and operation	Indonesian Environmental Ministerial Diploma No. 48/MENLH/11/1996 on Noise Level Standards
4	Vibration	Pre-construction, construction and operation	Indoensian Environmental Ministerial Diploma No. 49/MENLH/11/1996 on Vibration Level Standards

(2) Ambient Environmental quality

Ambient environmentalquality consists of standards relevant to maintain good quality of air, water and soil. In relation to ambient air quality, project owner and regulatory agencies should measure the ambient air quality at least once a year and compare the results to the baseline survey in absence of the project. Recommended standards for ambient air quality are the Indonesian Government Regulation No. 41/1999. Water body found in the area is coastal water body and the recommended standards for the water quality is Indonesian Ministry of Environment Ministerial Decision (KepMen LH) Kep.51/MENLH/2004.

(3) Occupational Health and Safety Standard

Recommended Occupational Health and Safety Standards for every project activity during the construction and during the operation should be followed. This includes:

- General construction health and safety standard
- Safey and health standard of of vessel construction

- Occupational health and safety standard in marine environment
- Occupational health and safety standard related to operation of oil piping system
- Occupational health and safety standard related to operation fuel storage
- Occupational health and safety standard related operation machine
- Occupational health and safety standard related to operation fuel transportation

CHAPTER VIII: MONITORING PROGRAMS

Monitoring program is very important to ensure that the mitigation measures are implemented effectively by project proponent. The objectives of the monitoring programs are:

- To measure the impacts that occur during pre-construction, construction, operation and maintenance
- To ensure compliance with legal requirements and corporate commitments
- To determine effectiveness of mitigation measures and other environmental and social protection measures
- To determine accuracy of impact predictions
- To facilitate impact management by warning of previously unanticipated impact

The content and frequency of monitoring reports will be agreed by the NDPCEI and Global Petroleum a quarterly monitoring report on EMMP implementation will be prepared and submitted to NDPCEI by project proponent.

Recommended monitoring program for the facility are spelled out in the following table.

Table 8.1.Monitoring for the Mitigation Measures

Component	Phase	Potential Impacts	Mitigation Measures	Monitoring Measures
Jetty Development	Pre-Construction	Water quality, bottom contamination and marine and coastal ecology	- Limit compaction to areas that will be developed only (footprint of jetty structure with enough buffer area as allowance) - Compaction conducted during low tide to minimize dispersement to other locations	- Monitor for turbidity that last for more than 12 hours.
			- Provision of temporary sanitation facilities with waste disposed off at the Tibar waste water treatment plant - Provision of garbage bins and signs throughout to warn workers not to litter the marine environment - Worker awareness training of the sensitivity of coral reef community and its function in fishery production.	- Monitoring for leak of waste water effluent into the environment - Monitoring for solid waste floating in the marine environment or stranded on the beach - Monitoring for behaviour among workers, for example not using proper sanitation facilities.
		Occuptational health and safety	Use of worker's protection apparatus, including: 1. Bright vest for easy identification of workers 2. Ear and eyes protection 3. Helmet 4. Foot protection (safety boot) and wet suit as necessary First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response procedures	- Use of protection apparatus should be monitored by pre-construction operator and SEPFOPE - First aid kid should be monitored for sufficient and usability of stock - Worker's training should be monitored by ANP and SEPFOPE
	Construction of Jetty	Water quality, bottom contamination, marine and coastal ecology - negative	- Limit compaction to areas that will be developed only (footprint of jetty structure with enough buffer area as allowance) - Compaction conducted during low tide to minimize dispersement to other locations	- Monitor for turbidity that last for more than 12 hours.
			- Provision of temporary sanitation facilities with waste disposed off at the Tibar waste water treatment plant - Provision of garbage bins and signs throughout to warn workers not to litter the marine environment - Worker awareness training of the sensitivity of coral reef community and its function in fishery production.	- Monitoring for leak of waste water effluent into the environment - Monitoring for solid waste floating in the marine environment or stranded on the beach - Monitoring for behaviour among workers, for example not using proper sanitation facilities.

	Marine and coastal ecology – positive	- The enactment of submerged structures will automatically provide attachment place for soft corals and other marine biota. Proliferation of the biota will depend on several factors, including tide influence and level of sedimentation in the area	- No specific monitoring measures have been proposed for this, however, special care should be given during fixing or part replacement of the jetty structure as not to displace existing bottom biota that have proliferated on the surface of structure
	Coastal hydrology – changes in current pattern, waves and sediment movement	- No specific measures have been proposed since the jetty structure has been designed to be supported with piles rather than a massive wall structure that tend to inhibit long shore drift movement (example: Pertamina's jetty in Pante Kelapa). - Piles support will not restrict much of the waves and current movement	It is actually hard to predict the ultimate impact of alteration to existing coastal hydrology pattern. As such, monitoring should look for evidence of negative impacts of alteration to current, wave and sediment movement. Negative impacts including higher level of sedimentation around the piles and beach erosion on nearby location that threaten the integrity of structure.
		- Geomorphology, soil type, climatic condition as well as land cover that make up the watershed lead to naturally high sedimentation load going into the bay. Sediment flush happens especially during the rainy season where load from upper watershed are transported rapidly into the bay. This will likely lead to a frequent need to dredge the area for maintenance purposes. - Recommended measure for this is tree planting in accessible upper watershed areas. This tree planting can be coordinated with local NGOs with experience conducting this type of programs.	- Monitoring for higher than usual sediment loading that leads to more frequent compaction needs.
	Structure inundation	Several measures are proposed to manage impacts from sea level rise: - Protection from wave action: in the form of fortification of the structure that connects the terrestrial complex and the jetty. Fortification should be designed with sufficient allowance for sea level rise. - Protection from inundation of jetty structure. The jetty has been designed to be 2.60 m from Low Water Spring (LWS) therefore it should be sufficient to withstand potential sea level rise.	- Monitoring for sea level movement especially in reference to jetty structure.
	Occuptational health and safety	Use of worker's protection apparatus, including: Bright vest for easy identification of workers 1. Ear and eyes protection 2. Helmet 3. Foot protection (safety boot) and wet suit as	- Use of protection apparatus should be monitored by pre-construction operator and SEPFOPE - First aid kid should be monitored for sufficient and usability of stock - Worker's training should be monitored by ANP and

		necessary First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response procedures	SEPFOPE
	Noise and vibration	- Use of newer and lower noise equipment - Measures for protection of workers from noise and vibration is the same as the above	- Monitoring for complaints from workers and local community.
Operation of Jetty	Water quality problem, bottom contamination and marine/coastal ecology	- Use of booms around the connection between tanker ship and jetty - Use of dispersant to minor spill. - For major spill from tanker ship, procedure for response is discussed in the following Section.	- Monitoring for evidence of spill in the marine water (oil film or slick) - Monitor for evidence of spill in the sandy beach - Water testing should be conducted on a regular basis (at least once a year) to understand in more detail level of certain hydrocarbon chemicals as well as toxic heavy metals in the water. Parameters tested should at least be the same as parameters that have been tested for the baseline data collection as reported in Chapter IV, Description of the Environment.
		- Provision of permanent sanitation facility with on site treatment to prevent highly polluted effluent going into the ground water or marine water. On site treatment typically consists of a septic tank with several "rooms" where waste water goes through and at the end, the effluent discharged will have less organic compound load. - Provision of permanent garbage bins on strategic locations throughout the facility. - Provision of signs that warn facility workers and visitors not to litter - Regular disposal of garbage to Tibar landfill. Burning of garbage should not be conducted on the site because it potentially release toxic chemicals into the air and marine water.	- Monitoring for signs of eutrophication. - Regular water testing as recommended above. - Monitoring for signs of litter in the marine environment, sandy beach.
		- Limit compaction as necessary to areas in need of fixing. - Compaction conducted during low tide to minimize dispersement to other locations	- Monitor for turbidity that last for more than 12 hours.

		Structural inundation or erosion of structure	Measures recommended for sea level rise have been discussed in the jetty construction section. During O&M, monitoring should be conducted to better anticipate impacts from sea level rise.	Monitoring for sea level movement especially in reference to jetty structure.
		Noise and vibration	Use of proper isolation on the ship's machinery room.	Monitoring for complaint from local community.
		Occupational health and safety	Use of worker's protection apparatus, including: 1. Bright vest for easy identification of workers 2. Ear and eye protection 3. Helmet 4. Foot protection (safety boot) and wet suit as necessary First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response procedures	- Monitoring for workers day to day activity to identify potential ways accidents can happen and anticipate before hand. - Monitoring for accidents that occur and adjust protection gears and work procedures as needed.
		Limited access to the beach especially by fishermen	- Find new access point and boat parking space for the fishermen. - Provide assistance in the form of new fishing equipment for those affected - Provide financial assistance to those affected to help ease out the transition from one place to another	- Monitoring for implementation of the management measure. Monitoring should be conducted with active collaboration from local authority (chefi de aldeia and chefi de suco). - Monitoring for resulting effect from moving the fishermen to a new place. How their level of income are affected and whether there are conflict at the new place. - Monitoring should be done for at least one year until the fishermen established their new parking space.
	Pre-construction-Storage facility	Water quality	- Dumping of excavation material unused for grading in the proper place (Tibar landfill). - Grading conducted during dry period to avoid runoff and spoil being transported to the nearby marine water	Monitor for turbidity that last more than 12 hours in the nearby area.
			- Provision of temporary sanitation facilities with waste disposed off at the Tibar waste water treatment plant - Provision of garbage bins and signs throughout to warn workers not to litter the marine environment - Worker awareness training of the sensitivity of coral reef community and its function in fishery production.	- Monitoring for leak of waste water effluent into the environment - Monitoring for solid waste floating in the marine environment or stranded on the beach - Monitoring for behaviour among workers, for example not using proper sanitation facilities.
		Bottom contamination	Same as above	Same as above
		Marine and coastal ecology	Same as above	Same as above

	Air quality problem	- Spraying broken soil every few hours - Workers and visitors wearing mask to protect from dust - Temporarily pave access road	Monitoring for dust and complaint from the neighbor or users of national road.
	Loss of terrestrial vegetation	- Replanting program in the upper watershed to make up for loss of several trees on the location - Landscaping using grass in the facility	Monitoring for at least one year until trees all grow. Every year, as part of Company Social Responsibility, continuous tree planting can be done.
	Noise and vibration impacts	- Use of newer equipment to reduce noise - Use of ear muffle or other protection	- Monitoring for complaint from worker
	Occupational health and safety	Use of worker's protection apparatus, including: 1. Bright vest for easy identification of workers 2. Ear and eye protection 3. Helmet 4. Foot protection (safety boot) and wet suit as necessary First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response procedures	- Monitoring for workers day to day activity to identify potential ways accidents can happen and anticipate before hand. - Monitoring for accidents that occur and adjust protection gears and work procedures as needed.
Construction-Storage facility	Water quality	- Dumping of excavation material unused for grading in the proper place (Tibar landfill). - Grading conducted during dry period to avoid runoff and spoil being transported to the nearby marine water	Monitor for turbidity that last more than 12 hours in the nearby area.
		- Provision of temporary sanitation facilities with waste disposed off at Tibar waste water treatment plant - Provision of garbage bins and signs throughout to warn workers not to litter the marine environment - Worker awareness training of the sensitivity of coral reef community and its function in fishery production.	- Monitoring for leak of waste water effluent into the environment - Monitoring for solid waste floating in the marine environment or stranded on the beach - Monitoring for behaviour among workers, for example not using proper sanitation facilities.
	Bottom contamination	Same as above	Same as above
	Marine and coastal ecology	Same as above	Same as above
	Structure inundation	- Ground elevation: As previously discussed under the Climate Section and Management Measure Section, it is recommended to elevate the site by 50 cm (based on the predicted rise of sea level in Timor Leste). This recommendation is also consistent with recommendation from the	- Monitoring for movement of sea surface and its encroachment to the facility. - Monitoring of the health of coral ecosystem by engaging expert that collect the data on coverage every year and survey to see sign of distress

	geotechnical study of the project site. - Protection from wave action: in the form of fortification of the structure that connects the terrestrial complex and the jetty. Fortification should be designed with sufficient allowance for sea level rise.	
Air quality problem	- Spraying of construction area every few hours - Workers and visitors wearing mask to protect from dust - Temporarily pave access road	Monitoring for dust and complaint from the neighbor or users of national road.
Soil and groundwater quality	- Provision of temporary storage with lining on the ground to prevent leaching of oil, cement and other chemicals into the soil - Careful use of application of oil, chemicals and cement to prevent spill into the ground - Swift cleaning action when there is spill - Dumping of used oil and other chemicals to the facility in Tibar.	- Monitoring for evidence of spill of lubricant oil, cement and chemicals on the ground - Monitoring for proper dumping of used oil, cement and other chemicals.
Noise and vibration	- Use of newer equipment to reduce noise - Use of ear muffle or other protection	- Monitoring for complaint from worker
Traffic disruption	- Assign a person to watch and direct the traffic every time a fleet of vehicle are in and out of the project area - Transport vehicle or other construction-related vehicle operate at night when possible - Put clear sign for detour or traffic direction within and outside of project location	- Monitoring for large increase of traffic due to construction material transport. - Monitoring for problems due to higher amount of traffic.
Occupational health and safety	Use of worker's protection apparatus, including: 1. Bright vest for easy identification of workers 2. Ear and eye protection 3. Helmet 4. Foot protection (safety boot) and wet suit as necessary First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response procedures	- Monitoring for workers day to day activity to identify potential ways accidents can happen and anticipate before hand. - Monitoring for accidents that occur and adjust protection gears and work procedures as needed.

Operation-Storage facility	Water quality	Management measures for slight to minor impacts: - The use of oil separator (constructed as part of the development). - The use of higher grade oil skimming machine when deemed necessary Management measures for major to extensive impacts: - Routine drill on response plans. There are in general two types of response plans – for spill that makes its way to the water and for spill stranded into the sand or nearby salt marsh.	For slight to minor impacts: - Monitor for evidence of oil in the environment Monitoring should be conducted on a daily basis. Clean swiftly when there is evidence of spill in the environment. - Monitor for effectiveness of oil separator basin. When not found to be effective, use higher grade skimming machine. - Periodically (at least once a year) conduct testing of effluent from the separator basin to see whether effluent is within allowable standards for effluent from downstream oil facility. Use applicable standards recommended in this EMP or use other standards as recommended by NDPCEI For major impacts: - Monitoring should focus on ensuring the integrity of the primary, secondary and tertiary containment methods.
		- Provision of permanent sanitation facility with on site treatment to prevent highly polluted effluent going into the ground water or marine water. - Provision of permanent garbage bins on strategic locations throughout the facility. - Provision of signs that warn facility workers and visitors not to litter. - Regular disposal of garbage to Tibar landfill. Burning of garbage should not be conducted on the site because it potentially release toxic chemicals into the air and marine water.	- Monitoring for signs of eutrophication - Regular water testing as recommended above. - Monitoring for signs of litter in the marine environment, sandy beach
	Bottom contamination	Same as above	Same as above
	Marine and coastal ecology	Same as above	Same as above
	Soil and groundwater quality	- Provision of permanent storage with lining on the ground to prevent leaching of oil, cement and other chemicals into the soil - Careful application of oil and other chemicals to prevent spill into the ground - Swift cleaning action when there is spill - Dumping of used oil and other chemicals to the facility in Tibar.	- Monitoring for evidence of spill of lubricant oil, cement and chemicals on the ground - Monitoring for proper dumping of used oil, cement and other chemicals.
	Air quality	- Use of newer or well maintained vehicle fleet to curb emission gases	Monitoring for elevated level of air pollution gasses including NO_2, SO_2, CO and CO_2. Air pollution in the area.

	Noise and vibration	- Use of newer equipment to reduce noise - Use of ear muffle or other protection	Monitoring for complaint from worker
	Occupational health and safety	Use of worker's protection apparatus, including: 1. Bright vest for easy identification of workers 2. Ear and eye protection 3. Helmet 4. Foot protection (safety boot) and wet suit as necessary First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response procedures	- Monitoring for workers day to day activity to identify potential ways accidents can happen and anticipate before hand. - Monitoring for accidents that occur and adjust protection gears and work procedures as needed.
	Structure inundation or structure erosion	- Protection from wave action: in the form of fortification of the structure that face the coastal areay. Fortification should be designed with sufficient allowance for sea level rise. -	- Monitoring for movement of sea surface and its encroachment to the facility.
	Visual quality	- Landscaping with grass in spaces between the facility and the fence	- Monitoring for complaints from passersby

Table 8.2.Recommended Monitoring Parameters for Air Quality, Marine Water Quality, Marine Ecological Quality and Social Impacts.

No	Parameters	Methodology	Sampling Location	Frequency	Responsibilities
Air Quality					
1	SO_2	In situ measurement	Within the perimeter of storage complex	Once a year	Project proponent in coordination with NDPCEI
2	NO_x				
3	PM_{10}				
4	$PM_{2.5}$				
Marine Water Quality - Physical Parameters					
1	Turbidity	In situ measurement	Coastal water by project site, exact sampling point to be determined by laboratory technician.	Once a year	Project proponent in coordination with Fishery and NDPCEI
2	Smell				
3	Suspended solid				
4	Solid waste				
5	Temperature				
6	Oil layer				
Marine Water Quality – Chemical Parameters					
1	pH	Laboratory tests	Coastal water by project site, exact sampling point to be determined by laboratory technician.	Once a year	Project proponent in coordination with Fishery and NDPCEI
2	Salinity				
3	Total ammonia				
4	Sulfide				
5	Total hydrocarbon				
6	Total fenol				
7	PCB				
8	Surfactant				
9	Oil and fat				
10	TBT				
Marine Water Quality – Soluble Heavy Metal					
1	Mercury	Laboratory tests	Coastal water by project site, exact sampling point to be determined by laboratory technician.	Once a year	Project proponent in coordination with Fishery and NDPCEI
2	Copper				
3	Cadmium				
4	Zinc				
5	Lead				
Marine Water Quality - Bacteriology					
1	Total coliform	Laboratory tests	Coastal water by project site, exact sampling point to be determined by laboratory technician.	Once a year	Project proponent in coordination with Fishery and NDPCEI
Marine Ecological Quality					
1	Shanon-Wienner Diversity Index and Simpson Index	Laboratory tests	Coastal water by project site, exact sampling point to be determined by laboratory technician.	Once a year	Project proponent in coordination with Fishery and NDPCEI
Social Impact					
1	Worker's Health and Safety	Record of health complaint, record of work-related accidents	Workers	Monthly	Project proponent in coordination with SEPFOPE
2	Social contribution	Record of contribution to local community, contribution to fishermen group	Local community, local fishermen group	Once a year	Project proponent in coordination with local authority and Ministry of Social Solidarity (MSS)
3	Social Order	Complaint from	Local community	Monthly review	Project proponent in

local community	coordination with local authority

In addition to the above monitoring program, a routine internal inspection and testing should be conducted to ensure the integrity of the primary, secondary and tertiary containment measures. This internal inspection should be conducted on a routine basis as noted in the following table. The responsibility for the inspection and testing rested at the hand of the project proponent (operator) in coordination with ANP.

Table 8.3. Monitoring Program for Primary, Secondary and Tertiary Containment Measures

No	Type	Management Measures	Maintenance/Monitoring Measures
1	Tank Overfill Protection	Tank level measurement	Regular (monthly) maintenance
		High Level Alarm (HLA) capable of annunciation and automatic shut down	Regular (monthly) testing
		High High Level Alarm (HHLA) capable of annunciation and automatic shut down	Regular (monthly) testing
2	Tank Maintenance and Inspection	Visual observation of leaks, crack, etc along the wall	Should be conducted at least of a weekly basis. Best if conducted on a daily basis.
		Undertank leak inspection	Should be conducted on a regular basis at least once a week. Best using visual and
3	Pipework and fuel transfer safety	Fire safe shut-off inlet/outlet valves that can be remotely shut off	Testing should be conducted on a weekly basis.
		Clear procedure for transfer control (written procedure)	Training at the beginning of operation and regularly at least once a year. Loading are always supervised.
4	Spill Accounting, Oil & Water Separator	Storage inventory reconciliation meaning input minus output of fuel equals what is left in the storage tanks. If fuel in the storage is less than input minus output, check for spill.	Conducted at least weekly and best if conducted on a daily basis.
		Oil/water separation dike to separate spill from tanks and off-tanks (from valves, joint, etc along the pipeworks). See Technical Drawing in Annex _2.1	Monitor the dike on a daily basis, skim oil leaks
5	Emergency Plan and Equipment	Fire Emergency Response Plan (to be prepared by Operator).	Regular (annual) training and drill
		Spill Response Plan	Regular (annual) training and drill
		Emergency equipment ready for	Regular (monthly) testing of

		rapid deployment for both spill and fire or spill only emergencies.	equipment

To ensure proper protection from fire accident, project proponent or in this case the project operator should also test and inspect the fire protection measures in place at the facility.The procedure for inspection and testing for fire protection should be coordinated with Civil Protection.

CHAPTER IX: REPORTING REQUIREMENT

All the monitoring activities should be coordinated with relevant government agency to ensure that the parameters being collected meet regulatory requirement in place for that particular set of parameters. After data have been collected, they should be submitted to relevant authority as previously noted in the above tables.

At a minimum, the reporting should cover:

- Internal monitoring and inspection
- Incident, accident and emergency reporting
- Performance indicators and any follow up actions needed
- Training programs

The types of report, including formatting and reporting frequency should be coordinated with relevant authority. Per NDPCEI's rules, however, the environmental license of the project is only valid for one year and should be renewed every year by reporting on an updated EMP. Therefore, at a minimum, a once a year reporting should be required.

CHAPTER X: RESPONSIBILITIES FOR MITIGATION AND MONITORING

As previously noted in Section 3.2 Relevant Institutional Aspects, the followingagencies within the government (Table 10.1) is responsible for environmental, social and economic safeguarding from impacts generated by the project.

Table 10.1. Relevant Institutions and Their Responsibilities

No	Responsibility	Relevant Institutes
1	Environment and Nature Protection (Terrestrial)	State Secretary of the Environment
		State Secretary of Forestry and Natural Protection
2	Marine and Coastal Environment	State Secretary for Fisheries and Aquaculture
3	Downstream Petroleum Industry	National Petroleum Authority (ANP)
4	Public and Worker's Health and Safety	Ministry of Health
		National Directorate for Civil Protection
		State Secretary for Labor Protection and Training (SEPFOPE)

Coordination between project proponent and these institutions should happen right from the preparation of the project, site preparation, construction and operation and maintenance phase.

1. Project Preparation

During project preparation, design for the facility is being drawn. Project proponent should coordinate with several institutions for several purposes related to their competency. The institutions and coordination purpose are:

- ANP: to adjust facility lay out and design to requirements for large fuel storage depot. After environmental license has been secured, the process for securing approval from ANP can commence.
- NDPCEI: for classification of environmental licensing requirements, preparation of environmental licensing.
- Civil Protection (Fire Fighter): to adjust fire protection lay out and design to requirements set out by Civil Protection.

2. Site Preparation
   - NDPCEI: to report mitigation and monitoring measures in place for mitigation of environmental impacts during Site Preparation. To report on the results of mitigation and monitoring measures. Coordinate for inspection.

3. Construction
   - NDPCEI: to report mitigation and monitoring measures in place for mitigation of environmental impacts during Construction. To report on the results of mitigation and monitoring measures. Coordinate for inspection during construction.
   - ANP: to report on the construction of requirements relevant to protection and safeguarding of the facility, the operation and workers in the facility. Report on the training arrangement for future staff of the facility because ANP regulation require that training be provided to all workers 6 months prior to the start of operation.
   - Civil Protection: to report on the construction of fire protection aparatus as required by previous consultation.

4. Operation and Maintenance
   - NDPCEI: to report mitigation and monitoring measures in place for mitigation of environmental impacts during Operation and Maintenance. To coordinate on evaluating the effectiveness of previous mitigation measures implemented during Site Preparation and Construction phases. Effective mitigation measures should be continued while those that are not effective should be adjusted. To coordinate for inspection during Operation and Maintenance.
   - ANP: further coordinate on several operational aspects of the facility, including training and skill transfer between foreign operators and local staff, emergency preparedness plans, evacuation plans, and other.
   - Civil Protection: in coordination with ANP, conduct initial testing of fire fighting equipment, implement fire drill and coordinate on evaluation of emergency preparedness and evacuation plans.
   - SEPFOPE: coordinate on workers' health and safety issue including the need to wear workplace protection and the kind of workplace protection needs to be provided for this type of work. Also coordinate on contract preparation and other labor-related issues.
   - MSS, ANP, Civil Protection, SEPFOPE: as a large industrial complex storing higly volatile compound, there is a risk of significant industrial accident to occur in the complex. Therefore, an large scale emergency preparedness plan should be prepared.

CHAPTER XI: EMERGENCY PLANS

In general, two types of emergency preparedness plans should be prepared for the facility – (i) emergency plans related to fire accident, (ii) emergency plans related to oil spill accident. In addition, for each type of accident, at least two types of emergency plans should be in place, the first one is for small to medium types of emergency and the second one is related to large and extensive types of accidents affecting nearby resources and facilities. Figure 11.1 provides an illustration of agencies responsible for the emergency plans.

Figure 11.1. Agencies Responsible for the Emergency Plans

	Small to Medium Scale	Large to Extensive Scale
Fire Accidents	Project Proponent (Operator) and evaluated by Civil Protection and ANP	A joint effort by ANP, Civil Protection, MSS, NDE, Fishery
Oil Spill Accidents	Project Proponent (Operator) and evaluated by ANP, Fishery and NDE	A joint effort by Project Proponent, ANP, Civil Protection, MSS, NDE, Fishery

The small to medium scale emergency preparedness plan will be provided by operator of the facility and evaluated by ANP and Civil Protection in the case of fire accident while for oil spill accident, the emergency preparedness plan should be prepared by project proponent and evaluated by ANP, Fishery and NDPCEI because oil spill can happen on the water and most likely affecting coral reef beds and other coastal resources nearby.

The large to extensive emergency preparedness plan should be prepared through a joint effort by relevant agencies including ANP, Civil Protection, MSS, NDPCEI and Fishery in the case of fire accident and ANP, MSS, NDPCEI and Fishery in the case of oil spill accidents. The involvement of MSS in both large scale emergency preparedness is based on the current arrangement for natural disaster response and management. It was not very clear, however, whether this arrangement is also relevant for industrial disaster response and management. It should be noted though that MSS has gotten support from United Nations Development Programme (UNDP) for natural disaster management including having the ability to map out evacuation routes and providing basic necessities for affected people.

As for downstream oil and gas industry, ANP remains to be the agency with the capacity to inspect and make sure that proper protection from large oil and gas industrial accidents are in place. The Civil Protection agency, on the other hand, has firefighting equipment but may lack the training and capacity to fight large scale fire.

CHAPTER XII: DECOMMISSIONING PLANS

No decommissioning plan has been specifically developed for the facility, as the project is being planned for long term use and further expansion in the form of more storage is being planned in the future. Therefore, decommissioning is only possible in the face of a force majeure for example, a natural disaster event take place leading to a significant damage to the facility. A large and extensive accident may also change the perception on the viability of a large facility like that in the location. Should this happened,a decommissioning plan should be developed by the operator/project proponent taking into consideration the demolition of the jetty as well. Such demolition plan should also incorporate measures to bring back the condition of the area to the original state.

CHAPTER XIII: CAPACITY DEVELOPMENT AND TRAINING

Capacity development and training is required for staff in the facility consisting of:

- For facility manager: training courses from accredited training providers, covering storage facility management course and Health, Safety and Environment (HSE) and quality standards.
- For staff: at a minimum, all staff in the facility should be provided with certified training on first aid and safety.

The responsibility for EMP implementation as well as monitoring of the environmental parameters rests with project operator or in this case management of the facility. It is therefore very critical for the manager to have proper training on HSE and to understand the EMP well.

In addition to the above, as part of skill transfer, several mid-level employees should be prepared to eventually take over management from foreign operator. These mid-level employees or management trainee should be provided all trainings required for facility manager.

CHAPTER XIV: PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

To ensure transparent EIS development process as well as on-going consultation with relevant stakeholders and affected community, this EIS formulation process will take several necessary steps as follows:

1. Conduct of stakeholder workshop
2. Interview with affected community, in this matter, local community in Aldeia Caitehu, SucoMotaulun. Key social issues related to gender and more equitable sharing of resources has been approached using secondary data available and no specific interview has been conducted for these groups of people as preliminary assessment noted that women and elderly or widow groups are not directly affected by the development.

15.1 Stakeholder Workshop

The first stakeholder workshop with the purpose of discussing draft Terms of Reference has been conducted. The workshop generated meaningful input and suggestions from stakeholders. These input and suggestion has been incorporated in the development of the EIS. Important notes from the stakeholder workshop are presented below.

1. MrPaulino from National Directorate of Land, Property and Cadastral Services

Question:

Would like to know the status of the land being proposed because according to regulation, there should not be any development 50m from the beach.

Response:

Before the environmental impact assessment process is being conducted, a package of Project Documents has been submitted to NDPCEI. This package include recommendation letter from DNTPSC on the status of the land stating that they knew about the plan to construct the storage facility and have no objection to the plan. Prior to the environmental assessment process too, Global Petroleum has peacefully resettle about seven households from the project site. The resettlement process is being conducted in coordination with Public Work where they conducted measurement of affected houses and recommend the amount of compensation. This process is being supervised by local authority.

Regarding the regulation of no development within 50m of the coastline, we will forward this information to the facility owner so project design can be readjusted.

2. Sr. Antonio LeloTaci, Director of NDPCEI

Comment: Confirmed that PEC has sent initial project document package to NDPCEI and that the recommendation letter from DNTPSC has been included. This project has been categorized as category A project because it is storing more than 30,000L of fuel. Category A project means that there is a potential for significant impacts that is why it we have to go through this scoping and stakeholder consultation activities.

3. Sr. Carlos da Conceição, NDPCEI

Question:

Potentially impacted component still very general. Need to make this more detailed.

What type of materials will be used for the storage tanks?

Why there is a plan to store LPG and other fuels in one place? This can compound the risk of explosion.

How about maintenance of facility ship? Where will it take place, because maintenance of facility ship such as repainting could generate toxic materials going into the environment.

Response:

Thanks for the input. Because right now we are in scoping stage, the potentially impacted area has not been presented in detail. However, we will make sure that more information will be included in the full EIS later. We have conducted several field data collection including coastal ecology, testing of marine water quality, socio-economic and bathymetry survey. All these information will be used in the analysis of potentially impacted area.

Information on the type of materials to be used for the storage tanks will be provided with the EIS.

Yes there is high risk of storing LPG with other types of fuel. Will check in more detail what facility owner's plan related to this.Checked this with facility owner and they noted that the plan to include storage for LPG has been dropped due to risk related to handling.

As far as we know there is no plan to do maintenance of ship at the jetty. The tanker ship will come from outside of the country and maintenance will be conducted outside of the country. Maintenance activity is relevant to the jetty structure and the storage facility and what to do so these activities will not impact the environment will be included in the EIS.

4. ANP, Sr. Cornelio Russini

Comment: For operational license of fuel storage, ANP is the agency with responsibility to issue. So far three project owners with interest to construct large fuel storage facility have reported to ANP. Activities during the operational phase of the project should be reported to ANP, such as the type of materials to be handled, whether or not there will be mixing, etc. There is a draft regulation for fuel storage facilities but right now still in draft stage.

5. Sr. Adalfredo, Santalum NGO

Suggestion:

Distance from project location to mangrove forest that is about 1.5 km should have buffer in the form of trees or others to anticipate dispersion of slick/oil film should there be oil spill.

Also need measures to prevent ground water pollution and pollution of surface water so children and animals will not be impacted.

6. Sr. Claudio Silva, Civil Protection/Bombeiros

Comment: Prior to construction, should coordinate with Civil Protection to make sure that fire hydrant system (size of connection and others) is compatible with fire-fighting apparatus owned by Civil Protection.

7. Sr. Romano A. Viegas, Environmental Health

Comment: When this fuel depot is operational, there could be high risk to community's or local worker's health. We need to pay attention to those things. The area will also further developed to the presence of workers making their house in there. There will be larger amount of waste (liquid and solid be produced), these things have impacts to hygiene and sanitation in the area.

Response: Thank you for the comment. Worker's Health and Safety will be addressed in the full EIS as well as solid and liquid waste load to the environment.

15.2 Second Stakeholder Workshop

The second stakeholder consultation was conducted after all the major work on EIS has been completed. Consultation objective was to present the finding and additional input from relevant stakeholder in order to improve the draft document of EIS. The result of public and community consultation is summarized as followed:

Table 15.1. Feedback and Questions of Stakeholder Engagement Meeting on September 1, 2015

No	Institution	Feedback	Question
1	Forestry	1. Appreciate the presentation because the implementation touch the degree law of relevant ministry 2. In the 2016-2021, the Forestry will implement the mangrove rehabilitation in the coastal area.	1. How to minimize the damage to the flora and fauna due to oil spill 2. Is the imported bitumen environmentally friendly?

		3. Not too concern about the development because it is located far from protected areas and mangrove communities.	
2	Civil Protection	1. Civil protection does not have the emergency response system in place. Is it possible for PEC to discuss the issue with relevant stakeholders. 2. The design of fire alarm and protection plan should be coordinate with the Fire Department at the National level	
3	ANP	1. Global Petroleum is asked to implement the best standard safety practice from Singapore 2. ANP will review all the proposed design of storage and jetty development 3. The incident in PERTAMINA is under investigation by ANP and Police due to potential for crime/fatal negligence involved 4.	1. Beside the air pollution, there will be also be a heat radiation that affect those around the storage tanks. How to mitigate this problem? 2. There is also potential for air quality problems from Volatile Organic Compounds (VOC). How to mitigate this? 3. How is runoff from the facility going to be treated
4	Ministry of Public Works	There is a possibility to expand the newly upgraded road of Dili-Liquica to 4 lanes, so there should be an extra allowance (set back from the road) for this.	
5	NDPCEI-Liquica	To get the grading material such as sand, soil, gravel, etc. should be coordinated with the Municipality of Liquica	Where can the company get the grading material?

15.3 Consultation with Affected Community

Fishing Activities

Tibar and Liquica is a robust fishing community supplying fresh catch to urban Dili. To better understand the characteristics of the fishing and other types of socio-economic activities around the project site, a field survey was conducted using questionnaire and direct interview methodology. Survey respondents consist of forty local residents within Aldeia Caitehu. Since project location is not a boat launching area

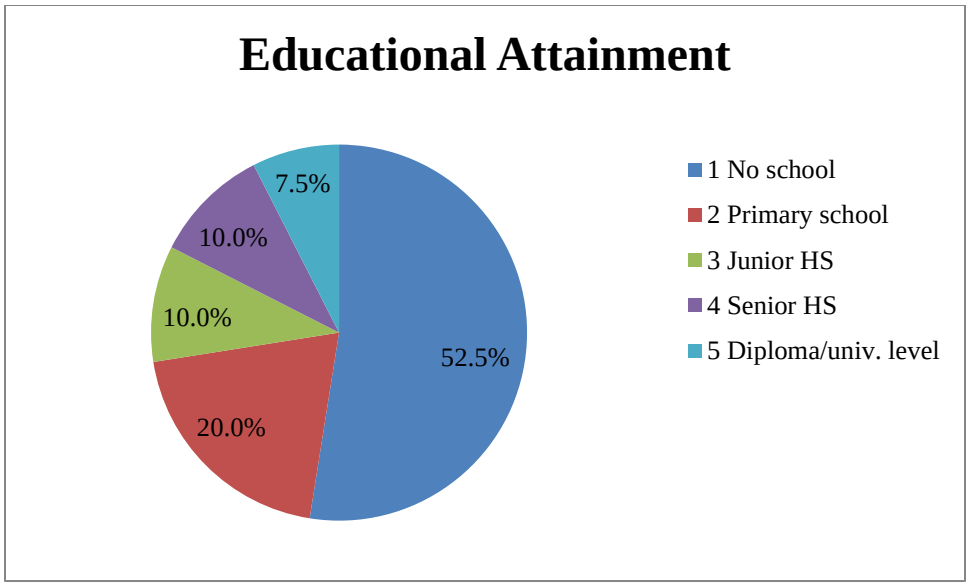
and another important types of jobs (industrial and temporary road work) exist in the community, the socio-economic survey has been structured to cover the whole Aldeia and not only fishermen in the area.

Respondent characteristics

Respondents are between 21 to 85 years old with most of them aged between 30 – 45 years old. Each respondent reported that they are responsible for between one and fifteen persons with average dependents of five persons.

More than half of the respondents reported no primary education while those graduated from primary educational institutions are about one in five. Approximately 7.5% of respondent reported diploma or university level of education while the rest of the respondents are either graduates of junior or senior high schools. Figure 15.1 presents educational attainment characteristics of respondents.

Figure 15.1 Educational Attainment Characteristics of Respondents



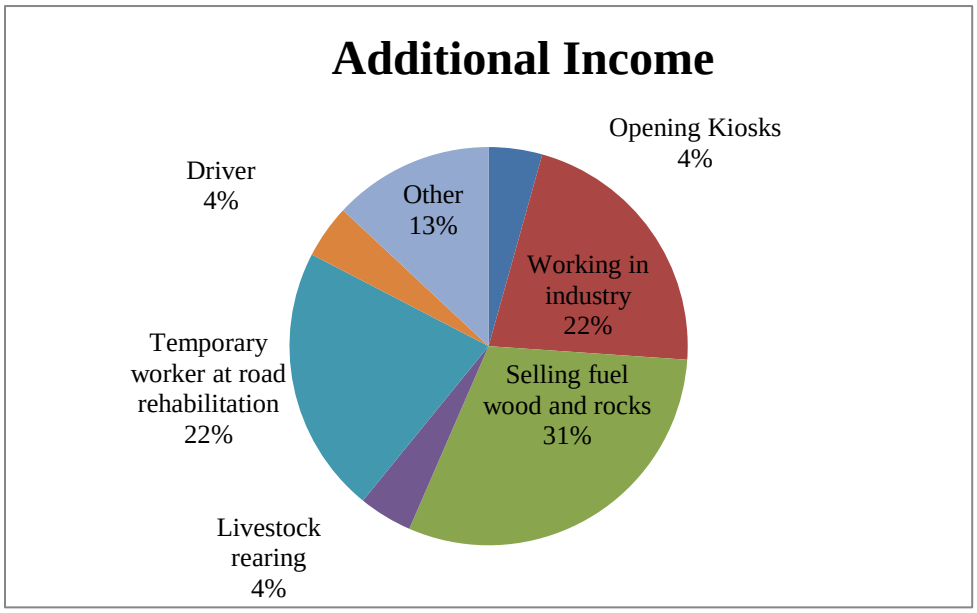
Respondent Livelihood

About half of population (55%) inAldeia Caitehu is fishermen while 27.5% are farmer and the rest are doing other types of work (Table 14.2). Like many communities in Timor Leste, besides the above main occupation, local community in Aldeia Caitehu also supplement their incomes from farming and fishing with other types of cash-generating income including running kiosks, selling fuel wood, working as temporary labor in the industrial facilities close by and others. Figure 14.2 presents the type of additional work reported by local community.

Table 15.2 Main Types of Income

No	Type of Main Job	Percent
1	Fishermen	55%
2	Farmer	27.50%
3	Others	17.50%

Figure 15.2 Source of Additional Income



For fishermen, they reported that fishing has been their long term occupation with more than 60% fishermen noted that they have fished for more than 10 years. Most of the fishermen try to fish everyday, weather permitted. Fishing apparatus reported to be traditional fishing gear (gill net and hook) with no fishermen reporting using arrow. Boat launching is located in Ulmera and all fishing apparatus kept in the same place.

Fishing and the other income generation activities generates sufficient income for about half (52%) of the respondent while the rest noted that they are not happy with their current level of income. Of those that reported sufficient income, about 80% noted that the income they have are also sufficient for *adat* (customary duties) with the rest noted that although they are happy with their income, the *adat*requirement sometimes take a significant portion of their incomes away.

Besides asking about respondents' perceived sufficiency of the current income, respondents were also asked whether they would like to change job from their current occupation. Respondents answers are consistent with level of satisfaction of the current income. About half of the respondents noted that they would like to change jobs. As for reasons for job change or no job change, respondents lists a variety of

reasons including no skills for other types of jobs or want to have higher income. Table 12.3 contains the list of reasons for wanting or not wanting to change job.

Table 15.3 Reasons for Wanting or Not Wanting Change in Job

No	Reason
	For Job Change
1	Would like to work at projects
2	Would like a permanent job
3	Would like professional (office) type of jobs
4	Would like to work as cleaner or driver
5	Just want higher income
	For No Job Change
1	Satisfied with current job
2	No other skills
3	No people to take to the other job
4	Already old

Respondents Knowledge about Reef Ecosystems

As part of the survey, respondents were also asked about their knowledge on reefal ecosystems that are present near where they live. Most respondents indicated that they know about the reef ecosystem with function as fish habitat. Mostly thought that the reef ecosystem has been impacted from human activities from fishing activities especially from the use of nets and the method to free tangle nets (using iron stick or bamboo to break the reef). About 10% of respondent suggest that damage to coral reef are due to the use of fish bomb indicating that while not wide spread or widely acknowledged, there are fishermen that use illegal method of fishing.

Fishermen Opinion and Concern on the Proposed Development

Respondents noted that they already knew about the development plan mostly through previous socialization by local authority (chefie de aldeia/chefie de suco). Regarding the plan itself, respondents overwhelmingly agree (97.5%) reasoning that they or their kids can get a job in the facility. About 32.5% of respondents noted that they are directly impacted from the development, meaning that they have to relocate out of their houses. Those directly impacted reported getting cash for their property with 100% thought that the compensation is fair.

Respondents' perceived potential environmental impacts from the development range from concerns that construction activities will exacerbate problems with access road as the national road is currently being rehabilitated making access difficult to concerns related to access to the coastal area (for recreation or collecting shrimp). Respondents have also thought the development might have negative environmental impacts to the nearby waters.

In terms of recommendations to project proponent, response from local community again echoed the overwhelming concerns related to provision of jobs especially for youth in the area. They also noted that priority should be given to local community for any job opening in the facility.

15.4 Focus Group Discussion with Affected and Vulnerable Population

The environmental impacts assessment results was being consulted and informed to the local community members who will be affected directly and indirectly from the project. The meeting was conducted on November 7, 2015 in Aldeia Caitehu (within the designated project location) and attended by 10 community members. In addition to the focus group meeting, the consultation was also conducted by consulting the individual and vulnerable people in the household.

Figure 15.3. Community consultation and discussion with Affected People in the project area

The objective of the meeting was to inform to the community on the result of the study of environmental impact assessment (EIA) and proposed Environmental Management Plan (EMP) to minimize the negative impacts of the proposed project. The meeting was attended by 12 members of the community of AldeiaKaitehu, who are affected directly by the project. The community members include the chief of AldeiaKaitehu, youth, vulnerable old people, women, and productive people.

During the discussion the community members raised several issues related to the project. However, in general community members are positive and supportive to the project and expect

that a lot of social and economic benefit will be realized by the project to the community members. Their expectation includes the following:

1. In general the community members are very supportive to the proposed project but they are afraid on the major impacts such as fire or oil spill and expect the project owner to have a comprehensive plan on the prevention side to happen
2. The community members expect to involve in the program
3. Project owner to actively involved in the community and help the community if community member has a difficulty, such as in the disaster event (flooding) and community difficulty in water resources and other social events that need help
4. Appreciate the job and opportunity that will be created as a result of the project
5. The community expect the project to commence as soon as possible
6. Community members are happy to hear that the proper EIS and EMP have proposed to project owner and government so that the implementation will not
7. The community members are afraid of major impacts such as disaster scale that may occur but hope that the company will take any necessary measure to protect its business and community

The following table summarized the questions and suggestions raised by the community members during the focus group meeting.

Table 15.4 List of Suggestion and question Raised during the Focus group Discussion

Name	Question	Suggestions	Response
SrFranscisco C.		• During the project implementation the dust must be sprayed two times a day to minimize the impact. • We are afraid of disaster such as large scale fire hazard, so the company must put the proper plan to anticipate the fire hazard • In our community, we have unskilled labor, driver, driver of heavy duty equipment, so we want these jobs to be given to our community members	• Yes, dust spraying and compacting is one of the responsibilities of the project owner. • Large scale fire is an industrial accident. Proper fire prevention will put in placed and checked by fire protection agency and ANP • Jobs will be available, but jobs should be provided to workers that can work well, have good skill and have discipline. Local community will be the first choice but good skill and discipline is a must.
Sr.Domingos C.	The company came to the local level and registered the name and it was known as " Global" but now the name is Global Petroleum		The names refer to the same company. Global is the short version. Global Petroleumis the long version.

Sr. Elias Coreia		• We ask the company to help the community in providing the water supply and contribute to the social charity whenever we need	• Water supply and other social contribution can be considered. What is for sure is that the company would like to maintain good relationship with neighbors therefore as long as it is reasonable, it will give contribution for community development.
Sr. Afonso C Freitas		• Ask the company to engage and absorb our young people to work in their project • Once the project completed, the company should help us	• Yes, there will be training as well to local labor. During the training the company will be able to see who has good skill and can work well.

CHAPTER XV: WORK PLAN AND IMPLEMENTATION SCHEDULE OF EMP

The workplan and implementation schedule of the EMP is given as follows:

Activity of EMP	Year1				Year2				Year 3	
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
	Pre-Construction		Construction						Operation	
Dust Management	v	v	v	v	v	v	v	v		
Solid and Liquid waste Management	v	v	v	v	v	v	v	v	Constinouus	
Occupattional heath and Safety	v	v	v	v	v	v	v	v		
Noise Management	v	v	v	v	v	v	v	v		
Inccident management	v	v	v	v	v	v	v	v	Constinouus	
Traffic Management	v				v				Constinouus	
Fire Control and Management									Constinouus	
Oil spill detection and management									Constinouus	
Occupational health and Safety	v				v				Constinouus	
Storm runoff and sedimentation										
Solid and Liquid waste Management	v	v	v	v	v	v	v	v	Constinouus	
Air quality monitoring	v				v				Constinouus	
Water quality monitoring			v		v				Constinouus	

The work plan of the proposed EMP program must apply in every step of the project from pre-construction, construction phase, and during the operation of the facility.

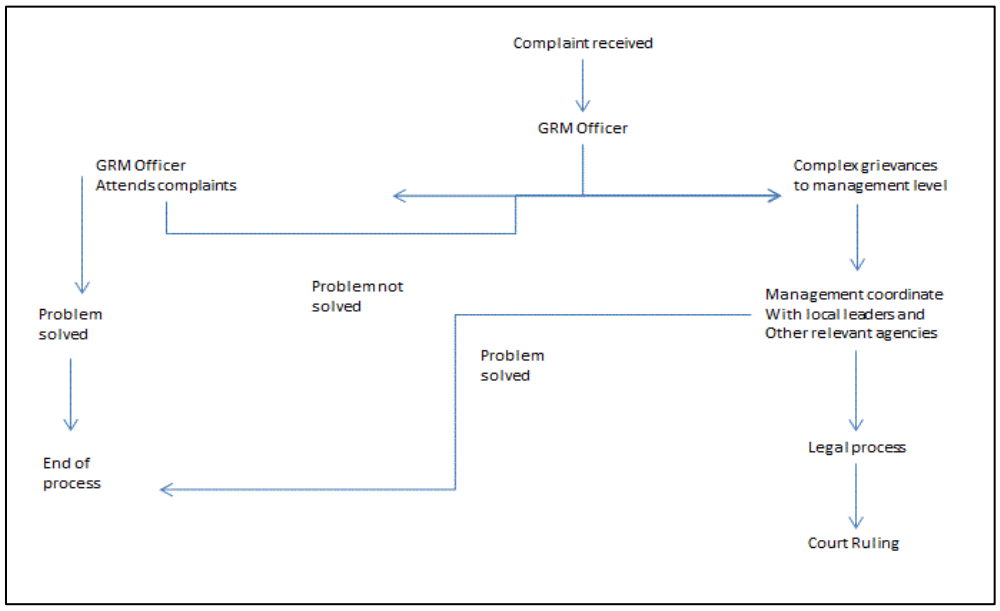
- Implementation of EMP during the pre-construction activity
- Implementation of EMP during the construction phase
- Implementation of EMP during the operational phase
- Implementation of EMP during the decommission phase

CHAPTER XVI: GRIEVANCE REDRESS MECHANISM

A Grievance Redress Mechanism (GRM) will be established to address complaints by affected people related to impacts from the development. The GRM will be facilitated by the project proponent where grievances about project's general and environmental performance will be collected and attended. A signage will be erected in the front office notifying the public on how to log their complaint, relevant contact numbers and contact person within the management at the facility.

A close contact will also be maintained at all times with chefi de suco, chefi de aldeia as well as other local authorities. Any complaints should be addressed promptly using several layers as presented in the following figure.

Figure 16.1 Grievance Redress Mechanism



Any complaint received at the front office will be directed to the Grievance Officer who will then sort out the complaints. Simpler complaints will be directly attended by the Grievance Officer in coordination with the chefi de suco. If the complaints are not solved or if the grievance is complex in nature, the GO will report to the upper management who will resolve the issue in coordination with local leaders and relevant agencies at the district or national level.

The last layer of the GRM is the legal remedy where all other mechanisms to solve the issue have failed. Court ruling, however, will be the last resort to solve problems since it will take considerable time and energy for both parties involved. Therefore, mediation and friendly approach to the affected person should be pursued first.

CHAPTER XVII: COST ESTIMATE

Total cost needed to implement the EMP can be estimate from activity, instruments required, and personnel required implementing the plan. Cost figure consist of the following:

- Instrument for sampling and monitoring (Fire alarm system, water quality lab, air quality instrument, leak detection instrument,
- Officer for environmental and instrument specialist
- Administration
- Upland catchment protection
- Community support system (community development)
- Out sourcing expert for review
- Construction safety
- Solid waste management
- Wastewater treatment
- Detention treatment
- Reporting cost

The total cost required by Global Petroleum to implement the proposed EMP is about USD 195,000 during the pre-construction and construction phases. During the O&M phase, the total cost for mitigation measures is predicted to be about USD 85,000. A detail breakdown of the costs are provided in the following table.

Table 16.1. Total Cost of the Management Measures

Phase	Group of Activities	Activities	Quantity	Unit	Unit Cost ($)	Total Cost ($)
Pre-Construction	Excavation Material from Grading of Fuel Storage Site	Dumping of excavation material in proper dumping station (Tibar)	2	dumping trip	600	1200
	Air Quality	Spraying of grading site	120	work days	35	4200
	Loss of Terrestrial Vegetation	Replanting program in the upper watershed (to be conducted during O&M phase)	See O&M phase			
	Sanitation	Provision of temporary sanitation facilities	3	temporary toilets for 120 days	200	600
		Routine disposal of liquid waste	24	dumping trip	50	1200
		Garbage bins	10	bins	20	200
		Routine disposal of solid waste	24	dumping trip	25	600
		Worker awareness training	1	event	150	150
	Occupational Health and Safety & Noise and Vibration	Workers protection gears (boots, ear muffle, goggle, bright vest, etc.)	40	protection kit	60	2400
	Total Pre-Construction Cost during the 6 months					**$ 10,550.00**

Construction	Sea Level Rise	Fortification of structure that connects the complex to the jetty	1	structure	150000	150000
		Site elevation	1	time	10000	10000
		Coral reef survey	See Monitoring Measure Costing			
	Air Quality	Spraying of grading site	360	time	35	12600
	Soil and Groundwater Protection	Provision of temporary storage with lining on the ground	1	storage	5000	5000
		Routine dumping of used oil and other chemicals to Tibar	15	dumping trip	35	525
	Traffic Disruption	One personel to direct traffic	1	personel	2700	2700
		Provision of signage	4	signs	10	40
	Occupational Health and Safety & Noise and Vibration	Workers protection gears	40	protection kit	60	2400
	Total Construction Cost during 1.5 years					**$ 183,265.00**
Operation	Oil transfer from jetty to storage	Provision of booms and dispersant	5	units	5000	25000
	Oil filling into trucks for distribution to customer	Provision of oil-water separator basin or higher grade separator machine (optional)	1	structure	5000	5000
	Sanitation	Provision of permanent sanitation facilities	4	units	600	2400
		Routine disposal of liquid waste	1	dumping trip	35	35
		Provision of permanent solid waste facilities	10	units	20	200
		Routine disposal of solid waste	26	dumping trip	25	650
		Provision of "No Littering" signs throughout facilities and in the beach areas	15	signs	20	300
	Tree Planting in the upper watershed	Tree Planting in the upper watershed	1	event	1000	1000
	Air Quality	Spraying of facility site	180	days	35	6300
	Occupational Health and Safety & Noise and vibration from equipment operation	Workers protection gears	24	kit	60	1440
	Beach Access by Fishermen	Finding new access points	1	event	40000	40000
		Provide assistance to the fishermen				
	Total Operation and Maintenance Cost per Year					**$ 82,325.00**

For monitoring purposes, total cost is estimated at USD 11,000 for pre-construction and construction phases. For the O&M phase, the total monitoring cost is estimated at USD 28,000. A detail breakdown of the monitoring cost is provided in the following table.

Table 16.2. Cost Figure of the EMP Implementation during Operation of the Facility

Phase	Monitoring Measures	Remarks	Quantity	Unit	Unit Cost ($)	Total Cost ($)
Pre-Construction & Construction	Monitoring for turbidity that lasts long	Facility operator, daily basis	720	days	10	7200
	Monitoring for leak of waste water and solid waste into the beach and marine environment, monitoring for signs of eutrophication	Facility operator,daily basis	720	days		
	Monitoring of worker's behavior related to solid and liquid waste, related to the use of personal safety protection	Facility operator, daily basis	720	days		
	Provision of First Aid kit	Facility operator	5	first aid kit	35	175
	Monitoring for negative effect of changes in coastal hydrology to the integrity of the development	Facility operator, daily basis, require data collection and keeping of record	720	days	5	3600
	TOTAL for Pre-Construction and Construction for two years					**$ 10,975.00**
Operation	Monitoring for leak of waste water and solid waste into the beach and marine environment, monitoring for signs of eutrophication	Facility operator, daily basis	365	days	10	3650
	Monitoring of worker's behavior related to solid and liquid waste, related to the use of personal safety protection	Facility operator, daily basis	365	days		
	Provision of grievance redress procedure to allow for monitoring of complaints from local community and workers	Facility operator	365	days		
	Monitoring for proper dumping of liquid waste, solid waste and used oil and other chemicals	Facility operator, monthly basis	12	days	5	60
	Provision of First Aid kit	Facility operator	5	first aid kit	35	175
	Monitoring for negative effect of changes in coastal hydrology to the integrity of the development	Facility operator, daily basis, require data collection and keeping of record	720	days	5	3600

	Monitoring of sea level movement					
	Monitoring of coral reef's health	Engage local environmental NGO, initial and yearly study can be conducted for 1 month	30	days	50	1500
	Outreach to local community, local authority and fishermen group	Facility operator and representative of upper management, can be conducted once a year during christmas time, anniversary of facility or other proper time	1	per year	5000	5000
	Marine water quality test	Engage a laboratory	1	per year	6000	6000
	Marine ecological integrity test (benthic communities stability)	Engage a laboratory				
	Monitoring for oil spill on a daily basis and monitoring to the effectiveness of oil separator basin	To determine needs for higher grade oil-water separator	365	days	5	1825
	Monitoring for dust pollution on a daily basis	Facility operator				
	Air quality test	Engage a laboratory	1	per year	5000	5000
	Monitoring for tree planting program	Engage local environmental NGO, conduct three planting during rainy season once a year	20	days	25	500
	Monitoring for integrity of primary, secondary and tertiary containment measures	Internal inspection by operator, require data collection and record keeping, conduct at least weekly	52	per yer	10	520
	TOTAL for Operation and Maintenance					**$ 27,830.00**

CHAPTER XVIII: REVIEW OF THE EMP

The EMP should be reviewed by project owner, updated and submitted to NDPCEI for re-approval every year. Project proponent can engage local consultants for update of the EMP. Data collection should take place as part of the EMP update focusing on near coast water quality assessment and air quality data.

NDPCEI can review results from monitoring activities and compare them with baseline results collected during EIS preparation. Monitoring or data collection can also be taken on need basis when certain parameters have visually been observed to be elevated. Complains from community should also be taken into consideration and appropriate assessment and data collection take place to formulate proper ways to address the complaints.

CHAPTER XIX: NON-TECHNICAL SUMMARY

The Caitehu fuel storage and jetty plans is a project proposed by Global Petroleum, and product trading PTY, Lda , a partnership between foreign and Timorese-own private companies. Company's representative and his contact details are provided as follows:

Sr. Julian Chiang (Director)
Rua Pertamina, Pantai Kelapa, Dili, Timor Leste
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The main objective of the development is for the reliability of fuel supply for domestic needs in order for Timor Leets's development to run smoothly. Given the current situation with fuel supply infrastructure in the country, there is a tremendous need to invest in the modernization of fuel supply transport and handling through the development of large scale storage and sea transport (jetty or port) facility that will allow for faster, safer and more reliable supply into the country. Hence, the idea for the development of Caitheu Fuel Storage and Jetty Plant came into being.

The proposed development consists of two major components:

1. Jetty development, consisted of a jetty with the size of 12 x40 m with 150 m catwalk from shorelines;

2. Fuel storage development consisted of twenty one tanks with the size of 20,000 (3 tanks), 15,000 CBM (4 tanks), 5,000 CBM (4 tanks), 3,000 CBM (11 tanks) and 2,000 (2 tanks).

Jetty Development

As can be seen from the detail EIS that small disturbance on the coral reef habitat and marine water may occurs during the pre-construction and construction phases of the development. The major impacts mainly on the operation when the oil tanker loading the oil into the storage system, where there may potential fire and oil spill within the marine ecosystem. The minor issue can be mitigated with the proposed mitigation plan, while the major issue such as disaster should be responded by involving national and international aid, as the scale will be beyond the ability of the project owner to handle. Nonetheless, the catastrophic event or major disaster event usually occurs but with very low probability.

Fuel Storage Complex

The fuel storage facility consists mainly of six storages, office buildings, utilities, piping system, and the necessary control system. This facility will take roughly 4.5 ha land, which has been secured through long-term lease arrangement between project proponent and the government of Timor Leste.

This Environmental Impact Statement (EIS) has been prepared as part of the process to secure an environmental licensing. Before the EIS is being developed, a project document has been submitted to the

National Directorate of Pollution Control and Environmental Impact (NDPCEI). The project document was submitted to allow authority to determine whether the project proponent should develop a full EIS or a simplified EIS. NDPCEI required that project proponent develop a full EIS because the proposed development is located near sensitive ecosystem, in this case the coral reef ecosystem.

As a fuel storage and sea transport development located near sensitive area and large national infrastructure, the development potentially has devastating impacts from day to day operation (cumulative impacts) as well as from large scale oil spill or fire accidents. It is therefore very important to develop a thorough program for impact management and monitoring measures. It is also vital to develop emergency preparedness and response procedures to accidents in any scale it might happen. A thorough management and monitoring program will result in an excellent record in Health, Safety and Environment (HSE) and can serve as a model of responsible development for Timor Leste.

Institution and Legal Frameworks

As part of the EIS development, analysis of relevant institution and legal framework in effect in Timor Leste should be conducted. It was found that protection of the environment is protected by the country's Constitution. For example, article 6(f) of the Constitution clearly mentions that one of the objectives of the State is to protect the environment and preserve the natural resources.

Additionally, other relevant laws and regulations are also in effect for the protection of the environment and for the protection of affected community. These laws and regulations include local and international laws and regulations. Some of the important laws and regulations are listed as follows:

Table 19.1. Relevant Regulatory Framework of Timor Leste Environmental Protection

Agency	Relevant Laws
State Secretary of the Environment	Decree Law No.5/2011
	Decree Law No. 26/2012 on Environmental Base Law
	(Draft) Law on Biodiversity (March 2012)
	(Draft) Law on Protected Area (May 2013)
	UNTAET Law No. 19/2000 on Protected Area
State Secretary of Forestry and Protection of the Nature	(Draft) Law on Protected Area (May 2013)
	UNTAET Law No. 19/2000 on Protected Area
State Secretary of Fisheries and Aquaculture	Law No. 12/2004 on Crimes Related to Fisheries
	Law No.6/2004 on Legal Basis for Management and Regulation of Fisheries and Aquaculture
National Petroleum Authority	(Draft) Regulation No. xx/2014 on Installation and Operation of Fuel Storage

International	Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Dumping Protocol) United Nations Convention on Biological Diversity (UNCBD) United Nations Framework Convention on Climate Change (UNFCCC)

Contractual and Corporate Obligations

The proposed development is 100% private sector-funded, therefore, there are not much contractual and corporate obligations in relation to the natural environment and social impacts resulted from the development. Decree Law No.5/2011 in Articles 15 and 16 established the Impacts and Benefit Agreement procedure to allow for project proponent and affected communities around Category A projects to enter into a legal agreement for the community's benefit.

For this particular project, as part of the development process, project proponent has entered into agreements with several members of the community that are being resettled out of project site. These contractual agreements are related to compensation payment to the community member to move out of their houses to a new location. 11 members of the community signed the agreement and have since moved out of their houses. The contracts for compensation payment are provided in Annex A.

Brief Description of Impacts

Impacts from Jetty Structure

The following table presents all potential impacts from the development of the jetty structure grouped based on the activities that generate the impacts – i.e. site preparation (Pre-Construction), Construction and Operation and Management (After Construction).

Table 19.2. Type, Nature, Indicator and Methodology to Assess Impacts from Jetty Development

Type of Impact	Nature of Impact	Scope of Impact	Impact Indicator	Design and Methodology to Assess Impacts
Impacts during Site Preparation				
Water quality From increased turbidity due to compaction	Localized, direct, short term (temporary), negative but not Significant, unavoidable	Near coast water especially in the embayment area	Turbidity level, temperature, DO, chemical test	Visual, on-site and laboratory test designed to measure important water quality parameters
Bottom contamination From resettlement of sediment due to compaction	Localized, direct, could be medium term, negative but not significant, unavoidable	Areas immediate along the footprint of the jetty, some impacts to the	Areas covered by sediment settlement, areas cleared out	Visual assessment

		embayment		
Marine and coastal ecology From loss of coral reef habitat	Direct and indirect, cumulative, Could be medium term, Not significant, unavoidable	The coastal area	Benthic macrofauna	Especially for coral reef, at a minimum, the study should be designed to track long-term changes in coral beds. Laboratory test designed to measure stability of benthic macrofauna community.
Impacts during Construction				
Water quality, Bottom contamination, Marine and Coastal Ecology	Same as during Site Preparation, related to increased turbidity			
Marine and Coastal ecology New structure as "attachment place"	Localized esp. on structures in the water, long term, **positive**, not significant, unavoidable	Submerged structure only	Colonization of submerged structure	Visual
Coastal Hydrology from enactment of large structure in marine environment**:**				
Changes in current pattern, wave and sediment movement that could lead to higher sedimentation rate or erosion	Localized, indirect, Long term, negative and could be significant, unavoidable	Areas immediate to the jetty structure	Beach erosion (loss of sandy area along the beach) or coastal erosion (loss of sediment from the bottom of the coastal area).	Actually impacts will directly be felt by the facility in terms of the frequent need to dredge from the high rate of sedimentation.
Stagnant pool of water may be formed behind structures	Localized especially around Jetty structure, long term, negative but not significant, unavoidable	Areas immediate to the jetty structure	Formation of stagnant water	Visual
Noise and vibration From equipment operation	Localized, short term, negative, not significant, unavoidable	Only up to areas 100 meters away from the source of the noise. See detailed explanation on noise impacts in Section	Community complain	On site test

		6.1.3		
Water quality, bottom contamination and marine ecology from waste generation From worker activities	Localized, short term, negative, not significant, avoidable	Affecting area immediate to the jetty structure and the embayment. Solid waste could travel a long distance in the marine environment .	Concentration of solid waste along the beach, solid waste floating in the beach area and around the project area, evidence of eutrophication in the water	Visual
Impacts during Operation and Maintenance				
From Ship Traffic				
Water quality, Bottom contamination, Marine and Coastal Ecology:				
Oil spill	(Depending on scale of spill) Could be dispersed to larger area, long term and significant although avoidable	Area immediate to the jetty structure, the embayment including sensitive receptor nearby. Large scale oil spill could travel to larger marine environment	Thin or thick layer of oil on the water surface (oil slick), toxic soluble material in the water originated from oil spill	Visual, laboratory testing designed to measure oil spill impacts including level of toxicology. At the very least, laboratory testing of marine water should cover parameters tested in the baseline information data collection.
Waste water	Localized, could be significant to sensitive flora and fauna, avoidable	Area immediate to jetty structure up to the embayment	Eutrophication, bacterial count	Visual, laboratory testing
Garbage (solid waste)	Could be dispersed to larger marine environment, could be significant to sensitive flora and fauna, avoidable	Area immediate to jetty structure, the embayment and potentially dispersed to the larger marine water	Concentration of solid waste along the beach, solid waste floating in the beach area and around the project area	Visual

Noise and Vibration from ship traffic	Localized, not significant, happened several times in a month during the time ship is coming	Most likely affecting workers on the ship and jetty structure only	Noise level, complain from surrounding resident	Site testing or nuisance level
From Maintenance of Jetty				
Water quality, Bottom contamination, Marine and Coastal Ecology From increased turbidity related to fixing and parts replacement	Same as during Site Preparation above			

Impacts from Fuel Storage Development

Major impacts from fuel storage development are related especially to oil spill and fire hazard. Magnitude of impacts will depend on the scale of the spill and fire with impacts range from slight to extensive impacts (Table 18.4) that can lead to long term alteration to ecosystem function and permanent species or asset loss. The following table contains potential environmental impacts from fuel storage development.

Table 19.3. Type, Nature, Indicator and Methodology to Assess Impacts from Fuel Storage Development

Type of Impact	Nature of Impact	Impact Indicator	Methodology to Assess Impacts
Impacts during Site Preparation			
Surface and Marine Water quality, bottom contamination and marine/coastal ecology From increased turbidity due to spoil from site preparation	Localized, direct, short term (temporary), negative but not Significant, unavoidable	Turbidity level, temperature, DO, chemical test	Visual, on-site and laboratory test
Terrestrial Ecology	Direct, long term, not significant, unavoidable	Loss of habitat	Site survey
Impacts during Construction			
Surface and marine water quality, Bottom contamination, Marine and Coastal Ecology from increased turbidity due to spoil from site preparation	Same as during Site Preparation, related to increased turbidity due to spoil from construction activities		
Soil and ground water quality from spill of oil and other chemicals used	Direct, cumulative, Could be medium term, Could be significant	Evidence of oil spill on the soil, amount of hydrocarbon compound	Visual, on site and laboratory test

	depending on the scale, avoidable	in the soil	
Air Qualityfrom traffic during construction	Direct, short term, not significant, unavoidable	Level of NO_2, SO_2, PM_{10}, $PM_{2.5}$	Visual, on site test
Noise and vibration from operation of equipment	Direct, short term, not significant, unavoidable	Level of noise and vibration	Site testing or complaints for nuisance from local community
Impacts during Operation and Maintenance			
Surface water quality, marine water quality, bottom contamination, marine and coastal ecology from:			
Oil spill	(Depending on scale of spill) Could be dispersed to larger area, long term and significant although avoidable	Thin or thick layer of oil on the water surface (oil slick), toxic soluble material in the water originated from oil spill	Visual, laboratory testing
Liquid and solid waste	Localized, could be significant to sensitive flora and fauna, avoidable	Solid waste floatingin the beach area and around the project area, bacterial contamination, level of nutrients in the water	Visual, laboratory testing
Soil and ground water quality from spill of oil and other chemicals used	Direct, cumulative, Could be long term, Could be significant depending on the scale, avoidable	Evidence of oil spill on the soil, amount of hydrocarbon compound in the soil	Visual, on site and laboratory test
Air Quality from traffic during construction	Direct, long term, not significant, unavoidable	Level of NO_2, SO_2, PM_{10}, $PM_{2.5}$	Visual, on site test
Noise and vibration from operation of equipment	Direct, long term, not significant, unavoidable	Level of noise and vibration	Site testing or complaints for nuisance from local community
Visual quality	Direct, long term, not significant, unavoidable	Visual stimulation	Visual

Potential Climate Change Impacts

The most relevant climate change-related impacts to fuel storage facilities development in the coastal locations are sea level rise and changes in climatic parameters especially rainfall and temperature. Climate change is an important factor in Health, Safety and Environment (HSE) because it has the potential to exacerbate existing impacts. Moreover, climate change might induce unexpected and costly failure of the facility itself due to direct impacts from sea level rise especially during storm surge, increase of extreme weather events that induce erosion, flooding, changes in groundwater profile, and prolong the dry weather seasons that can affect the water source availability.

There are four relevant risks from climate change to the proposed development. They are:

- ✓ Risk from sea level rise

- ✓ Risk from changing rainfall pattern
- ✓ Risk from changing temperature

Potential Social Impacts

Social impacts are assessed within the context of the local community where development is taking place, that is, AldeiaCaitehu and SucoMotaulun. Workers in the facility whether they come from Motaulun or other places are also included in the analysis because the social consequences of the development will also be felt by them. Desk review and field interview conducted for the project found several key social issues in the affected community that are relevant to the development. The key social issues are:

1. Relatively high unemployment level in Suco Motaulun: based on Census 2010 data, it was found that the unemployment rate in the Suco 9. 98% or about one in ten persons that are available for work do not find job.
2. The community health status is still a reflection of rural Timor Leste's health status where there is a need for improvement on the number of children receiving immunization, nutrition status of children and the prevalence of malaria. Health facility remains basic in the community.
3. In terms of educational attainment, Suco Motaulun has about 68% of population 5 years old and over with some schooling (Census 2010). This relatively higher number, however, is not reflected in the educational attainment at the secondary level, where there is only 1.59% of the population actually finished tertiary/diploma or university level of education (Census 2010).
4. Educational facility only covers primary to junior high school level. High school students have to commute to Liquica or Dili for continued education.
5. Gender equality in general is improving, however, there are more work to be done as indicated by the presence of less girls in the university level education (83 girls for every 100 boys enrolled). In the employment sector, data from the United Nations Development Programme (UNDP) also pointed to the traditional male dominance in the non-agricultural emplyment sector.
6. An analysis of potential social stress and shocks from the proposed development to vulnerable groups in the community is especially relevant to affected population near the development. As noted in the previously mentioned Sections, fishing is the main occupation reported by a significant number of the population (50%). The fishermen group, however, will not be directly impacted from the development as they do not launch their boat from near the project area and will not be directly impacted from any damage to the coral reef. No direct impact will also be directed to the mangrove forest nearby therefore, ecosystem services provided by the mangrove community will not be directly impacted from the development.
7. Direct impact will be mostly felt by local communities in Aldeia Caitehu, especially those living across the road and on the eastern side of the proposed facility.

Per the above findings, several recommendations have been put forward for the development to help contribute to the improvement of social condition as well as to ease the impacts on the fishermen group. The recommendations are:

1. Absorption of local labor into the facility: this should start right from the beginning phase of the development/site preparation to construction and operation and management.

2. Preference to women labor: it is believed that certain percentage of labor in the facility should be made open for women, preferably for permanent position. Permanent position carries with it more benefits in the form of opportunities for education and training that not only increase the skill level but provide with positive learning and working experience.
3. Education and training for facility's employees: this should be pursued in a continuous basis with tangible results. For example, upper level management that will be filled with foreign employees at the start of the employment should be filled with Timor Leste citizens within several years.
4. Social contribution: routine social contribution should be made to local community and should contribute to meeting long term social needs of the community. For example, contribution into local schools and health care center, scholarship for students in need and others. This routine social contribution can be coordinated with the church and local authority as the prominent social institutions in the community.

Potential Economic Impacts

Several important benefits will be able to be realized by investment in the mitigation measures. The benefits are as follows:

1. Protection of the coral ecosystem nearby. Losses due to the loss of coral bed from jetty development has been predicted to be between USD 40 and USD 302/year (from loss of fishery and coastal protection) and between USD 46 and USD 540/year (from loss of fishery, coastal protection and tourism potential). There is a potential for much greater losses than the above numbers should larger scale spill occur.
2. Rehabilitation of the environment. In addition to protection benefits, other benefits that should be taken into consideration is the benefits in terms of the avoidance of conducting rehabilitation should large scale spill and fire/explosion occur.
3. Protection of nearby infrastructure. Should any major accident happen, most likely, not all of the infrastructure will be damaged, however, at least a part of it will be affected such as the national road and electricity lines. Economic loss due to disruption of national road access could be significant because nearby road is an regional, national and international access to Indonesia.
4. Protection of workers. It is hard to put a price on the protection of human being from injury or loss of life. It should also be noted that not only workers in the facility will be affected. Should a major accident happen, there is a high possibility that nearby community might be affected.

<u>Proposed Mitigation Measures</u>

Potentially significant environmental, social and economic impacts are related to oil spill and the fire/explosion potential of that comes out of wrong handling of the fuel. To avoid these risks, several mitigation measures have been proposed to be incorporated into the development. The mitigation measures are divided into two types of mitigation measures – (1) mitigation measures for major impacts (related to oil spill and fire/explosion) and (2) mitigation measures for smaller or minor impacts (related to day to day operation and workers activities on the facility.

a. Management Plans for Major Impacts

Major impacts are related to oil spill and the associated fire/explosion risks of a fuel storage facility therefore management plans for this should be with the purpose of minimizing risks from spill as well as fire/explosion. Recommended management measures for these risks are provided in the following table.

Table 19.4. Summary of Management Measures for Oil Spill and Fire/Explosion Risks

No	Mitigation Measures	Purpose
Measures for Slight to Local Spills		
1.	Water-Oil Separator	Separating minor spills originating from the bundwall area
2.	High Grade Skimming Machine	Optional equipment for separating water-oil from the water oil separator if the gravity system failed
3.	Use of Booms around Tanker Ship	Containment of oil spill during transfer of oil from the tanker ship to the fuel storage.
4.	Application of Detergent (Dispersant)	Breaking the oil droplets to allow for faster natural assimilation in the case of slight to local spill into the marine environment
Measures for Large to Extensive Spills		
5.	Well-designed tanks, pipework, valves, gauging and alarm system, corrosion protection (also called primary containment)	Prevent release from tank overfilling, rapture and leakage through tank walls, bottom and the pipework
6.	Well-designed bund walls, ground lining and bund /wall seals	Prevent release to the environment should primary containment fail
7.	Well-designed drainage ditches and separate basins to contain spill	Additional barrier to prevent uncontrolled spread from failure of secondary containment. Tertiary containment should be controlled separately from the secondary containment
8.	Application of response plans that incorporate proper overall goals and objectives	Responding to large or extensive spill. Have to be a coordinated attempt by several relevant agencies.
9.	Application of proper mechanical, chemical and biological cleaning methodologies	Part of the response plans was the cleaning of spill. A combination of mechanical, chemical and biological cleaning methodologies should be employed to ensure better results.
10.	Provision of industrial-scale fire-fighting apparatus consisting of water, sand and foam	Fast response to major fire
11.	Provision of portable fire-extinguishers at strategic areas	Fast response to minor fire

b. Management Plans for Minor Impacts

Minor impacts are typically impacts related to day to day operation of the facility such as impacts related to solid and liquid waste produced by workers on the site, noise and vibration from equipment operation. To help mitigated these types of impacts, the following measures are proposed(Table19.4).

Table 19.5. Summary of Management Measures for Minor Impacts

Component	Phase	Potential Impacts	Mitigation Measures
Jetty Development	Pre-Construction	Water quality, bottom contamination and marine and coastal ecology	- Limit compaction to areas that will be developed only (footprint of jetty structure with enough buffer area as allowance) - Compaction conducted during low tide to minimize dispersement to other locations
			- Provision of temporary sanitation facilities with waste disposed off at the Tibar waste water treatment plant - Provision of garbage bins and signs throughout to warn workers not to litter the marine environment - Worker awareness training of the sensitivity of coral reef community and its function in fishery production.
		Occuptational health and safety	Use of worker's protection apparatus, including: 1. Bright vest for easy identification of workers 2. Ear and eyes protection 3. Helmet 4. Foot protection (safety boot) and wet suit as necessary First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response procedures
	Construction of Jetty	Water quality, bottom contamination, marine and coastal ecology - negative	- Limit construction to areas that will be developed only (footprint of jetty structure with enough buffer area as allowance) - Construction activities conducted during low tide to minimize dispersement to other locations
			- Provision of temporary sanitation facilities with waste disposed off at the Tibar waste water treatment plant - Provision of garbage bins and signs throughout to warn workers not to litter the marine environment - Worker awareness training of the sensitivity of coral reef community and its function in fishery production.
		Marine and coastal ecology – positive	- The enactment of submerged structures will automatically provide attachment place for soft corals and other marine biota. Proliferation of the biota will depend on several factors, including tide influence and level of sedimentation in the area
		Coastal hydrology – changes in current pattern, waves and sediment movement	- No specific measures have been proposed since the jetty structure has been designed to be supported with piles rather than a massive wall structure that tend to inhibit long shore drift movement (example: Pertamina's jetty in Pante Kelapa). - Piles support will not restrict much of the waves and current movement
			- Geomorphology, soil type, climatic condition as well as land cover that make up the watershed lead to naturally high sedimentation load going into the bay. Sediment flush happens especially during the rainy season where load from upper watershed are transported rapidly into the bay. This will likely lead to a frequent need to dredge the area for maintenance purposes. - Recommended measure for this is tree planting in accessible upper watershed areas. This tree planting can be coordinated with local NGOs with experience conducting this type of programs.
		Structure inundation	Several measures are proposed to manage impacts from sea level rise: - Protection from wave action: in the form of fortification of the structure that connects the terrestrial complex

			and the jetty. Fortification should be designed with sufficient allowance for sea level rise. - Protection from inundation of jetty structure. The jetty has been designed to be 2.60 m from Low Water Spring (LWS) therefore it should be sufficient to withstand potential sea level rise.
		Occuptational health and safety	Use of worker's protection apparatus, including: Bright vest for easy identification of workers 1. Ear and eyes protection 2. Helmet 3. Foot protection (safety boot) and wet suit as necessary First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response procedures
		Noise and vibration	- Use of newer and lower noise equipment - Measures for protection of workers from noise and vibration is the same as the above
	Operation of Jetty	Water quality problem, bottom contamination and marine/coastal ecology	- Provision of permanent sanitation facility with on site treatment to prevent highly polluted effluent going into the ground water or marine water. On site treatment typically consists of a septic tank with several "rooms" where waste water goes through and at the end, the effluent discharged will have less organic compound load. - Provision of permanent garbage bins on strategic locations throughout the facility. - Provision of signs that warn facility workers and visitors not to litter - Regular disposal of garbage to Tibar landfill. Burning of garbage should not be conducted on the site because it potentially release toxic chemicals into the air and marine water.
			- Limit dredging as necessary to areas in need of fixing. - Dredging conducted during low tide to minimize dispersement to other locations
		Structural inundation or erosion of structure	Measures recommended for sea level rise have been discussed in the jetty construction section. During O&M, monitoring should be conducted to better anticipate impacts from sea level rise.
		Noise and vibration	Use of proper isolation on the ship's machinery room.
		Occupational health and safety	Use of worker's protection apparatus, including: 1. Bright vest for easy identification of workers 2. Ear and eye protection 3. Helmet 4. Foot protection (safety boot) and wet suit as necessary First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response procedures
		Limited access to the beach especially by fishermen	- Find new access point and boat parking space for the fishermen. - Provide assistance in the form of new fishing equipment for those affected - Provide financial assistance to those affected to help ease out the transition from one place to another

	Pre-construction-Storage facility	Water quality	- Dumping of excavation material unused for grading in the proper place (Tibar landfill). - Grading conducted during dry period to avoid runoff and spoil being transported to the nearby marine water
			- Provision of temporary sanitation facilities with waste disposed off at the Tibar waste water treatment plant - Provision of garbage bins and signs throughout to warn workers not to litter the marine environment - Worker awareness training of the sensitivity of coral reff community and its function in fishery production.
		Bottom contamination	Same as above
		Marine and coastal ecology	Same as above
		Air quality problem	- Spraying broken soil every few hours - Workers and visitors wearing mask to protect from dust - Temporarily pave access road
		Loss of terrestrial vegetation	- Replanting program in the upper watershed to make up for loss of several trees on the location - Landscaping using grass in the facility
		Noise and vibration impacts	- Use of newer equipment to reduce noise - Use of ear muffle or other protection
		Occupational health and safety	Use of worker's protection apparatus, including: 1. Bright vest for easy identification of workers 2. Ear and eye protection 3. Helmet 4. Foot protection (safety boot) and wet suit as necessary First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response procedures
	Construction-Storage facility	Water quality	- Dumping of excavation material unused for grading in the proper place (Tibar landfill). - Grading conducted during dry period to avoid runoff and spoil being transported to the nearby marine water
			- Provision of temporary sanitation facilities with waste disposed off at Tibar waste water treatment plant - Provision of garbage bins and signs throughout to warn workers not to litter the marine environment - Worker awareness training of the sensitivity of coral reef community and its function in fishery production.
		Bottom contamination	Same as above
		Marine and coastal ecology	Same as above
		Structure inundation	- Ground elevation: As previously discussed under the Climate Section and Management Measure Section, it is recommended to elevate the site by 50 cm (based on the predicted rise of sea level in Timor Leste). This recommendation is also consistent with recommendation from the geotechnical study of the project site. - Protection from wave action: in the form of fortification of the structure that connects the terrestrial complex and the jetty. Fortification should be designed with sufficient allowance for sea level rise.

		Air quality problem	- Spraying of construction area every few hours - Workers and visitors wearing mask to protect from dust - Temporarily pave access road
		Soil and groundwater quality	- Provision of temporary storage with lining on the ground to prevent leaching of oil, cement and other chemicals into the soil - Careful use of application of oil, chemicals and cement to prevent spill into the ground - Swift cleaning action when there is spill - Dumping of used oil and other chemicals to the facility in Tibar.
		Noise and vibration	- Use of newer equipment to reduce noise - Use of ear muffle or other protection
		Traffic disruption	- Assign a person to watch and direct the traffic every time a fleet of vehicle are in and out of the project area - Transport vehicle or other construction-related vehicle operate at night when possible - Put clear sign for detour or traffic direction within and outside of project location
		Occupational health and safety	Use of worker's protection apparatus, including: 1. Bright vest for easy identification of workers 2. Ear and eye protection 3. Helmet 4. Foot protection (safety boot) and wet suit as necessary First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response procedures
	Operation-Storage facility	Water quality	- Provision of permanent sanitation facility with on site treatment to prevent highly polluted effluent going into the ground water or marine water. - Provision of permanent garbage bins on strategic locations throughout the facility. - Provision of signs that warn facility workers and visitors not to litter. - Regular disposal of garbage to Tibar landfill. Burning of garbage should not be conducted on the site because it potentially release toxic chemicals into the air and marine water.
		Bottom contamination	Same as above
		Marine and coastal ecology	Same as above
		Soil and groundwater quality	- Provision of permanent storage with lining on the ground to prevent leaching of oil, cement and other chemicals into the soil - Careful application of oil and other chemicals to prevent spill into the ground - Swift cleaning action when there is spill - Dumping of used oil and other chemicals to the facility in Tibar.
		Air quality	- Use of newer or well maintained vehicle fleet to curb emission gases
		Noise and vibration	- Use of newer equipment to reduce noise - Use of ear muffle or other protection

		Occupational health and safety	Use of worker's protection apparatus, including: 1. Bright vest for easy identification of workers 2. Ear and eye protection 3. Helmet 4. Foot protection (safety boot) and wet suit as necessary First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response procedures
		Structure inundation or structure erosion	- Protection from wave action: in the form of fortification of the structure that face the coastal areay. Fortification should be designed with sufficient allowance for sea level rise.
		Visual quality	- Landscaping with grass in spaces between the facility and the fence

Governing Parameters

The proposed governing parameters are used to quantify measurable environmental quality such that changes in environmental conditions can be compared to the baseline and ambient quality threshold. The following standards could be used as threshold values for environmental evaluation.

(1) Emission

There are no national standards for emission currently in effect in Timor Leste. Therefore, international emission standards from other countries have to be adopted. Several types of emission standards are recommended for the facility as listed in the following table.

Table 19.6. Emission Standards Recommended

No	Element	Source	Recommended Standards
1	Air	Vehicular emission	Indonesian Government's Regulation No. 35/MENLH/10/1993 on Upper Limit for Vehicle Emission
2	Water	Drainage water loading from the facility as a whole	Indonesian Environmental Ministerial Diploma No. 42/MENLH/10/1996 on Wastewater Standards for Oil, Gas, and Geothermal Activities
3	Noise	Pre-construction, construction and operation	Indonesian Environmental Ministerial Diploma No. 48/MENLH/11/1996 on Noise Level Standards
4	Vibration	Pre-construction, construction and operation	Indoensian Environmental Ministerial Diploma No. 49/MENLH/11/1996 on Vibration Level Standards

(2) Ambient Environmental quality

Ambient environmental quality consists of standards relevant to maintain good quality of air, water and soil. In relation to ambient air quality, project owner and regulatory agencies should measure the ambient air quality at least once every year and compare the results to the baseline survey conducted as part of the EIS development. Recommended standards for ambient air quality are the Indonesian Government Regulation No. 41/1999. Water body found in the area is coastal water body and the recommended standards for the water quality is Indonesian Ministry of Environment Ministerial Decision (KepMen LH) Kep.51/MENLH/2004.

(3) Occupational Health and Safety Standard

Recommended Occupational Health and Safety Standards for every project activity during the pre-construction, construction and during the operation should be followed. This includes general construction health and safety requirements, occupational health and safety standard in marine environment and occupational, safety standard in operation of fuel storage as well as others.

Monitoring Programs

Monitoring program is very important to ensure that the mitigation measures are implemented effectively by project proponent. Another objective of the monitoring programs including to determine effectiveness of mitigation measures and to facilitate impact management by warning of previously unanticipated impacts.

Recommended monitoring program for the facility are spelled out in the following table.

Table 19.7. Monitoring for the Mitigation Measures

Component	Phase	Potential Impacts	Mitigation Measures	Monitoring Measures
Jetty Development	Pre-Construction	Water quality, bottom contamination and marine and coastal ecology	- Limit compaction to areas that will be developed only (footprint of jetty structure with enough buffer area as allowance) - Compaction conducted during low tide to minimize dispersement to other locations	- Monitor for turbidity that last for more than 12 hours.
			- Provision of temporary sanitation facilities with waste disposed off at the Tibar waste water treatment plant - Provision of garbage bins and signs throughout to warn workers not to litter the marine environment - Worker awareness training of the sensitivity of coral reef community and its function in fishery production.	- Monitoring for leak of waste water effluent into the environment - Monitoring for solid waste floating in the marine environment or stranded on the beach - Monitoring for behaviour among workers, for example not using proper sanitation facilities.
		Occuptational health and safety	Use of worker's protection apparatus, including: 5. Bright vest for easy identification of workers 6. Ear and eyes protection 7. Helmet 8. Foot protection (safety boot) and wet suit as necessary First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response procedures	- Use of protection apparatus should be monitored by pre-construction operator and SEPFOPE - First aid kid should be monitored for sufficient and usability of stock - Worker's training should be monitored by ANP and SEPFOPE
	Construction of Jetty	Water quality, bottom contamination, marine and coastal ecology - negative	- Limit construction activities to areas that will be developed only (footprint of jetty structure with enough buffer area as allowance) - Construction conducted during low tide to minimize dispersement to other locations	- Monitor for turbidity that last for more than 12 hours.
			- Provision of temporary sanitation facilities with waste disposed off at the Tibar waste water treatment plant - Provision of garbage bins and signs throughout to warn workers not to litter the marine environment - Worker awareness training of the sensitivity of coral reef community and its function in fishery production.	- Monitoring for leak of waste water effluent into the environment - Monitoring for solid waste floating in the marine environment or stranded on the beach - Monitoring for behaviour among workers, for example not using proper sanitation facilities.

		Marine and coastal ecology – positive	- The enactment of submerged structures will automatically provide attachment place for soft corals and other marine biota. Proliferation of the biota will depend on several factors, including tide influence and level of sedimentation in the area	- No specific monitoring measures have been proposed for this, however, special care should be given during fixing or part replacement of the jetty structure as not to displace existing bottom biota that have proliferated on the surface of structure
		Coastal hydrology – changes in current pattern, waves and sediment movement	- No specific measures have been proposed since the jetty structure has been designed to be supported with piles rather than a massive wall structure that tend to inhibit long shore drift movement (example: Pertamina's jetty in Pante Kelapa). - Piles support will not restrict much of the waves and current movement	It is actually hard to predict the ultimate impact of alteration to existing coastal hydrology pattern. As such, monitoring should look for evidence of negative impacts of alteration to current, wave and sediment movement. Negative impacts including higher level of sedimentation around the piles and beach erosion on nearby location that threaten the integrity of structure.
			- Geomorphology, soil type, climatic condition as well as land cover that make up the watershed lead to naturally high sedimentation load going into the bay. Sediment flush happens especially during the rainy season where load from upper watershed are transported rapidly into the bay. This will likely lead to a frequent need to dredge the area for maintenance purposes. - Recommended measure for this is tree planting in accessible upper watershed areas. This tree planting can be coordinated with local NGOs with experience conducting this type of programs.	- Monitoring for higher than usual sediment loading that leads to more frequent dredging needs.
		Structure inundation	Several measures are proposed to manage impacts from sea level rise: - Protection from wave action: in the form of fortification of the structure that connects the terrestrial complex and the jetty. Fortification should be designed with sufficient allowance for sea level rise. - Protection from inundation of jetty structure. The jetty has been designed to be 2.60 m from Low Water Spring (LWS) therefore it should be sufficient to withstand potential sea level rise.	- Monitoring for sea level movement especially in reference to jetty structure.
		Occuptational health and safety	Use of worker's protection apparatus, including: Bright vest for easy identification of workers 4. Ear and eyes protection 5. Helmet 6. Foot protection (safety boot) and wet suit as	- Use of protection apparatus should be monitored by pre-construction operator and SEPFOPE - First aid kid should be monitored for sufficient and usability of stock - Worker's training should be monitored by ANP and

			necessary First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response procedures	SEPFOPE
		Noise and vibration	- Use of newer and lower noise equipment - Measures for protection of workers from noise and vibration is the same as the above	- Monitoring for complaints from workers and local community.
	Operation of Jetty	Water quality problem, bottom contamination and marine/coastal ecology	- Use of booms around the connection between tanker ship and jetty - Use of dispersant to minor spill. - For major spill from tanker ship, procedure for response is discussed in the following Section.	- Monitoring for evidence of spill in the marine water (oil film or slick) - Monitor for evidence of spill in the sandy beach Water testing should be conducted on a regular basis (at least once a year) to understand in more detail level of certain hydrocarbon chemicals as well as toxic heavy metals in the water. Parameters tested should at least be the same as parameters that have been tested for the baseline data collection as reported in Chapter IV, Description of the Environment.
			- Provision of permanent sanitation facility with on site treatment to prevent highly polluted effluent going into the ground water or marine water. On site treatment typically consists of a septic tank with several “rooms” where waste water goes through and at the end, the effluent discharged will have less organic compound load. - Provision of permanent garbage bins on strategic locations throughout the facility. - Provision of signs that warn facility workers and visitors not to litter - Regular disposal of garbage to Tibar landfill. Burning of garbage should not be conducted on the site because it potentially release toxic chemicals into the air and marine water.	- Monitoring for signs of eutrophication. - Regular water testing as recommended above. - Monitoring for signs of litter in the marine environment, sandy beach
			- Limit dredging as necessary to areas in need of fixing. - Dredging conducted during low tide to minimize dispersement to other locations	- Monitor for turbidity that last for more than 12 hours.

		Structural inundation or erosion of structure	Measures recommended for sea level rise have been discussed in the jetty construction section. During O&M, monitoring should be conducted to better anticipate impacts from sea level rise.	Monitoring for sea level movement especially in reference to jetty structure.
		Noise and vibration	Use of proper isolation on the ship's machinery room.	Monitoring for complaint from local community.
		Occupational health and safety	Use of worker's protection apparatus, including: 5. Bright vest for easy identification of workers 6. Ear and eye protection 7. Helmet 8. Foot protection (safety boot) and wet suit as necessary First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response procedures	- Monitoring for workers day to day activity to identify potential ways accidents can happen and anticipate before hand. - Monitoring for accidents that occur and adjust protection gears and work procedures as needed.
		Limited access to the beach especially by fishermen	- Find new access point and boat parking space for the fishermen. - Provide assistance in the form of new fishing equipment for those affected - Provide financial assistance to those affected to help ease out the transition from one place to another	- Monitoring for implementation of the management measure. Monitoring should be conducted with active collaboration from local authority (chefi de aldeia and chefi de suco). - Monitoring for resulting effect from moving the fishermen to a new place. How their level of income are affected and whether there are conflict at the new place. - Monitoring should be done for at least one year until the fishermen established their new parking space.
	Pre-construction-Storage facility	Water quality	- Dumping of excavation material unused for grading in the proper place (Tibar landfill). - Grading conducted during dry period to avoid runoff and spoil being transported to the nearby marine water	Monitor for turbidity that last more than 12 hours in the nearby area.
			- Provision of temporary sanitation facilities with waste disposed off at the Tibar waste water treatment plant - Provision of garbage bins and signs throughout to warn workers not to litter the marine environment - Worker awareness training of the sensitivity of coral reef community and its function in fishery production.	- Monitoring for leak of waste water effluent into the environment - Monitoring for solid waste floating in the marine environment or stranded on the beach - Monitoring for behaviour among workers, for example not using proper sanitation facilities.
		Bottom contamination	Same as above	Same as above
		Marine and coastal ecology	Same as above	Same as above

		Air quality problem	- Spraying broken soil every few hours - Workers and visitors wearing mask to protect from dust - Temporarily pave access road	Monitoring for dust and complaint from the neighbor or users of national road.
		Loss of terrestrial vegetation	- Replanting program in the upper watershed to make up for loss of several trees on the location - Landscaping using grass in the facility	Monitoring for at least one year until trees all grow. Every year, as part of Company Social Responsibility, continuous tree planting can be done.
		Noise and vibration impacts	- Use of newer equipment to reduce noise - Use of ear muffle or other protection	- Monitoring for complaint from worker
		Occupational health and safety	Use of worker's protection apparatus, including: 5. Bright vest for easy identification of workers 6. Ear and eye protection 7. Helmet 8. Foot protection (safety boot) and wet suit as necessary First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response procedures	- Monitoring for workers day to day activity to identify potential ways accidents can happen and anticipate before hand. - Monitoring for accidents that occur and adjust protection gears and work procedures as needed.
	Construction-Storage facility	Water quality	- Dumping of excavation material unused for grading in the proper place (Tibar landfill). - Grading conducted during dry period to avoid runoff and spoil being transported to the nearby marine water	Monitor for turbidity that last more than 12 hours in the nearby area.
			- Provision of temporary sanitation facilities with waste disposed off at Tibar waste water treatment plant - Provision of garbage bins and signs throughout to warn workers not to litter the marine environment - Worker awareness training of the sensitivity of coral reef community and its function in fishery production.	- Monitoring for leak of waste water effluent into the environment - Monitoring for solid waste floating in the marine environment or stranded on the beach - Monitoring for behaviour among workers, for example not using proper sanitation facilities.
		Bottom contamination	Same as above	Same as above
		Marine and coastal ecology	Same as above	Same as above
		Structure inundation	- Ground elevation: As previously discussed under the Climate Section and Management Measure Section, it is recommended to elevate the site by 50 cm (based on the predicted rise of sea level in Timor Leste). This recommendation is also consistent with recommendation from the	- Monitoring for movement of sea surface and its encroachment to the facility. - Monitoring of the health of coral ecosystem by engaging expert that collect the data on coverage every year and survey to see sign of distress.

			geotechnical study of the project site. - Protection from wave action: in the form of fortification of the structure that connects the terrestrial complex and the jetty. Fortification should be designed with sufficient allowance for sea level rise.	
		Air quality problem	- Spraying of construction area every few hours - Workers and visitors wearing mask to protect from dust - Temporarily pave access road	Monitoring for dust and complaint from the neighbor or users of national road.
		Soil and groundwater quality	- Provision of temporary storage with lining on the ground to prevent leaching of oil, cement and other chemicals into the soil - Careful use of application of oil, chemicals and cement to prevent spill into the ground - Swift cleaning action when there is spill - Dumping of used oil and other chemicals to the facility in Tibar.	- Monitoring for evidence of spill of lubricant oil, cement and chemicals on the ground - Monitoring for proper dumping of used oil, cement and other chemicals.
		Noise and vibration	- Use of newer equipment to reduce noise - Use of ear muffle or other protection	- Monitoring for complaint from worker
		Traffic disruption	- Assign a person to watch and direct the traffic every time a fleet of vehicle are in and out of the project area - Transport vehicle or other construction-related vehicle operate at night when possible - Put clear sign for detour or traffic direction within and outside of project location	- Monitoring for large increase of traffic due to construction material transport. - Monitoring for problems due to higher amount of traffic.
		Occupational health and safety	Use of worker's protection apparatus, including: 5. Bright vest for easy identification of workers 6. Ear and eye protection 7. Helmet 8. Foot protection (safety boot) and wet suit as necessary First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response procedures	- Monitoring for workers day to day activity to identify potential ways accidents can happen and anticipate before hand. - Monitoring for accidents that occur and adjust protection gears and work procedures as needed.

	Operation-Storage facility	Water quality	Management measures for slight to minor impacts: - The use of oil separator (constructed as part of the development). - The use of higher grade oil skimming machine when deemed necessary Management measures for major to extensive impacts: - Routine drill on response plans. There are in general two types of response plans – for spill that makes its way to the water and for spill stranded into the sand or nearby salt marsh.	For slight to minor impacts: - Monitor for evidence of oil in the environment - Monitoring should be conducted on a daily basis. Clean swiftly when there is evidence of spill in the environment. - Monitor for effectiveness of oil separator basin. When not found to be effective, use higher grade skimming machine. - Periodically (at least once a year) conduct testing of effluent from the separator basin to see whether effluent is within allowable standards for effluent from downstream oil facility. Use applicable standards recommended in this EMP or use other standards as recommended by NDPCEI. For major impacts: - Monitoring should focus on ensuring the integrity of the primary, secondary and tertiary containment methods.
			- Provision of permanent sanitation facility with on site treatment to prevent highly polluted effluent going into the ground water or marine water. - Provision of permanent garbage bins on strategic locations throughout the facility. - Provision of signs that warn facility workers and visitors not to litter. - Regular disposal of garbage to Tibar landfill. Burning of garbage should not be conducted on the site because it potentially release toxic chemicals into the air and marine water.	- Monitoring for signs of eutrophication. - Regular water testing as recommended above. - Monitoring for signs of litter in the marine environment, sandy beach
		Bottom contamination	Same as above	Same as above
		Marine and coastal ecology	Same as above	Same as above
		Soil and groundwater quality	- Provision of permanent storage with lining on the ground to prevent leaching of oil, cement and other chemicals into the soil - Careful application of oil and other chemicals to prevent spill into the ground - Swift cleaning action when there is spill - Dumping of used oil and other chemicals to the facility in Tibar.	- Monitoring for evidence of spill of lubricant oil, cement and chemicals on the ground - Monitoring for proper dumping of used oil, cement and other chemicals.
		Air quality	- Use of newer or well maintained vehicle fleet to curb emission gases	Monitoring for elevated level of air pollution gasses including NO_2, SO_2, CO and CO_2. Air pollution in the area.

		Noise and vibration	- Use of newer equipment to reduce noise - Use of ear muffle or other protection	Monitoring for complaint from worker
		Occupational health and safety	Use of worker's protection apparatus, including: - Bright vest for easy identification of workers - Ear and eye protection - Helmet - Foot protection (safety boot) and wet suit as necessary First aid kit should be made available on the site Workers should be trained in first aid response Workers should be trained in emergency response procedures	- Monitoring for workers day to day activity to identify potential ways accidents can happen and anticipate before hand. - Monitoring for accidents that occur and adjust protection gears and work procedures as needed.
		Structure inundation or structure erosion	- Protection from wave action: in the form of fortification of the structure that face the coastal areay. Fortification should be designed with sufficient allowance for sea level rise.	- Monitoring for movement of sea surface and its encroachment to the facility. - Monitoring of the health of coral reef ecosystem by engaging expert that collect the data on coverage every year and survey to see sign of distress
		Visual quality	- Landscaping with grass in spaces between the facility and the fence	- Monitoring for complaints from passersby

Table 19.8.Recommended Monitoring Parameters for Air Quality, Marine Water Quality, Marine Ecological Quality and Social Impacts.

No	Parameters	Methodology	Sampling Location	Frequency	Responsibilities
Air Quality					
1	SO_2	In situ measurement	Within the perimeter of storage complex	Once a year	Project proponent in coordination with NDPCEI
2	NO_x				
3	PM_{10}				
4	$PM_{2.5}$				
Marine Water Quality - Physical Parameters					
1	Turbidity	In situ measurement	Coastal water by project site, exact sampling point to be determined by laboratory technician.	Once a year	Project proponent in coordination with Fishery and NDPCEI
2	Smell				
3	Suspended solid				
4	Solid waste				
5	Temperature				
6	Oil layer				
Marine Water Quality – Chemical Parameters					
1	pH	Laboratory tests	Coastal water by project site, exact sampling point to be determined by laboratory technician.	Once a year	Project proponent in coordination with Fishery and NDPCEI
2	Salinity				
3	Total ammonia				
4	Sulfide				
5	Total hydrocarbon				
6	Total fenol				
7	PCB				
8	Surfactant				
9	Oil and fat				
10	TBT				
Marine Water Quality – Soluble Heavy Metal					
1	Mercury	Laboratory tests	Coastal water by project site, exact sampling point to be determined by laboratory technician.	Once a year	Project proponent in coordination with Fishery and NDPCEI
2	Copper				
3	Cadmium				
4	Zinc				
5	Lead				
Marine Water Quality - Bacteriology					
1	Total coliform	Laboratory tests	Coastal water by project site, exact sampling point to be determined by laboratory technician.	Once a year	Project proponent in coordination with Fishery and NDPCEI
Marine Ecological Quality					
1	Shanon-Wienner Diversity Index	Laboratory tests	Coastal water by project site, exact sampling point to be determined by laboratory technician.	Once a year	Project proponent in coordination with Fishery and NDPCEI
Social Impact					
1	Worker's Health and Safety	Record of health complaint, record of work-related accidents	Workers	Monthly	Project proponent in coordination with SEPFOPE
2	Social contribution	Record of contribution to local community, contribution to fishermen group	Local community, local fishermen group	Once a year	Project proponent in coordination with local authority and Ministry of Social Solidarity (MSS)
3	Social Order	Complaint from	Local community	Monthly review	Project proponent in

		local community			coordination with local authority

In addition to the above monitoring program, a routine internal inspection and testing should be conducted to ensure the integrity of the primary, secondary and tertiary containment measures. This internal inspection should be conducted on a routine basis. The responsibility for the inspection and testing rested at the hand of the project proponent (operator) in coordination with ANP.

To ensure proper protection from fire accident, project proponent or in this case the project operator should also test and inspect the fire protection measures in place at the facility.The procedure for inspection and testing for fire protection should be coordinated with Civil Protection.

Reporting Requirement

All the monitoring activities should be coordinated with relevant government agency to ensure that the parameters being collected meet regulatory requirement in place for that particular set of parameters. After data have been collected, they should be submitted to relevant authority as previously noted in the above tables.

At a minimum, the reporting should cover:

- Internal monitoring and inspection
- Incident, accident and emergency reporting
- Performance indicators and any follow up actions needed
- Training programs

The types of report, including formatting and reporting frequency should be coordinated with relevant authority. Per NDPCEI's rules, however, the environmental license of the project is only valid for one year and should be renewed every year by reporting on an updated EMP. Therefore, at a minimum, a once a year reporting should be required.

Responsibility for Mitigation and Monitoring

The followingagencies within the government (Table 19.8) is responsible for environmental, social and economic safeguarding from impacts generated by the project.

Table 19.9. Relevant Institutions and Their Responsibilities

No	Responsibility	Relevant Institutes
1	Environment and Nature Protection (Terrestrial)	State Secretary of the Environment
		State Secretary of Forestry and Natural Protection
2	Marine and Coastal Environment	State Secretary for Fisheries and Aquaculture
3	Downstream Petroleum Industry	National Petroleum Authority (ANP)
4	Public and Worker's Health and Safety	Ministry of Health

		National Directorate for Civil Protection
		State Secretary for Labor Protection and Training (SEPFOPE)

Emergency Plans

In general, two types of emergency preparedness plans should be prepared for the facility – (i) emergency plans related to fire accident, (ii) emergency plans related to oil spill accident. In addition, for each type of accident, at least two types of emergency plans should be in place, the first one is for small to medium types of emergency and the second one is related to large and extensive types of accidents affecting nearby resources and facilities. Figure 19.1 provides an illustration of agencies responsible for the emergency plans.

Figure 19.10. Agencies Responsible for the Emergency Plans

	Small to Medium Scale	Large to Extensive Scale
Fire Accidents	Project Proponent (Operator) and evaluated by Civil Protection and ANP	A joint effort by ANP, Civil Protection, MSS, NDE, Fishery
Oil Spill Accidents	Project Proponent (Operator) and evaluated by ANP, Fishery and NDE	A joint effort by Project Proponent, ANP, Civil Protection, MSS, NDE, Fishery

The small to medium scale emergency preparedness plan will be provided by operator of the facility and evaluated by relevant agencies which are ANP and Civil Protection in the case of fire accident. For oil spill accident, the emergency preparedness plan should be prepared by project proponent and evaluated by ANP, Fishery and NDPCEI because oil spill can happen on the water and most likely affecting mangrove and other coastal resources nearby.

Large to extensive emergency preparedness plans should be prepared through a joint effort by relevant agencies including ANP, Civil Protection, MSS, NDPCEI and Fishery in the case of fire accident and ANP, MSS, NDPCEI and Fishery in the case of oil spill accidents.

Decommissioning Plans

No decommissioning plan has been specifically developed for the facility, as the project is being planned for long term use and further expansion in the form of more storage is being planned in the future. Therefore, decommissioning is only possible in the face of a force majeure for example, a natural disaster event take place leading to a significant damage to the facility. A large and extensive accident may also

change the perception on the viability of a large facility like that in the location. Should this happened, a decommissioning plan should be developed by the operator/project proponent taking into consideration the demolition of the jetty as well. Such demolition plan should also incorporate measures to bring back the condition of the area to the original state.

Capacity Development and Training

Capacity development and training is required for staff in the facility consisting of:

- For facility manager: training courses from accredited training providers, covering storage facility management course and Health, Safety and Environment (HSE) and quality standards.
- For staff: at a minimum, all staff in the facility should be provided with certified training on first aid and safety.

The responsibility for EMP implementation as well as monitoring of the environmental parameters rests with project operator or in this case management of the facility. It is therefore very critical for the manager to have proper training on HSE and to understand the EMP well.

In addition to the above, as part of skill transfer, several mid-level employees should be prepared to eventually take over management from foreign operator. These mid-level employees or management trainee should be provided all trainings required for facility manager.

Public Consultation and Information Disclosure

Public and community consultation were conducted with two kinds of meeting arrangement: (1) Large meeting by inviting many and (2) meeting one on one in the project location. (3). Intensive discussion with relevant government bodies. The purpose of the consultation was to gauge the stakeholder opinion and concern regarding the project activity and impacts that may arise during each cycle of project implementation. The consultation also aims to communicate the scope of the EIS and receive and opinion from various stakeholders in order to improve the results of the impact assessment.

Public meetings as part of the EIS process were conducted two times to consult on the project scoping of the EIA and the draft EIS. The results of these large consultation meetings were very useful in terms of providing additional information for improvement of the EIA scoping document and improvement of the draft EIS. Representatives from various agencies raised mostly technical opinions related to project. The representatives consist of Fisheries, ANP, Civil Protection, NDPCEI, NGOs, and community representatives. Main inputs received during public consultation are presented in the following table.

Table 19.11. Main Input from Stakeholder Consultation

No	Agency	Main Input
	Stakeholder Meeting I	
1	Directorate of Land, Property and Cadastral Service (DNTPSC)	There should not be any development 50m from the beach.
2	National Directorate of Pollution Control and Environmental Impact (NDPCEI)	Potentially impacted component still very general. Need to make this more detailed.
3	National Petroleum Authority (ANP), Downstream Directorate	For operational license of fuel storage, ANP is the agency with responsibility to issue. So far three project owners with interest to construct large fuel storage facility have reported to ANP. Activities during the operational phase of the project should be reported to ANP, such as the type of materials to be handled, whether or not there will be mixing, etc. There is a draft regulation for fuel storage facilities but right now still in draft stage.
4	Santalum NGO	Need measures to prevent ground water pollution and pollution of surface water so children and animals will not be impacted
5	Civil Protection/Fire Fighting	Prior to construction, should coordinate with Civil Protection to make sure that fire hydrant system (size of connection and others) is compatible with fire-fighting apparatus owned by Civil Protection.
6	Ministry of Health, Environmental Health Department	When this fuel depot is operational, there could be high risk to community's or local worker's health. We need to pay attention to those things. The area will also further developed to the presence of workers making their house in there. There will be larger amount of waste (liquid and solid be produced), these things have impacts to hygiene and sanitation in the area.
	Stakeholder Meeting II	
1	Directorate of Protected Area and Conservation of Nature	Not too concern about the development because it is located far from protected areas and mangrove communities.
2	Civil Protection/Fire Fighting	Civil protection does not have the emergency response system in place. Is it possible for PEC to discuss the issue with relevant stakeholders.
3	ANP, Downstream Directorate	1. ANP will review all the proposed design of storage and jetty development 2. The incident in PERTAMINA is under investigation by ANP and Police due to potential for crime/fatal negligence involved
4	Ministry of Public Work	There is a possibility to expand the newly upgraded road of Dili-Liquica to 4 lanes, so there should be an extra allowance (set back from the road) for this.
5	NDPCEI Liquica	To get the grading material such as sand, soil, gravel, etc. should be coordinated with the Municipality of Liquica

Workplan and Implementation Schedule of the EMP

The workplan and implementation schedule of the EMP is given as follows:

Activity of EMP	Year1				Year2				Year 3	
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
	Pre-Construction		Construction						Operation	
Dust Management	v	v	v	v	v	v	v	v		
Solid and Liquid waste Management	v	v	v	v	v	v	v	v	Constinouus	
Occupattional heath and Safety	v	v	v	v	v	v	v	v		
Noise Management	v	v	v	v	v	v	v	v		
Inccident management	v	v	v	v	v	v	v	v	Constinouus	
Traffic Management	v				v				Constinouus	
Fire Control and Management									Constinouus	
Oil spill detection and management									Constinouus	
Occupational health and Safety	v				v				Constinouus	
Storm runoff and sedimentation										
Solid and Liquid waste Management	v	v	v	v	v	v	v	v	Constinouus	
Air quality monitoring	v				v				Constinouus	
Water quality monitoring			v		v				Constinouus	

Grivance Redress Mechanism

A Grievance Redress Mechanism (GRM) will be established to address complaints by affected people related to impacts from the development. The GRM will be facilitated by the project proponent where grievances about project's general and environmental performance will be collected and attended. A signage will be erected in the front office notifying the public on how to log their complaint, relevant contact numbers and contact person within the management at the facility.

Cost Estimate

The total cost required by Global Petroleum to implement the proposed EMP is about USD 195,000 during the pre-construction and construction phases. During the O&M phase, the total cost for mitigation measures is predicted to be about USD 85,000. For monitoring purposes, total cost is estimated at USD 11,000 for pre-construction and construction phases. For the O&M phase, the total monitoring cost is estimated at USD 28,000.

Review of the EMP

The EMP should be reviewed by project owner and then updated and re-submitted to NDPCEI for re-approval every year. Project proponent can engage local consultants for update of the EMP. Data collection should take place as part of the EMP update focusing on near coast water quality assessment and air quality data.

NDPCEI can review results from monitoring activities and compare them with baseline results collected during EIS preparation. Monitoring or data collection can also be taken on need basis when certain parameters have visually been observed to be elevated. Complains from community should also be taken into consideration and appropriate assessment and data collection take place to formulate proper ways to address the complaints.