

1.3 HYPOTHETICAL SIGNIFICANT IMPACTS TO BE ASSESSED

Methods was applied to identify hypothetical significant impacts were through discussions involving the EIA team and the project proponent in a series of workshops; impact analogies of ongoing Tangguh LNG operations; periodical reports review of the RKL-RPL implementation for ongoing Tangguh LNG operations; desktop studies, field observations, and professional judgement by experts.

Next, potential impact evaluations for each environmental and social parameter will be developed for Gas Exploitation, Gas Transmission, LNG Train, and Marine Facilities activities. Outcomes of this evaluation will be used to identify the hypothetical significant impact matrix and the impact flow chart. The impact flow chart will then be applied to:

- (1) determine the correlation between an environmental and social impact with other ones;
- (2) determine primary, secondary, and tertiary impacts, and so forth; and
- (3) identify environmental and social components/parameters that will be mostly affected by the project activities.

The potential impact evaluations to identify hypothetical significant impacts addressed in this EIS for Integrated Activities of the Tangguh LNG Expansion Project were conducted and incorporated within Book II-Appendix 1 of the EIS ToR (ANDAL ToR) as agreed by the Ministry of the Environment on July 24th, 2013 according to Deputy Minister of the Environment Decree No. 30 Year 2013. Table I-30

1.3.1 Gas Exploitation Activity

The scoping process for Gas Exploitation activities (offshore platforms and wells drilling) generated hypothetical significant impacts to be assessed in EIS (ANDAL) as presented in Table I-31. The matrix of hypothetical significant impacts and flow chart indicating correlation between one hypothetical significant impact with other hypothetical significant impacts along with derivative impacts are presented respectively in **Table I-33 Hypothetical Significant Impacts Matrix of Gas Exploitation Activities (Offshore Platforms and Production Wells Drilling)**

and **Figure I-66** as incorporated in the Terms of Reference of the EIS (ANDAL ToR) approved by Ministry of the Environment (Appendix I - Deputy Minister of the Environment Decree No. 30 Year 2013). Summary of the scoping process is presented in **Figure I-67**.

Table I-32 Hypothetical Significant Impacts of Gas Exploitation Activities (Offshore Platforms and Production Wells Drilling)

No.	Environmental Components	Parameters
1.	Noise	1. Increase in Noise Level
2.	Seawater Quality	1. Increase in Total Suspended Solids (TSS) Content 2. Increase in Oil and Grease Concentrations
3.	Marine Biota	1. Changes in Nekton Diversity (Including Marine Mammals) 2. Decrease in Benthos Abundance 3. Decrease in Plankton Abundance
4.	Economics	1. Job Opportunities and Unemployment 2. Fishery Activity Disturbance 3. Sea Transportation Accessibility Disturbance 4. Changes in Local Businesses Growth
5.	Social - Cultural	1. Community Perception 2. Social Tension

Note:

1. The Terms of Reference for the EIS (ANDAL ToR) was prepared according to Minister of the Environment Regulation No. 8 Year 2006 as all significant impacts were grouped into several categories according to their relationship among one another before they were ranked according to their significance level.
2. However, this EIS (ANDAL) document that has been prepared referred to Minister of the Environment Regulation No. 16 Year 2012, and does not set out to rank hypothetical significant impacts by their significance level. Table above, therefore, ranks environmental components and impacted environmental parameters in accordance with the Matrix of Hypothetical Significant Impacts in **Table I-32 Hypothetical Significant Impacts Matrix of Gas Exploitation Activities (Offshore Platforms and Production Wells Drilling)**. **Table I-33**

Hypothetical Significant Impacts Matrix of Gas Exploitation Activities (Offshore Platforms and Production Wells Drilling)

Table I-33 Hypothetical Significant Impacts Matrix of Gas Exploitation Activities (Offshore Platforms and Production Wells Drilling)

ENVIRONMENTAL COMPONENTS		PROPOSED ACTIVITIES		PRE-CONSTRUCTION PHASE		CONSTRUCTION PHASE										OPERATION PHASE		POST-OPERATION PHASE						
				Socialization of the Proposed Activity	Gas Field Appraisal and Exploration Program	Workforce Mobilization and Demobilization	Sea Transportation for Workforce, Equipment and Materials	Transportation and Installation of Offshore Platform	Production Wells Drilling	Alternatives of Drilling Mud and Drill Cuttings Management		Production Wells Clean-up (Flaring)	Non-Hazardous and Hazardous Waste Management	Wastewater Management	Storage and Loading of Fuel and Chemicals	Workforce Mobilization	Gas Exploitation and Offshore Platform Operations	Existence of Offshore Platforms	Maintenance of Production Wells and Offshore Platforms	Non-Hazardous and Hazardous Waste Management	Wastewater Management	Storage and Loading of Fuel and Chemicals	Workforce Demobilization	Facilities Decommissioning
										1. Re-injection of Drill Cuttings and Final Drilling Mud Into Sub-Surface Formations	2. Overboard Discharge													
		A1	A2	B1	B2	B3	B4	B5	B6	B7	B8	B9	C1	C2	C3	C4	C5	C6	C7	D1	D2			
		Potential Impacts Evaluation Results																						
Physical-Chemical	Air Quality	Increase in SO _x Concentration																						
		Increase in NO _x Concentration																						
		Increase in HC (Hydrocarbon) Concentration																						
		Increase in Total Suspended Particulate (TSP) Content																						
		Increase in Opacity																						
	Greenhouse Gas (GHG)	Light Sighting																						
		Increase in CO ₂ emission																						
	Odor	Increase in H ₂ S Concentration																						
		Increase in Noise Level																						
	Hydrology	Changes in Creek Morphology																						
		Increase in Creek Water Flow Rate																						
		Increase in Surface Water Runoff																						
		Changes in Drainage Pattern																						
	Hydrogeology	Decrease in Shallow Groundwater Level																						
		Increase in Seawater Intrusion																						
		Land Subsidence																						
	Oceanography	Changes in Current Pattern																						
		Increase in Shoreline Abrasion																						
	Soil	Increase in Shoreline Accretion																						
		Increase in Soil Erosion																						
	Physiography	Increase in Total Petroleum Hydrocarbon (TPH) Concentration																						
		Changes in Landscape																						
	Surface Water Quality	Increase in Total Dissolved Solids (TDS) Content																						
		Increase in Total Suspended Solids (TSS) Content																						
		Changes in pH Values																						
		Increase in Oil and Grease Concentration																						
		Decrease in Dissolved Oxygen (DO) Content																						
		Increase in COD Content																						
Increase in BOD Content																								
Increase in Total Phenol Concentration																								
Groundwater Quality		Increase in Total Dissolved Solids (TDS) Content																						
		Changes in pH Value																						
	Increase in Oil and Grease Concentration																							
	Increase in Salinity Value																							
Seawater Quality	Increase in Coli Bacteria Content (Coliform)																							
	Increase in Total Suspended Solids (TSS) Content																							
	Increase in Salinity Value																							
	Decrease in Dissolved Oxygen (DO) Content																							
	Increase in COD Content																							
	Increase in BOD Content																							
Biological	Terrestrial Flora	Increase in Oil and Grease Concentration																						
		Increase in Ammonia Concentration																						
		Increase in Total Phenol Concentration																						
	Terrestrial Fauna	Changes in Structure and Composition of Species																						
		Changes in Land Cover																						
	Freshwater Biota	Changes in Species Diversity (Endangered and Exotic Species, Ethnobotany)																						
		Species Diversity (Endangered and Exotic Species, Migratory)																						
		Changes in Species Distribution																						
	Marine Biota	Changes in Wildlife Habitat																						
		Decrease in Plankton Abundance																						
Decrease in Benthos Abundance																								
Changes in Nekton Diversity																								
Socio-Economic and Cultural	Demographics	Decrease in Plankton Abundance																						
		Decrease in Benthos Abundance																						
		Changes in Nekton Diversity (Including Marine Mammals)																						
	Economy	Increase in Exotic Species																						
		Changes in Population Migration (Mobility)																						
		Workforce: Job Opportunities and Unemployment																						
		Changes in Population Structure (Age, Education, Gender, Ethnicity, Religion)																						
	Socio-Cultural	Changes in Local Business Growth (Financial Institutions, Entrepreneurship)																						
		Changes in Level of Income (Income per Capita, Household Income, Expenditure)																						
		Changes in Livelihood Patterns																						
Education	Fishery Activity Disturbance																							
	Transportation Accessibility Disturbance																							
	Community Perception																							
	Assimilation and Acculturation																							
Public Health	Changes in Social Norms and Values																							
	Social Tension																							
	Indigenous People Marginalization																							
	Changes in Cultural Heritage																							
Public Health	Vulnerable Community Groups (Women, Children, the Poor, the Elderly, and the Disabled)																							
	Changes in Access to Education																							
	Changes in Disease Pattern																							
	Changes in Disease Prevalence																							
Public Health	Changes in Access to Healthcare																							
	Changes in Environmental Health Changes																							

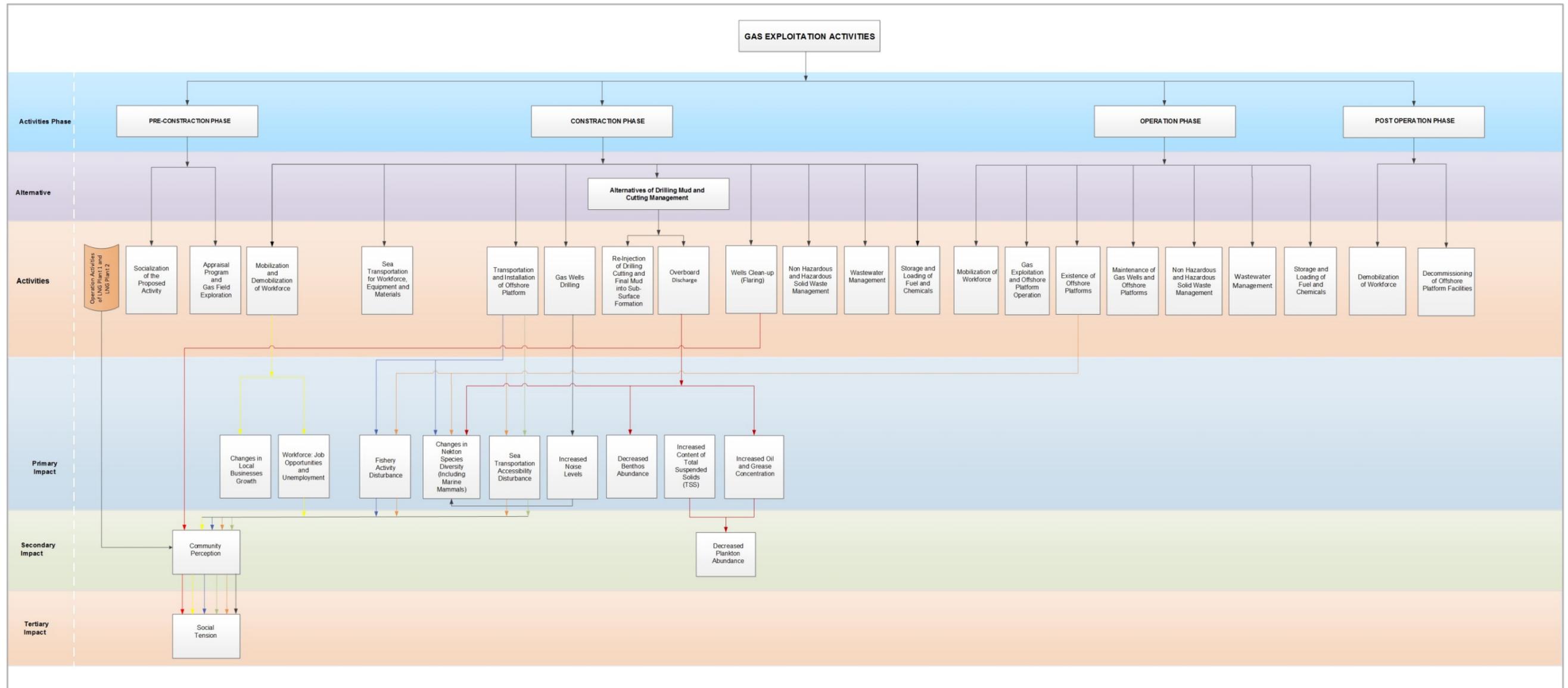


Figure I-68 Flow Chart of Hypothetical Significant Impacts of Gas Exploitation Activities (Offshore Platforms and Production Wells Drilling)

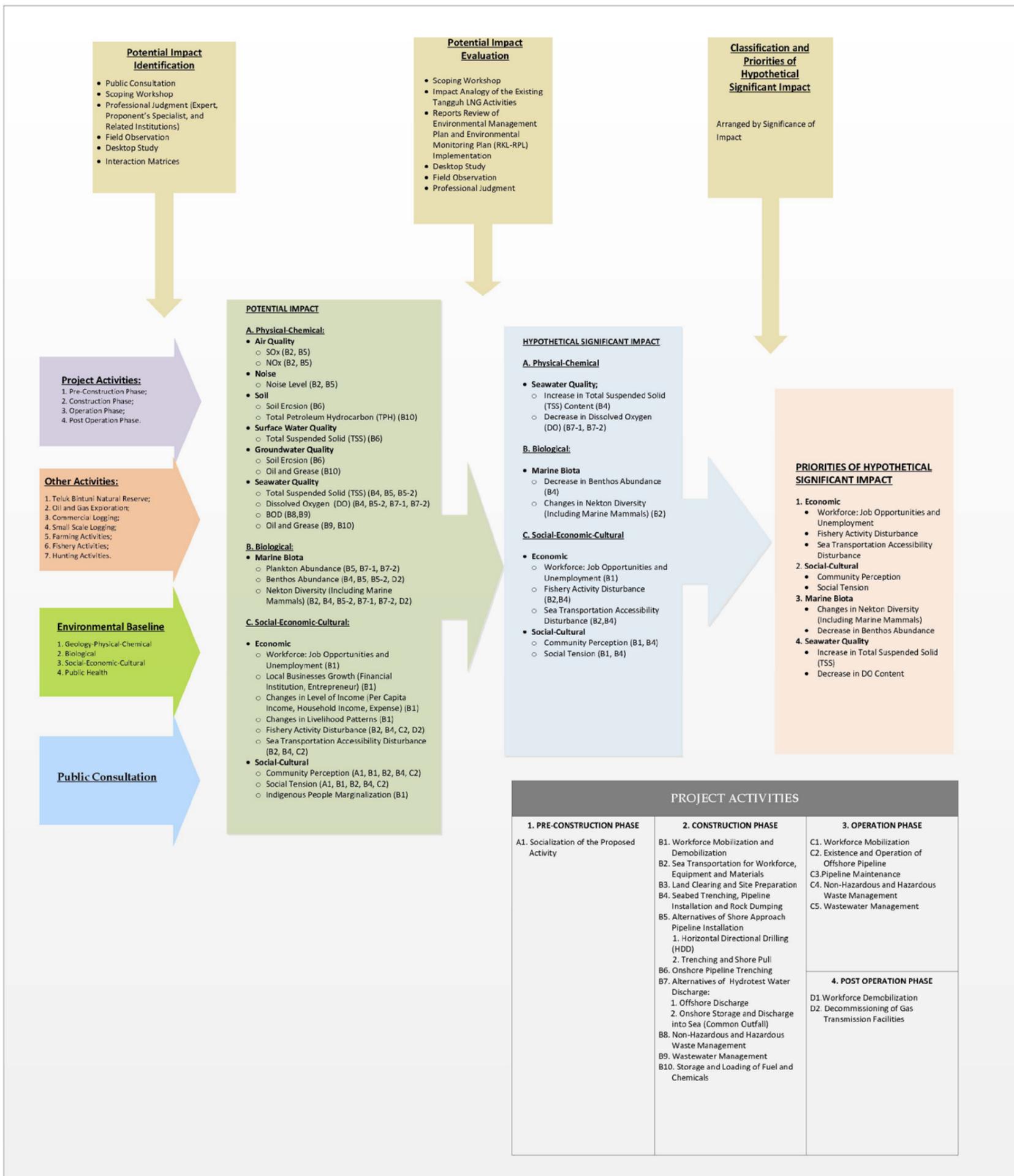


Figure I-69 Summary of the Scoping Process for Gas Exploitation Activities (Offshore Platforms and Production Wells Drilling)

1.3.2 Gas Transmission Activity

The scoping process for Gas Transmission activities generated hypothetical significant impacts to be assessed in EIS (ANDAL) which as presented in Table I-4. The matrix of hypothetical significant impacts and flow chart indicating the correlation between one hypothetical significant impact with other hypothetical significant impacts along with derivative impacts are presented respectively in **Table I-34 Hypothetical Significant Impacts Matrix of Gas Transmission Activities**

and **Figure I-70** as incorporated in the Terms of Reference of the EIS (ANDAL ToR) approved by Ministry of the Environment (Appendix I - Deputy Minister of the Environment No. 30 Year 2013). Summary of the scoping process is presented in **Figure I-71**.

Table I-5 Hypothetical Significant Impacts of Gas Transmission Activities

No.	Environmental Components	Parameters
1.	Seawater Quality	1. Decrease in DO Content 2. Increase in Total Suspended Solids (TSS) Content
2.	Marine Biota	1. Changes in Nekton Diversity (Including Marine Mammals) 2. Benthos Abundance
3.	Economics	1. Job Opportunities and Unemployment 2. Fishery Activity Disturbance 3. Sea Transportation Accessibility Disturbance
4.	Social - Cultural	1. Community Perception 2. Social Tension

Note:

1. The terms of reference for the EIS (ANDAL ToR) was prepared according to Minister of the Environment Regulation No. 8 Year 2006 as all significant impacts were grouped into several categories according to their relationship among one another before they were ranked according to their significance level.
2. However, this EIS (ANDAL) document that has been prepared referred to Minister of the Environment No. 16 Year 2012, and does not set out to rank hypothetical significant impacts by their significance level. Table above, therefore, ranks environmental components and impacted environmental parameters in accordance with the Matrix of Hypothetical Significant Impacts in **Table I-34 Hypothetical Significant Impacts Matrix of Gas Transmission Activities**

Table I-34 Hypothetical Significant Impacts Matrix of Gas Transmission Activities

ENVIRONMENTAL COMPONENTS	PROPOSED ACTIVITIES	PRE-CONSTRUCTION PHASE	CONSTRUCTION PHASE										OPERATION PHASE					POST-OPERATION PHASE			
		Socialization of the Proposed Activity	Workforce Mobilization and Demobilization	Sea Transportation for Workforce, Equipment and Materials	Land Clearing and Site Preparation	Seabed Trenching, Pipeline Installation and Rock Dumping	Alternatives of Shore Approach Pipeline Installation		Onshore Pipeline Trenching	Alternatives of Hydrotest Water Discharge		Non-Hazardous and Hazardous Waste Management	Wastewater Management	Storage and Loading of Fuel and Chemicals	Workforce Mobilization	Existence and Operation of Offshore Pipeline	Pipeline Maintenance	Non-Hazardous and Hazardous Waste Management	Wastewater Management	Workforce Demobilization	Decommissioning of Gas Transmission Facilities
							Horizontal Directional Drilling (HDD)	Trenching and Shore Pull		Offshore Discharge	Onshore Storage and Discharge into Sea (Common Outfall)										
		A1	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	C1	C2	C3	C4	C5	D1	D2		
Potential Impact Evaluation Results																					
Physical-Chemical	Air Quality	Increase in SOx Concentration																			
		Increase in NOx Concentration																			
		Increase in HC (Hydrocarbon) Concentration																			
		Increase in Total Suspended Particulate (TSP) Content																			
		Increase in Opacity																			
	Greenhouse Gas (GHG)	Increase in CO ₂ emission																			
		Increase in H ₂ S Concentration																			
	Odor	Increase in H ₂ S Concentration																			
		Increase in Noise Level																			
	Hydrology	Changes in Creek Morphology																			
		Increase in Creek Water Flow Rate																			
		Increase in Surface Water Runoff																			
	Hydrogeology	Changes in Drainage Pattern																			
		Decrease in Shallow Groundwater Level																			
		Increase in Seawater Intrusion																			
	Oceanography	Land Subsidence																			
		Changes in Current Pattern																			
		Increase in Shoreline Abrasion																			
	Soil	Increase in Shoreline Accretion																			
		Increase in Soil Erosion																			
	Physiography	Increase in Total Petroleum Hydrocarbon (TPH) Concentration																			
		Changes in Landscape																			
	Surface Water Quality	Increase in Total Dissolved Solids (TDS) Content																			
		Increase in Total Suspended Solids (TSS) Content																			
		Changes in pH Values																			
		Increase in Oil and Grease Concentration																			
		Decrease in Dissolved Oxygen (DO) Content																			
Increase in COD Content																					
Groundwater Quality	Increase in BOD Content																				
	Increase in Total Phenol Concentration																				
	Increase in Total Dissolved Solids (TDS) Content																				
	Changes in pH Value																				
Seawater Quality	Increase in Oil and Grease Concentration																				
	Increase in Salinity Value																				
	Increase in Coli Bacteria Content (Coliform)																				
	Increase in Total Suspended Solids (TSS) Content																				
	Increase in Salinity Value																				
	Decrease in Dissolved Oxygen (DO) Content																				
Biological	Terrestrial Flora	Increase in COD Content																			
		Increase in BOD Content																			
		Increase in Oil and Grease Concentration																			
	Terrestrial Fauna	Changes in pH Value																			
		Increase in Total Phenol Concentration																			
	Freshwater Biota	Increase in Ammonia Concentration																			
		Changes in Structure and Composition of Species																			
	Marine Biota	Changes in Land Cover																			
		Changes in Species Diversity (Endangered and Exotic Species, Ethnobotany)																			
		Species Diversity (Endangered and Exotic Species, Migratory)																			
Socio-Economic and Cultural	Demographics	Changes in Species Distribution																			
		Changes in Wildlife Habitat																			
		Decrease in Plankton Abundance																			
	Economy	Decrease in Benthos Abundance																			
		Changes in Nekton Diversity																			
		Decrease in Plankton Abundance																			
	Socio-Cultural	Decrease in Benthos Abundance																			
		Changes in Nekton Diversity (Including Marine Mammals)																			
		Increase in Exotic Species																			
		Changes in Population Migration (Mobility)																			
Education	Changes in Population Structure (Age, Education, Gender, Ethnicity, Religion)																				
	Changes in Population Growth																				
	Workforce: Job Opportunities and Unemployment																				
Public Health	Public Health	Changes in Local Business Growth (Financial Institutions, Entrepreneurship)																			
		Changes in Level of Income (Income per Capita, Household Income, Expenditure)																			
		Changes in Livelihood Patterns																			
		Fishery Activity Disturbance																			

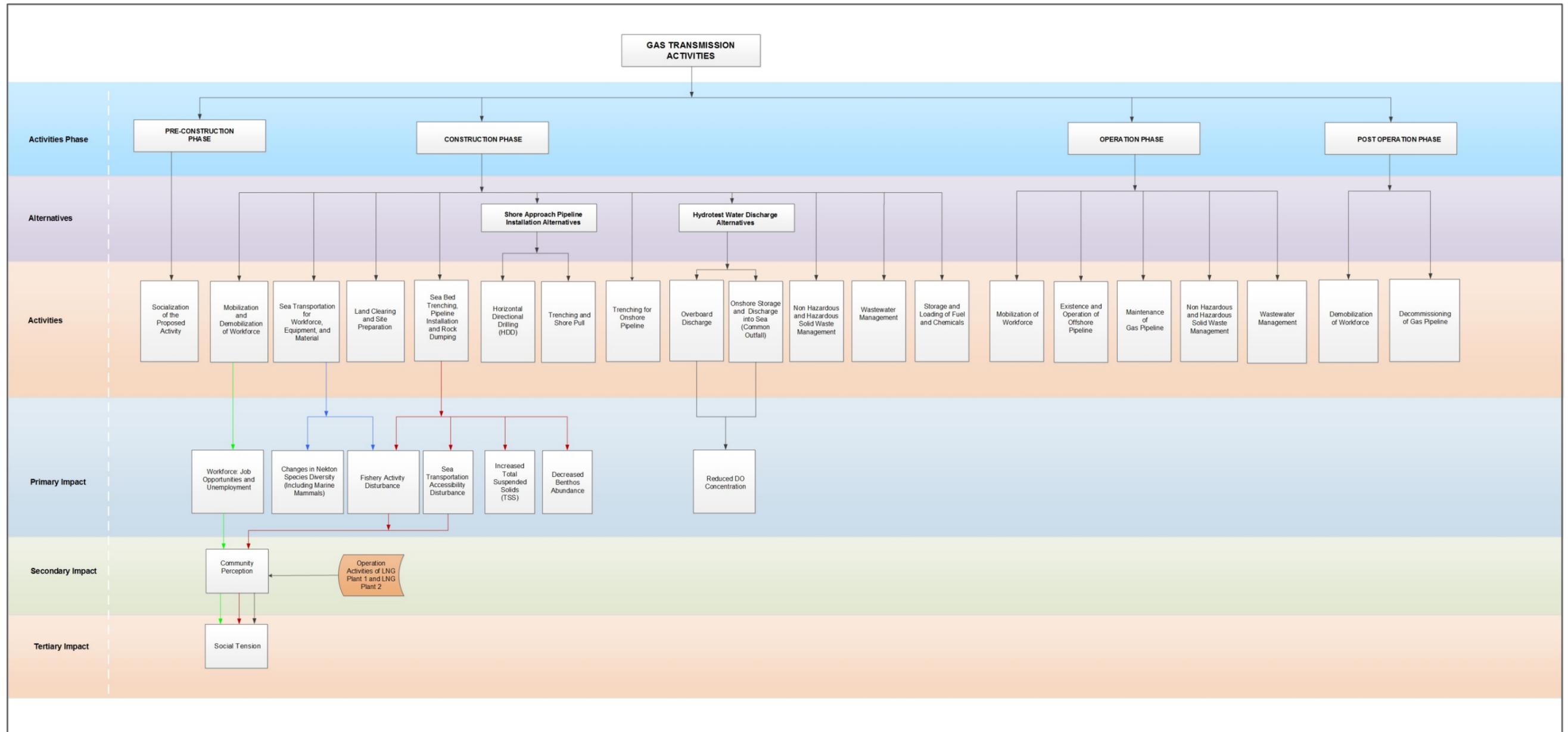


Figure I-72 Flow Chart of Hypothetical Significant Impacts of Gas Transmission Activities)

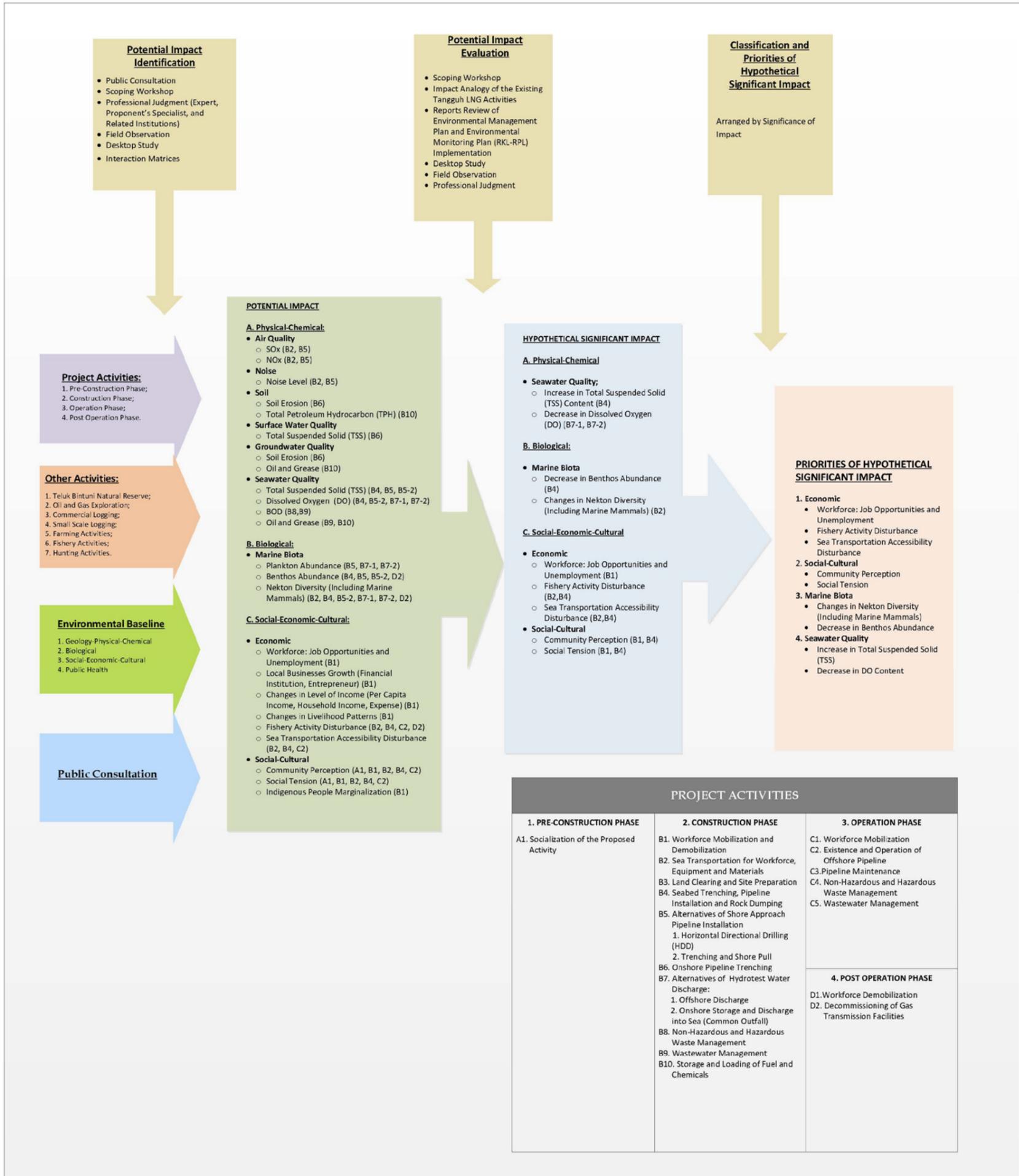


Figure I-73 Summary of the Scoping Process for Gas Transmission Activities

1.3.3 LNG Plant Activity

The scoping process for LNG Plant activities generated hypothetical significant impacts to be assessed in EIS (ANDAL) as presented in Table I-35. The matrix of hypothetical significant impacts and flow chart indicating correlation between one hypothetical significant impact with other hypothetical significant impact along with derivative impacts are presented respectively in Table I-37 Hypothetical Significant Impacts Matrix of LNG Plant Activities

and Figure I-74 as incorporated in the Terms of Reference of the EIS (ANDAL ToR) agreed by Ministry of the Environment (Appendix I - Deputy Minister of the Environment No. 30 Year 2013). Summary of the scoping process is presented in Figure I-75.

Table I-36 Hypothetical Significant Impacts of LNG Plant Activities

No.	Environmental Components	Parameters
1.	Air Quality	1. Light Sighting 2. Increase in Opacity
2.	Greenhouse Gases	1. Increase in CO ₂ Emission
3.	Noise	1. Increase in Noise Level
4.	Hydrology	1. Increase in Surface Water Run-Off 2. Increase in Creek Water Flow Rate 3. Changes in Creek Morphology 4. Changes in Drainage Patterns
5.	Hydrogeology	1. Decrease in Shallow Groundwater Level 2. Seawater Intrusion 3. Land Subsidence
6.	Soil	1. Increase in Soil Erosion
7.	Surface Water Quality	1. Increase in Total Suspended Solids (TSS) Content
8.	Seawater Quality	1. Increase in Ammonia Concentration 2. Increase in Salinity Value 3. Increase in COD Value
9.	Terrestrial Flora	1. Changes in Land Cover 2. Changes in Species Structure and Composition 3. Changes in Flora Diversity
10.	Terrestrial Fauna	1. Changes in Species Distribution 2. Changes in Fauna Diversity 3. Changes in Wildlife Habitats
11.	Marine Biota	1. Changes in Nekton Diversity (Including Marine Mammals)
12.	Demographics	1. Changes in Population Migration 2. Changes in Population Growth 3. Changes in Population Structure
13.	Economics	1. Job Opportunities and Unemployment 2. Changes in Level of Income

No.	Environmental Components	Parameters
		3. Changes in Livelihood Patterns 4. Changes in Local Business Growth
14.	Social - Cultural	1. Community Perception 2. Social Tension 3. Indigenous People Marginalization 4. Assimilation and Acculturation 5. Changes in Social Norms and Values 6. Changes in Cultural Heritage 7. Vulnerable Community Groups (Women, Children, the Poor, the Elderly, and the Disabled)
15.	Public Services including Education	1. Changes in Public Services including Education
16.	Public Health	1. Changes in Access to Healthcare 2. Changes in Disease Prevalence 3. Changes in Disease Patterns 4. Changes in Environmental Health

Note:

1. The Terms of Reference for the EIS (ANDAL ToR) was prepared according to Minister of the Environment No. 8 Year 2006 as all significant impacts were grouped into several categories according to their relationship among one another before they were ranked according to their significance level.
2. However, this EIS (ANDAL) document that has been prepared referred to Minister of the Environment Regulation No. 16 Year 2012, and does not set out to rank hypothetical significant impacts by their significance level. Table above, therefore, ranks environmental components and impacted environmental parameters in accordance with the Matrix of Hypothetical Significant Impacts in **Table I-37 Hypothetical Significant Impacts Matrix of LNG Plant Activities**

Table I-37 Hypothetical Significant Impacts Matrix of LNG Plant Activities

ENVIRONMENTAL COMPONENTS	PROPOSED ACTIVITIES	PRE-CONSTRUCTION PHASE	CONSTRUCTION PHASE										OPERATION PHASE										POST-OPERATION PHASE						
		Socialization of the Proposed Activity	Workforce Mobilization and Demobilization	Sea Transportation for Workforce, Equipment and Materials	Land Clearing	Site Preparation	Cut and Fill/Quarry	Construction of LNG Plant and its Supporting Facilities	Alternative of Water Supply		Non-Hazardous and Hazardous Waste Management	Wastewater Management	Power Generator (Diesel Generator)	Storage and Loading of Fuel and Chemicals	Workforce Mobilization	Flaring	Power Generator (Gas Turbines)	Boiler	Acid Gas Incinerator (AGI)	Alternative of Water Supply		Wastewater Management	Non-Hazardous and Hazardous Waste Management	Supporting Facilities (Non Production Facilities - NPF)	Storage and Loading of Fuel and Chemicals	Workforce Demobilization	Facilities Decommissioning	Revegetation	
		A1	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	D1	D2	D3		
		Potential Impact Evaluation Results																											
Physical-Chemical	Air Quality	Increase in SO _x Concentration																											
		Increase in NO _x Concentration																											
		Increase in HC (Hydrocarbon) Concentration																											
		Increase in Total Suspended Particulate (TSP) Content																											
		Increase in Opacity																											
	Greenhouse Gas (GHG)	Light Sighting																											
		Increase in CO ₂ emission																											
	Odor	Increase in H ₂ S Concentration																											
		Increase in Noise Level																											
	Hydrology	Changes in Creek Morphology																											
		Increase in Creek Water Flow Rate																											
		Increase in Surface Water Runoff																											
		Changes in Drainage Pattern																											
	Hydrogeology	Decrease in Shallow Groundwater Level																											
		Increase in Seawater Intrusion																											
		Land Subsidence																											
	Oceanography	Changes in Current Pattern																											
		Increase in Shoreline Abrasion																											
	Soil	Increase in Soil Erosion																											
		Increase in Total Petroleum Hydrocarbon (TPH) Concentration																											
	Surface Water Quality	Changes in Landscape																											
		Increase in Total Dissolved Solids (TDS) Content																											
	Groundwater Quality	Increase in Total Suspended Solids (TSS) Content																											
		Changes in pH Values																											
		Increase in Oil and Grease Concentration																											
		Decrease in Dissolved Oxygen (DO) Content																											
		Increase in COD Content																											
		Increase in BOD Content																											
Increase in Total Phenol Concentration																													
Increase in Total Dissolved Solids (TDS) Content																													
Changes in pH Value																													
Increase in Oil and Grease Concentration																													
Seawater Quality	Increase in Salinity Value																												
	Increase in Coli Bacteria Content (Coliform)																												
	Increase in Total Suspended Solids (TSS) Content																												
	Increase in Salinity Value																												
	Decrease in Dissolved Oxygen (DO) Content																												
	Increase in COD Content																												
Terrestrial Flora	Increase in BOD Content																												
	Increase in Oil and Grease Concentration																												
	Changes in pH Value																												
	Increase in Total Phenol Concentration																												
Terrestrial Fauna	Increase in Ammonia Concentration																												
	Changes in Structure and Composition of Species																												
Freshwater Biota	Changes in Land Cover																												
	Changes in Species Diversity (Endangered and Exotic Species, Ethnobotany)																												
Marine Biota	Species Diversity (Endangered and Exotic Species, Migratory)																												
	Changes in Species Distribution																												
Socio-Economic and Cultural	Changes in Wildlife Habitat																												
	Demographics																												
	Economy	Decrease in Plankton Abundance																											
		Changes in Population Migration (Mobility)																											
		Changes in Population Structure (Age, Education, Gender, Ethnicity, Religion)																											
	Socio-Cultural	Changes in Population Growth																											
		Workforce: Job Opportunities and Unemployment																											
		Changes in Local Business Growth (Financial Institutions, Entrepreneurship)																											
	Public Health	Changes in Level of Income (Income per Capita, Household Income, Expenditure)																											
		Changes in Livelihood Patterns																											
Fishery Activity Disturbance																													
Transportation Accessibility Disturbance																													
Public Health	Community Perception																												
	Assimilation and Acculturation																												
	Changes in Social Norms and Values																												
	Social Tension																												
Public Health	Indigenous People Marginalization																												
	Changes in Cultural Heritage																												
	Vulnerable Community Groups (Women, Children, the Poor, the Elderly, and the Disabled)																												
	Changes in Access to Education																												
Public Health	Changes in Disease Pattern																												
	Changes in Disease Prevalence																												
	Changes in Access to Healthcare																												
	Changes in Environmental Health Changes																												

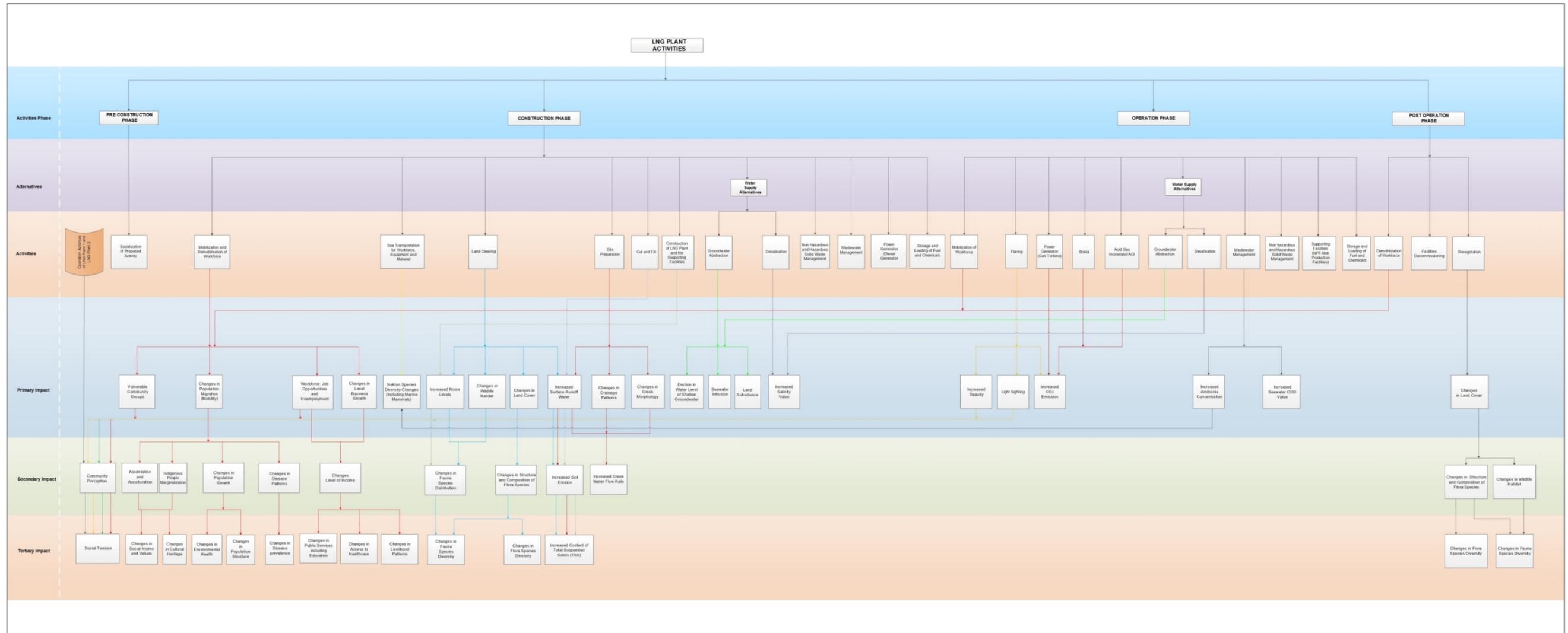


Figure I-76 Flow Chart of Hypothetical Significant Impacts of LNG Plant Activities)

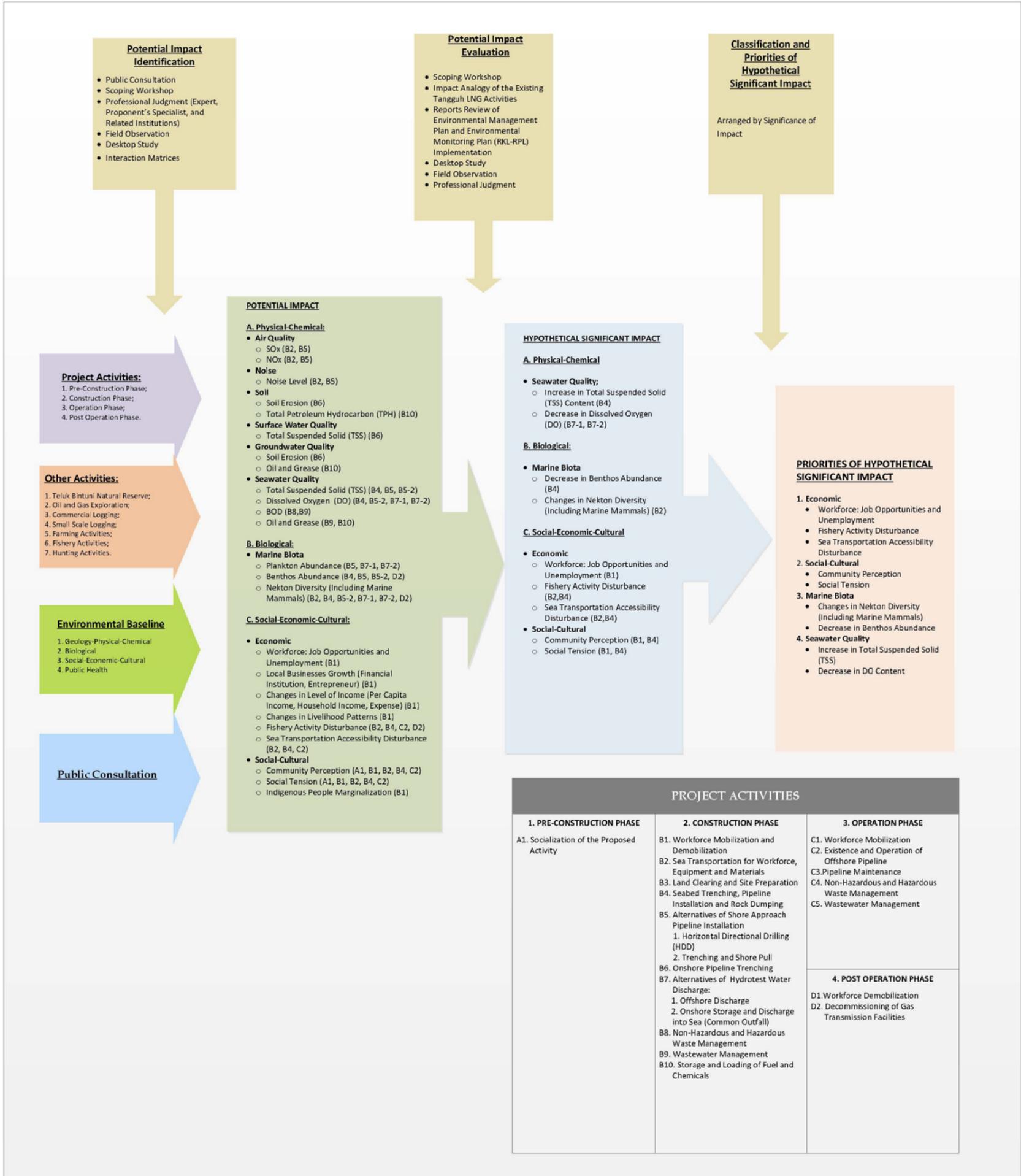


Figure I-77 Summary of the Scoping Process for LNG Plant Activities

1.3.4 Marine Facilities Activity

The scoping process for Marine Facilities Activities generated hypothetical significant impacts to be assessed in EIS (ANDAL) as presented in Table I-38. The matrix of hypothetical significant impacts and flow chart indicating correlation between one hypothetical significant impact with other hypothetical significant impacts along with derivative impacts are presented respectively in Table I-40 Hypothetical Significant Impacts Matrix of Marine Facilities Activities

and Figure I-78, as incorporated in the Terms of Reference of the EIS (ANDAL ToR) approved by Ministry of the Environment (Appendix I - Deputy Minister of the Environment No. 30 Year 2013). Summary of the scoping process is presented in Figure I-79.

Table I-39 Hypothetical Significant Impacts of Marine Facilities Activities

Priority	Environmental Components	Parameters
1.	Oceanography	1. Changes in Wave Patterns 2. Shoreline Abrasion
2.	Seawater Quality	1. Increase in Total Suspended Solids (TSS) Content
3.	Marine Biota	1. Changes in Nekton Diversity (Including Marine Mammals) 2. Decrease in Plankton Abundance 3. Decrease in Benthos Abundance
4.	Economics	1. Fishery Activity Disturbance 2. Sea Transportation Accessibility Disturbance
5.	Social - Cultural	1. Community Perception 2. Social Tension 3. Changes in Cultural Heritage

Note:

1. The Terms of Reference for the EIS (ANDAL ToR) was prepared according to Minister of the Environment No. 8 Year 2006 as all significant impacts were grouped into several categories according to their relationship among one another before they were ranked according to their significance level.
2. However, this EIS (ANDAL) document that has been prepared referred to Minister of the Environment No. 16 Year 2012, and does not set out to rank Hypothetical Significant Impacts by their significance level. Table above, therefore, ranks environmental components and impacted environmental parameters in accordance with the Matrix of Hypothetical Significant Impacts in Table I-40 Hypothetical Significant Impacts Matrix of Marine Facilities Activities

Table I-40 Hypothetical Significant Impacts Matrix of Marine Facilities Activities

ENVIRONMENTAL COMPONENTS		PROPOSED ACTIVITY	PRE-CONSTRUCTION PHASE	CONSTRUCTION PHASE											OPERATION PHASE						POST-OPERATION PHASE					
			Socialization of the Proposed Activity	Workforce Mobilization and Demobilization	Sea Transportation for Workforce, Equipment and Materials	Land Clearing	Site Preparation	Dredging and Dredge Material Disposal	BOF (Bulk Offloading Facility)	LNG Jetty 2 (Combined LNG Jetty - Condensate)	Combo Dock Enhancement	Non-Hazardous and Hazardous Waste Management	Wastewater Management	Storage and Loading of Fuel and Chemicals	Workforce Mobilization	Sea Transportation for Workforce, Equipment and Materials	Maintenance Dredging and Dredge Material Disposal	Loading and Transfer of LNG and Condensate	Non-Hazardous and Hazardous Waste Management	Wastewater Management	Storage and Loading of Fuel and Chemicals	Existence of Marine Facilities	Workforce Demobilization	Decommissioning of Marine Facilities		
		Potential Impact Evaluation Results	A1	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	C1	C2	C3	C4	C5	C6	C7	C8	D1	D2		
Physical-Chemical	Air Quality	Increase in SOx Concentration																								
		Increase in NOx Concentration																								
		Increase in HC (Hydrocarbon) Concentration																								
		Increase in Total Suspended Particulate (TSP) Content																								
		Increase in Opacity																								
	Greenhouse Gas (GHG)	Increase in CO2 emission																								
		Increase in H2S Concentration																								
	Noise	Increase in Noise Level																								
		Changes in Creek Morphology																								
	Hydrology	Increase in Creek Water Flow Rate																								
		Increase in Surface Water Runoff																								
		Changes in Drainage Pattern																								
	Hydrogeology	Decrease in Shallow Groundwater Level																								
		Increase in Seawater Intrusion																								
	Oceanography	Land Subsidence																								
		Changes in Current Pattern																								
		Increase in Shoreline Abrasion																								✓
	Soil	Increase in Soil Erosion																								
		Increase in Total Petroleum Hydrocarbon (TPH) Concentration																								
	Physiography	Changes in Landscape																								
		Increase in Total Dissolved Solids (TDS) Content																								
	Surface Water Quality	Increase in Total Suspended Solids (TSS) Content																								
		Changes in pH Values																								
		Increase in Oil and Grease Concentration																								
		Decrease in Dissolved Oxygen (DO) Content																								
		Increase in COD Content																								
		Increase in BOD Content																								
	Groundwater Quality	Increase in Total Phenol Concentration																								
		Increase in Total Dissolved Solids (TDS) Content																								
		Changes in pH Value																								
Increase in Oil and Grease Concentration																										
Seawater Quality	Increase in Salinity Value																									
	Increase in Coli Bacteria Content (Coliform)																									
	Increase in Total Suspended Solids (TSS) Content									✓																
	Increase in Salinity Value																									
	Decrease in Dissolved Oxygen (DO) Content																									
	Increase in COD Content																									
	Increase in BOD Content																									
Biological	Terrestrial Flora	Changes in Structure and Composition of Species																								
		Changes in Land Cover																								
	Terrestrial Fauna	Changes in Species Diversity (Endangered and Exotic Species, Ethnobotany)																								
		Species Diversity (Endangered and Exotic Species, Migratory)																								
Freshwater Biota	Changes in Species Distribution																									
	Changes in Wildlife Habitat																									
Marine Biota	Freshwater Biota	Decrease in Plankton Abundance																								
		Decrease in Benthos Abundance																								
	Marine Biota	Changes in Nekton Diversity																								
		Decrease in Plankton Abundance																								
Socio-Economic and Cultural	Demographics	Decrease in Benthos Abundance																								
		Changes in Nekton Diversity (Including Marine Mammals)																								
		Increase in Exotic Species																								
	Economy	Changes in Population Migration (Mobility)																								
		Changes in Population Structure (Age, Education, Gender, Ethnicity, Religion)																								
		Changes in Population Growth																								
		Workforce: Job Opportunities and Unemployment																								
	Socio-Cultural	Changes in Local Business Growth (Financial Institutions, Entrepreneurship)																								
		Changes in Level of Income (Income per Capita, Household Income, Expenditure)																								
		Changes in Livelihood Patterns																								
Education	Fishery Activity Disturbance																									
	Transportation Accessibility Disturbance																									
	Community Perception																									
	Assimilation and Acculturation																									
Public Health	Public Health	Changes in Social Norms and Values																								
		Social Tension																								
		Indigenous People Marginalization																								
Public Health	Public Health	Changes in Cultural Heritage																								
		Vulnerable Community Groups (Women, Children, the Poor, the Elderly, and the Disabled)																								
		Changes in Access to Education																								
Public Health	Public Health	Changes in Access to Healthcare																								
		Changes in Environmental Health Changes																								
		Changes in Disease Pattern																								
Public Health	Public Health	Changes in Disease Prevalence																								
		Changes in Access to Healthcare																								
		Changes in Environmental Health Changes																								

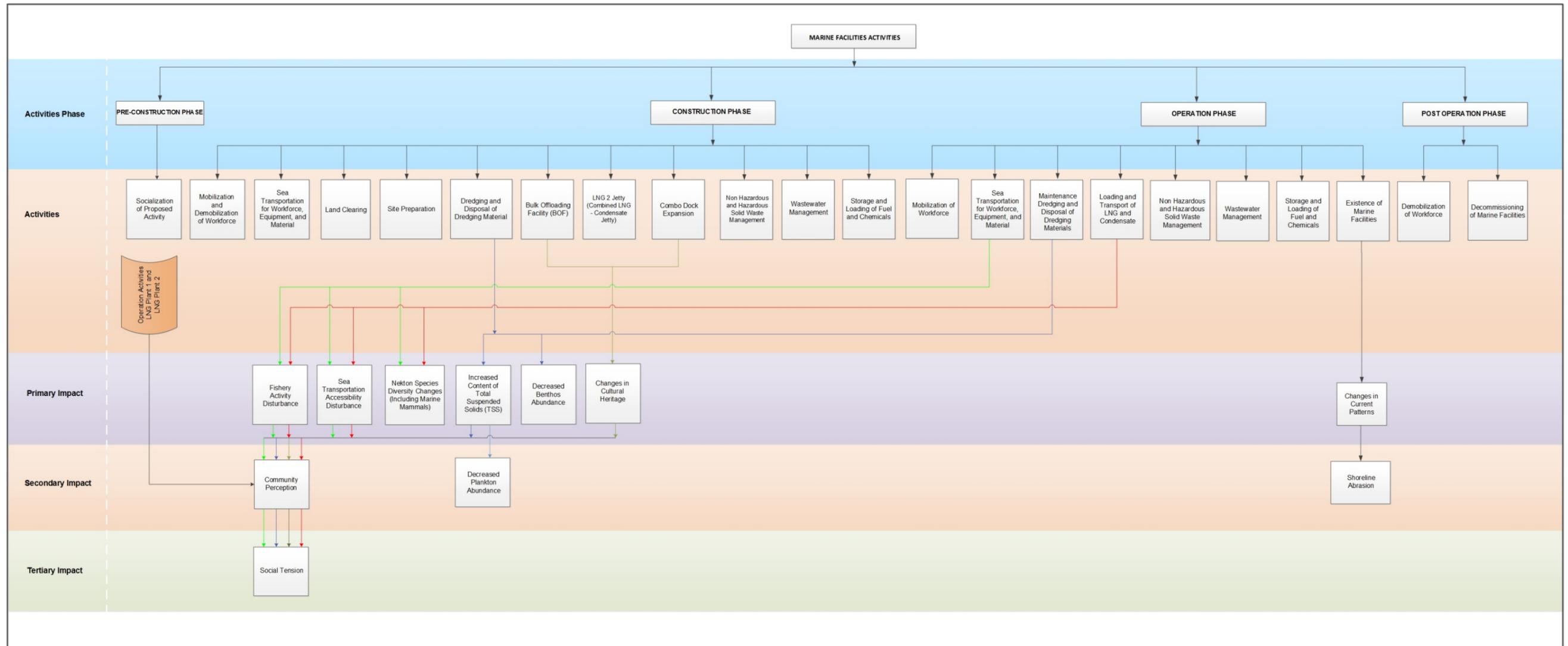


Figure I-80 Flow Chart of Hypothetical Significant Impacts of Marine Facilities Activities)

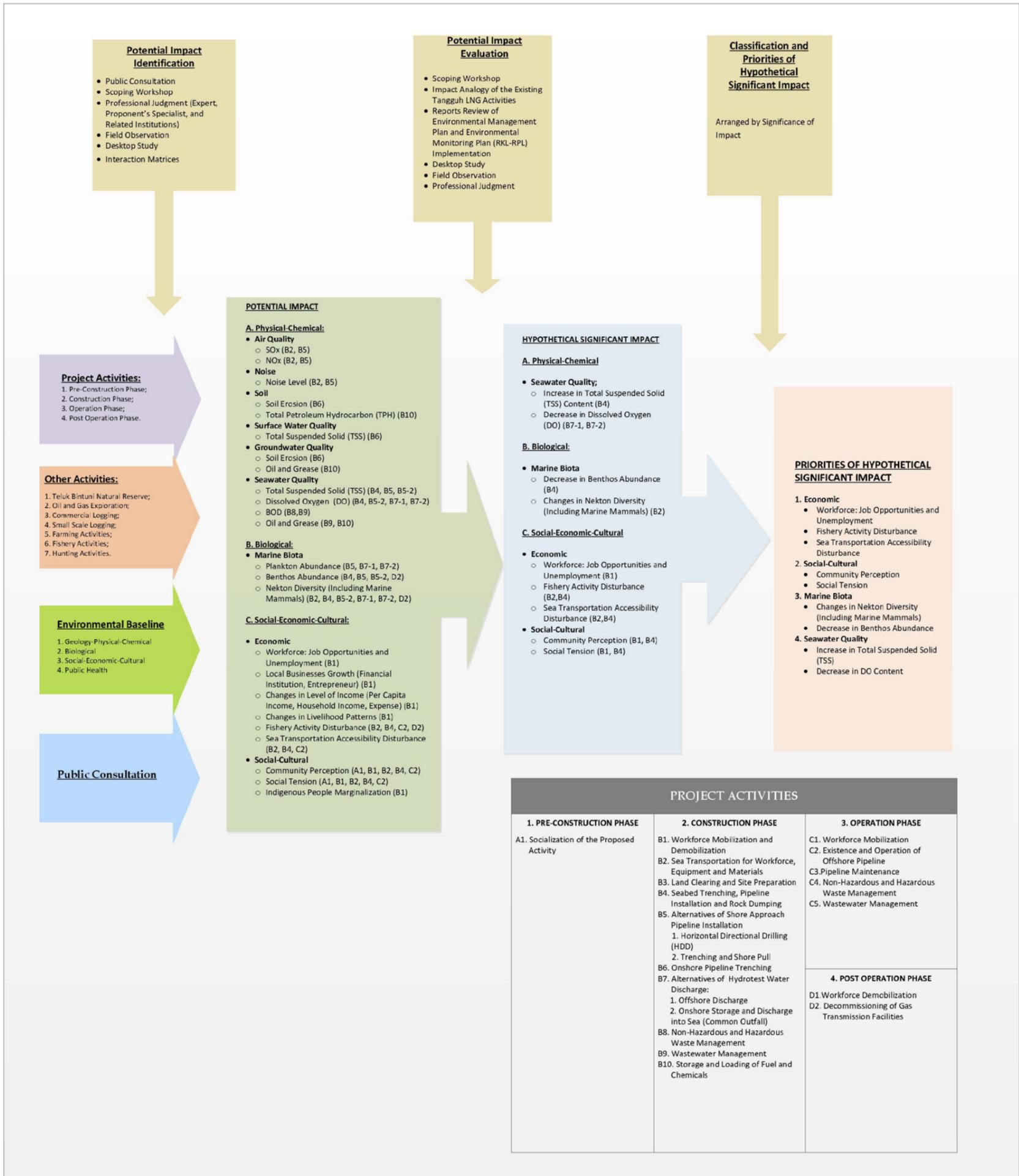
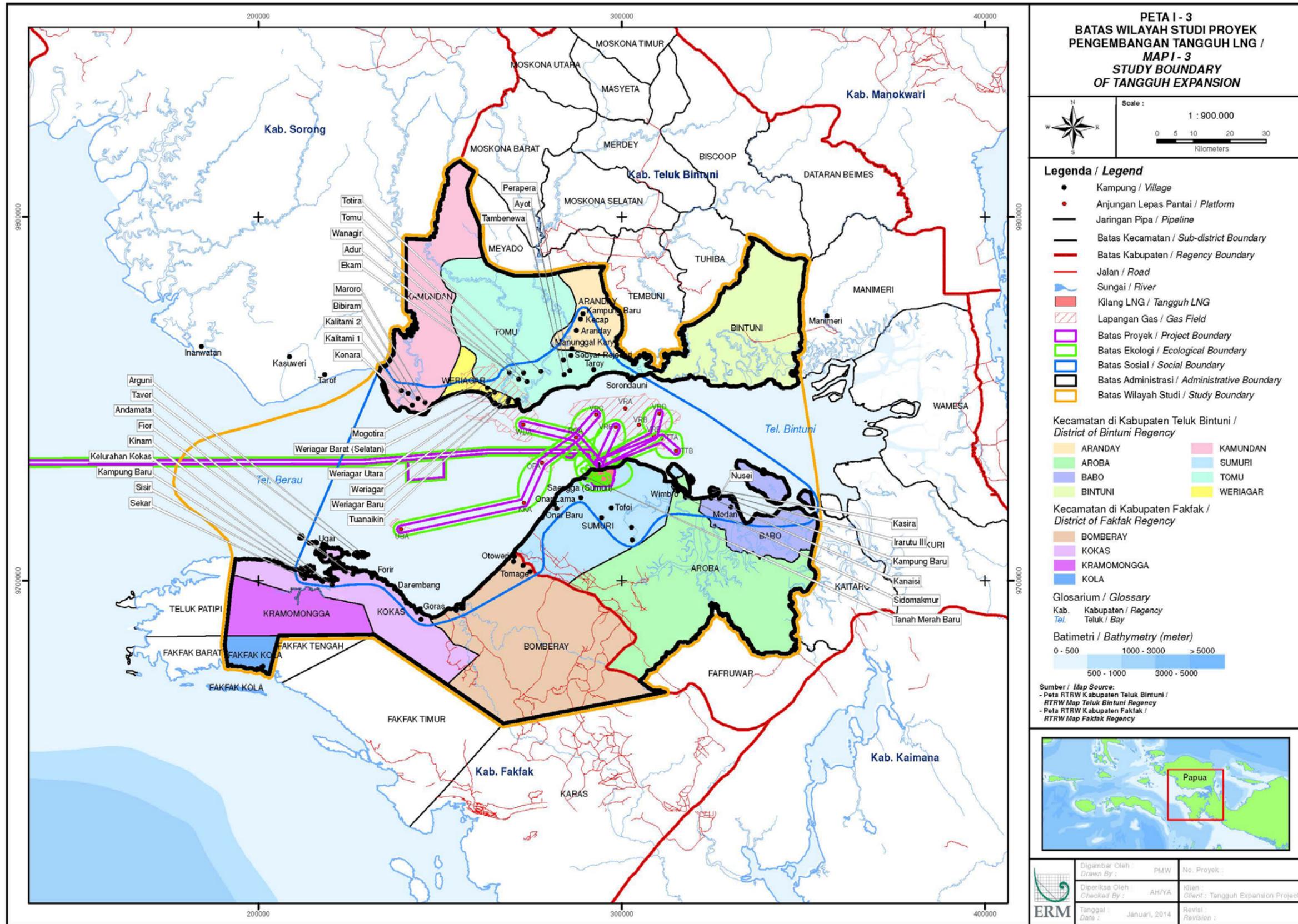


Figure I-81 Summary of the Scoping Process for Marine Facilities Activities

1.4 STUDY AREA BOUNDARY AND TIME FRAME OF IMPACTS ASSESSMENT

1.4.1 Study Area Boundary

The study area boundary of the ANDAL for the Integrated Activities of the Tangguh LNG Expansion Project is delineated through an overlaying process involving Project Boundary, Ecological Boundary, Social Boundary, and Administrative Boundary. The study area boundary covers all activities of the proposed Tangguh LNG Expansion Project during pre-construction, construction, operation, and post-operation phases of Gas Exploitation (Offshore Platforms and Gas Wells Drilling), Gas Transmission, LNG Train, and Marine Facilities activities. The study area boundary for the Tangguh LNG Expansion Project is presented in **Map I-3**. The study boundary is based on the ANDAL ToR approved by Ministry of the Environment on July 24th, 2013 according to Deputy Minister of the Environment Decree No. 30 Year 2013.



Map I-3 Study Area Boundary under the Tangguh LNG Expansion Project

a. Project Boundary

The project boundary for the proposed Tangguh LNG Expansion Project encompasses Initial Development and Future Development, as presented in **Table I-41**.

The project boundary for each main activity is described as follow:

- Each offshore platform will have an exclusion zone within a radius of 500 m;
- Subsea pipelines will have a buffer zone of 1 km to the left and 1 km to the right from the central line;
- The LNG Plant project boundary is located in forest area which has been relinquished for Tangguh LNG development (Ministry of Forestry Decree No. Sk. 287/Menhut-II/2004) dated August 5th, 2004 regarding Relinquishment of Production Forest Area which can be converted as of 3,380 ha for the Tangguh LNG Expansion and Community Resettlement of Simuri-Saengga and Tanah Merah villages where the area of 3,226 ha has been used for current Tangguh LNG operations as well as Tangguh LNG Expansion Facilities. Since February 25th, 2013 the area of 3,226 ha has been granted the right to use certificate issued by Land Office of the Teluk Bintuni Regency No. 00041 which will continuously valid as long as the land is used;
- Marine Facilities (including all jetties) will have safety exclusion zone within the Work Authority Area of the Sea Port (DLKR – *Daerah Lingkungan Kerja Pelabuhan* or The Work Authority Area and DLKP – *Daerah Lingkungan Kepentingan Pelabuhan* or The Interest Authority Area) recommended by Directorate General of Sea Communication; and
- Shipping channel and anchorage area for LNG Tankers, Condensate Tankers and other vessels. The width of the shipping channel is 2 km.

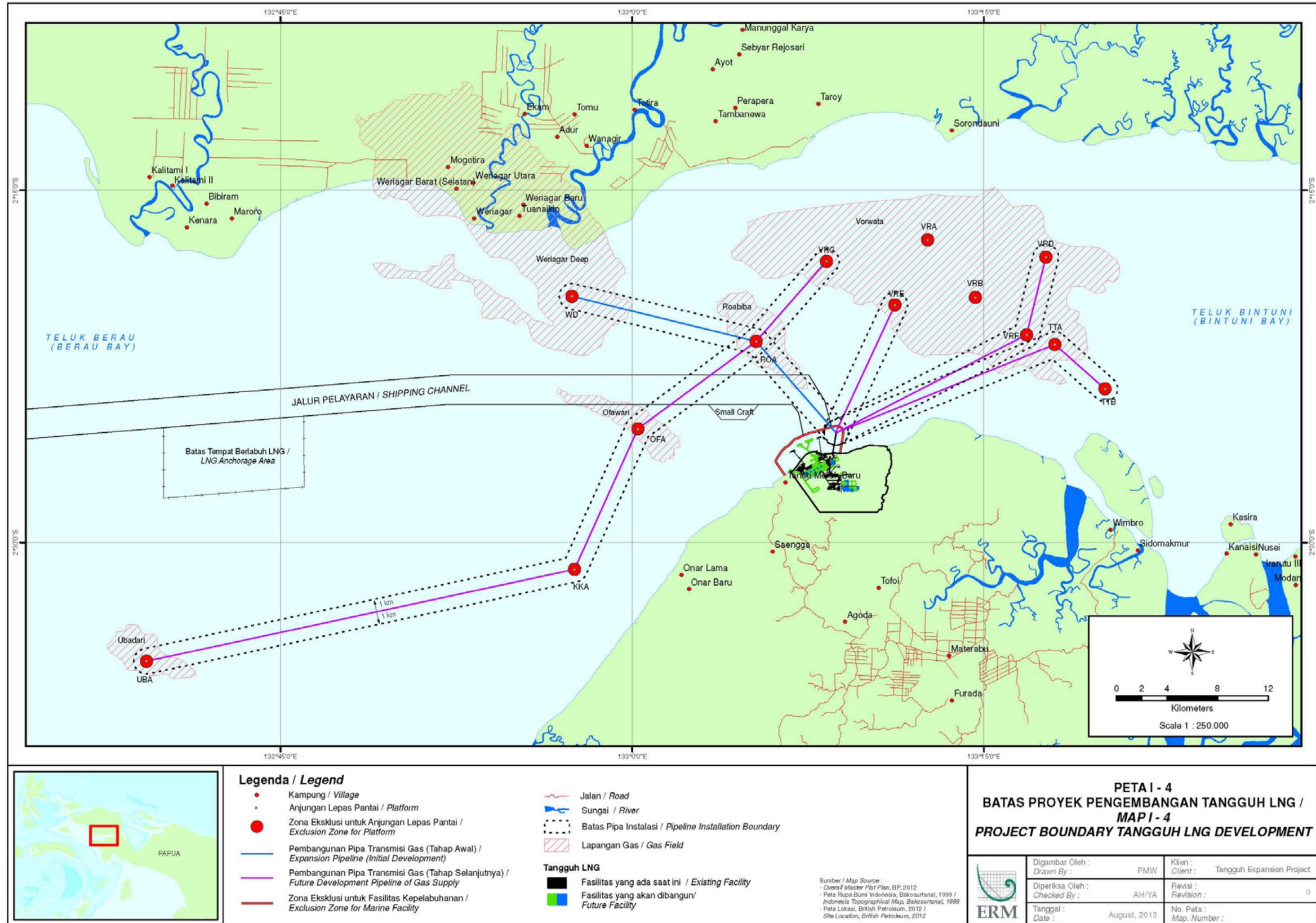
A map of the project boundary is depicted in **Map I-4**.

Table I-41 Initial Development and Future Development

No.	Facilities	Initial Development of the Tangguh LNG	Future Development (up to LNG Train 4)
1	Offshore platform (NUI)	2 offshore platforms (ROA & WDA)	Up to 9 offshore platforms (VRF, OFA, VRD, VRC, TTA, TTB, KKA, UBA, VRE)
2	Gas Production Wells	<p>ROA = 3 Production Wells + 1 DCRI Well (9 slots design)</p> <p>WDA = 4 WDJ Production Wells + 4 WDP Production Wells + 1 DCRI Well + 1 DCRI Well (potential) + 2 WDJ Production Wells (16 slots design)</p> <p>Infill wells (Further development of LNG Train 1 and LNG Train 2):</p> <ul style="list-style-type: none"> • 2 infill wells at VRA + potential DCRI through annulus • 2 infill wells at VRB + potential DCRI through annulus <p>Note: DCRI wells will be drilled on each offshore platform if DCRI option is deemed feasible and reinjection will be done to a dedicated reinjection well.</p>	<p>Detailed designs have not been defined yet, but the standard design is up to 16 slots for each offshore platform.</p> <p>Initial estimation of total production wells on each offshore platform:</p> <p>VRF = up to 7 wells OFA = up to 4 wells VRD = up to 6 wells VRC = up to 5 wells TTA = up to 7 wells TTB = up to 7 wells KKA = up to 2 wells UBA = up to 3 wells VRE = up to 5 wells</p> <p>Note : 1 DCRI Well will potentially be drilled for each offshore platform</p>

No.	Facilities	Initial Development of the Tangguh LNG	Future Development (up to LNG Train 4)
3	Subsea Pipelines	<p>Two Subsea Pipelines:</p> <p>WDA to ROA (hub platform) (Ø 24", estimated length of 16 km)</p> <p>ROA to ORF (Ø 24", estimated length of 14 km)</p>	<p>Up to 9 Subsea Pipelines with a standard diameter of 24"; a final design, however, has not been defined yet.</p> <p>The preliminary design is as follows:</p> <p>VRF to ORF (Ø 24" - estimated length of 19 km)</p> <p>OFA to ROA (Ø 16" - estimated length of 13 km)</p> <p>VRD to VRF (hub platform) (Ø 24" - estimated length of 7 km)</p> <p>VRC to ROA (Ø 24" - estimated length of 9 km)</p> <p>TTA to ORF (Ø 24" - estimated length of 20 km)</p> <p>TTB to ORF (Ø 24" - estimated length of 20 km)</p> <p>KKA to OFA (Ø 24" - estimated length of 30 km)</p> <p>UBA to OFA (Ø 24" - estimated length of 30 km)</p> <p>VRE to ORF (Ø 24" - estimated length of 15 km)</p> <p>Parallel Pipelines (Pipe diameter has not been defined yet; however, initial estimation is around 20"-24" diameter)</p> <p>ROA-WDA, ROA-ORF, VRA-ORF, VRB-ORF, VRE-ORF, VRF-ORF, TTA-ORF, TTB-ORF, KKA-ORF</p> <p>Additional onshore compression facility (near the ORF)</p> <p>The ORF will be expanded to accommodate additional pipelines in the future (the ORF is designed to be expandable).</p>
4	LNG Plant	<p>LNG Plant:</p> <p>1 expandable ORF</p> <p>1 LNG Train</p> <p>1 LNG Tank</p> <p>1 Condensate Tank</p> <p>Utility (1 AGRU - 2 AGIs)</p> <p>1 Flare (to accommodate 6 Trains) - wet and dry and common spare (backup)</p>	<p>LNG Plant:</p> <p>1 expandable ORF</p> <p>1 LNG Train</p> <p>1 LNG Tank</p> <p>1 Condensate Tank (Potential)</p> <p>Utility</p>

No.	Facilities	Initial Development of the Tangguh LNG	Future Development (up to LNG Train 4)
		1 BOG compressor 1 Tankage Flare	
5	Marine Facilities Activities	Marine Facilities Activities: 1 BOF (Bulk Offloading Facility) Dock - Permanent Combo Dock Expansion 1 Combined LNG - Condensate Jetty	
6	Survey, Seismic, and Drilling Activities of Exploration and Delineation/ Appraisal Wells	<ul style="list-style-type: none"> • Regional survey, geophysical and geotechnical activities at Berau PSC and Muturi PSC; • Seismic survey activities (3D and 2D) at Berau PSC and Muturi PSC; • Vertical Seismic Profiling (VSP) survey activities at all production wells to be drilled under the Tangguh LNG Expansion Project activities. • Drilling activities of exploration and delineation/appraisal wells: <ul style="list-style-type: none"> ○ Berau PSC exploration commitment that is drilling of one exploration well in Berau PSC area at prospect/lead to Kepe-kepe, Inos or Ubadari. ○ Delineation/appraisal well drilling i.e. O-2 and V-13 wells, which will be done in the near future at Ofaweri and Vorwata gas field, as well as other proposed delineation/appraisal well drilling at Berau PSC and Muturi PSC area which covers Vorwata, Wiriagar Deep, Ofaweri, Roabiba gas field and/or other prospects such as Kepe-kepe and Teteruga in the future. 	

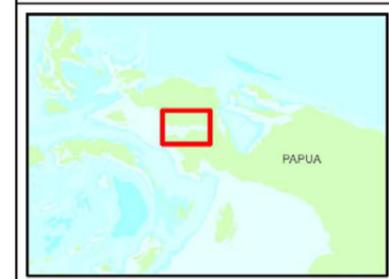
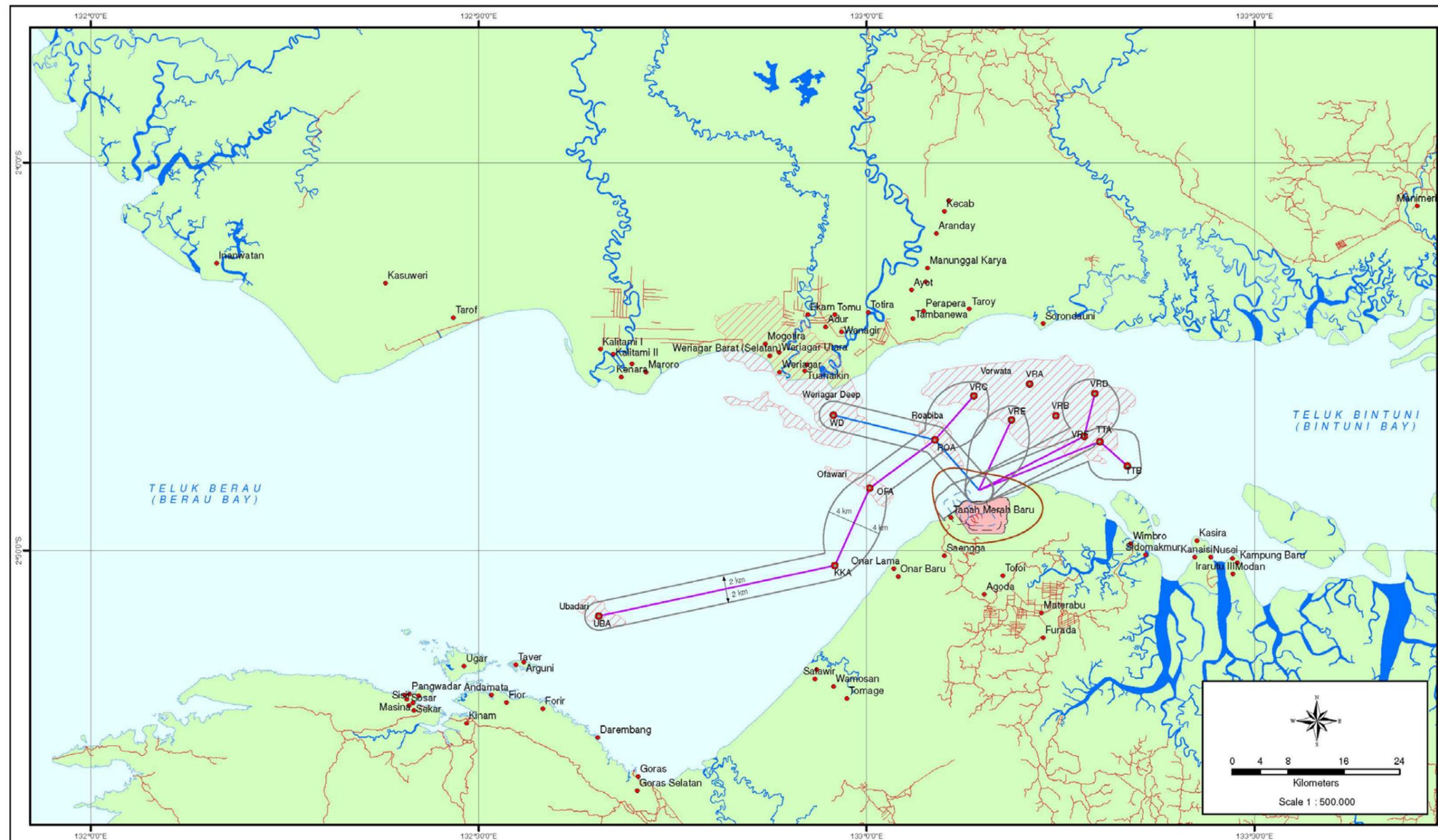


Map I-4 Project Boundary of the Tangguh LNG Expansion Project

b. Ecological Boundary

The ecological boundary was identified by taking into account the spatial distributions of hypothetical significant impacts caused by the project activities through ecological media, notably air and water. It encompasses terrestrial and marine ecosystems that are likely to be affected by activities implemented under the Tangguh LNG Expansion Project (see **Map I-5**). Ecological boundaries for each environmental component that may potentially become affected are detailed below:

1. ***Air quality***: main source of impact to air quality is air emission generated by Tangguh LNG Plant operations. Within the study area boundary, the annually prevailing wind direction is from West (18%) blowing at a maximum wind speed of 8.8 m/s, and 5.7 m/s from South-East. It is predicted that the majority of air emission will disperse toward East and North-West from the source (see **Map I-6**).
2. ***Noise***: main sources of impact to noise come from sea transportation, construction, and land clearing activities. Dispersion of noise impacts potentially occurred inside the project boundary (see **Map I-7**). Except for noise generated by sea transport as a line source that may potentially disperse on a larger area, but which would only affect to marine mammals.
3. ***Seawater Quality***: main sources of impact to seawater quality are from seabed trenching, subsea pipeline installation, drilling mud and drill cuttings discharge, and wastewater discharge (produced water and brine water reject). The dispersion of impact to seawater quality will follow the direction of waves coming from the impacts' source (see **Map I-8**).
4. ***Marine Biota***: main sources of impact to marine biota (plankton and benthos) are from seabed trenching, subsea pipeline installation, drilling mud and drill cuttings discharge, and installation of offshore platform activities.
5. ***Terrestrial Flora and Fauna***: main sources of impact to terrestrial flora and fauna are from land clearing and construction activities of the Tangguh LNG Plant and its supporting facilities that will generate noise affecting wildlife, notably birds (see **Map I-9**).

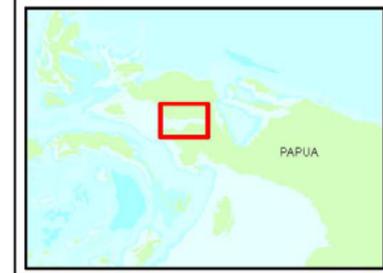
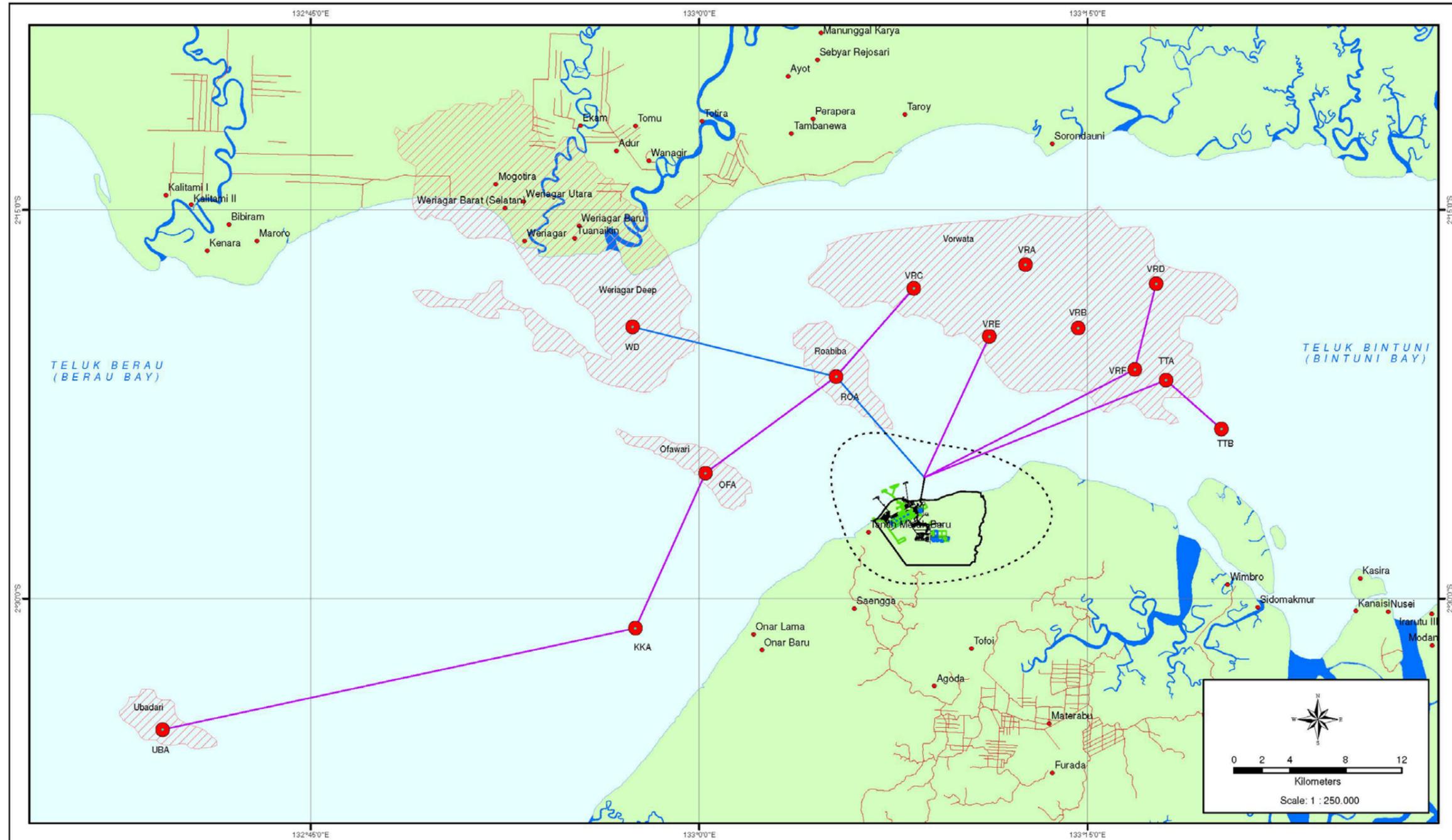


Legenda / Legend	
•	Kampung / Village
•	Anjungan Lepas Pantai / Platform
•	Zona Eksklusi untuk Anjungan Lepas Pantai / Exclusion Zone for Platform
	Jalan / Road
	Sungai / River
	Pembangunan Pipa Transmisi Gas (Tahap Awal) / Expansion Pipeline (Initial Development)
	Pembangunan Pipa Transmisi Gas (Tahap Selanjutnya) / Future Development Pipeline of Gas Supply
	Lapangan Gas / Gas Field
	Tangguh LNG
Batas Ekologi / Ecology Boundary	
	Fauna Terrestrial / Terrestrial Fauna
	Flora Terrestrial / Terrestrial Flora
	Kebersihan / Noise
	Kualitas Udara / Air Quality
	Kualitas Biologi Perairan dan Air Laut / Aquatic Biology and Sea Water Quality

PETA I - 5 BATAS EKOLOGI / MAP I - 5 ECOLOGY BOUNDARY		
Digambar Oleh / Drawn By :	PMW	Klien / Client : Tangguh Expansion Project
Diperiksa Oleh / Checked By :	AH/YA	Revisi / Revision : 0
Tanggal / Date :	Desember, 2013	No. Peta / Map Number :

Sumber / Map Source
 - Overall Master Plan, BP, 2012
 - Peta Rupa Bumi Indonesia, Bakosurtanal, 1999 / Indonesia Topographical Map, Bakosurtanal, 1999
 - Peta Lokasi, British Petroleum, 2012 / Site Location, British Petroleum, 2012

Map I-5 Ecological Boundary



Legenda / Legend

- Kampung / Village
- Anjungan Lepas Pantai / Platform
- Zona Eksklusi untuk Anjungan Lepas Pantai / Exclusion Zone for Platform
- Pembangunan Pipa Transmisi Gas (Tahap Awal) / Expansion Pipeline (Initial Development)
- Pembangunan Pipa Transmisi Gas (Tahap Selanjutnya) / Future Development Pipeline of Gas Supply
- Jalan / Road
- Sungai / River
- Batas Pipa Instalasi / Pipeline Installation Boundary
- ▨ Lapangan Gas / Gas Field

Tanggung LNG

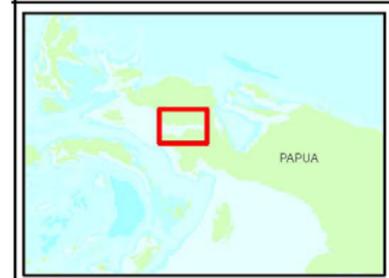
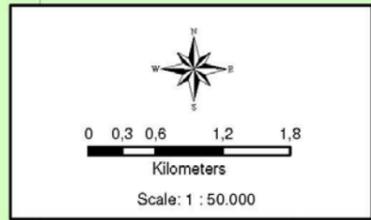
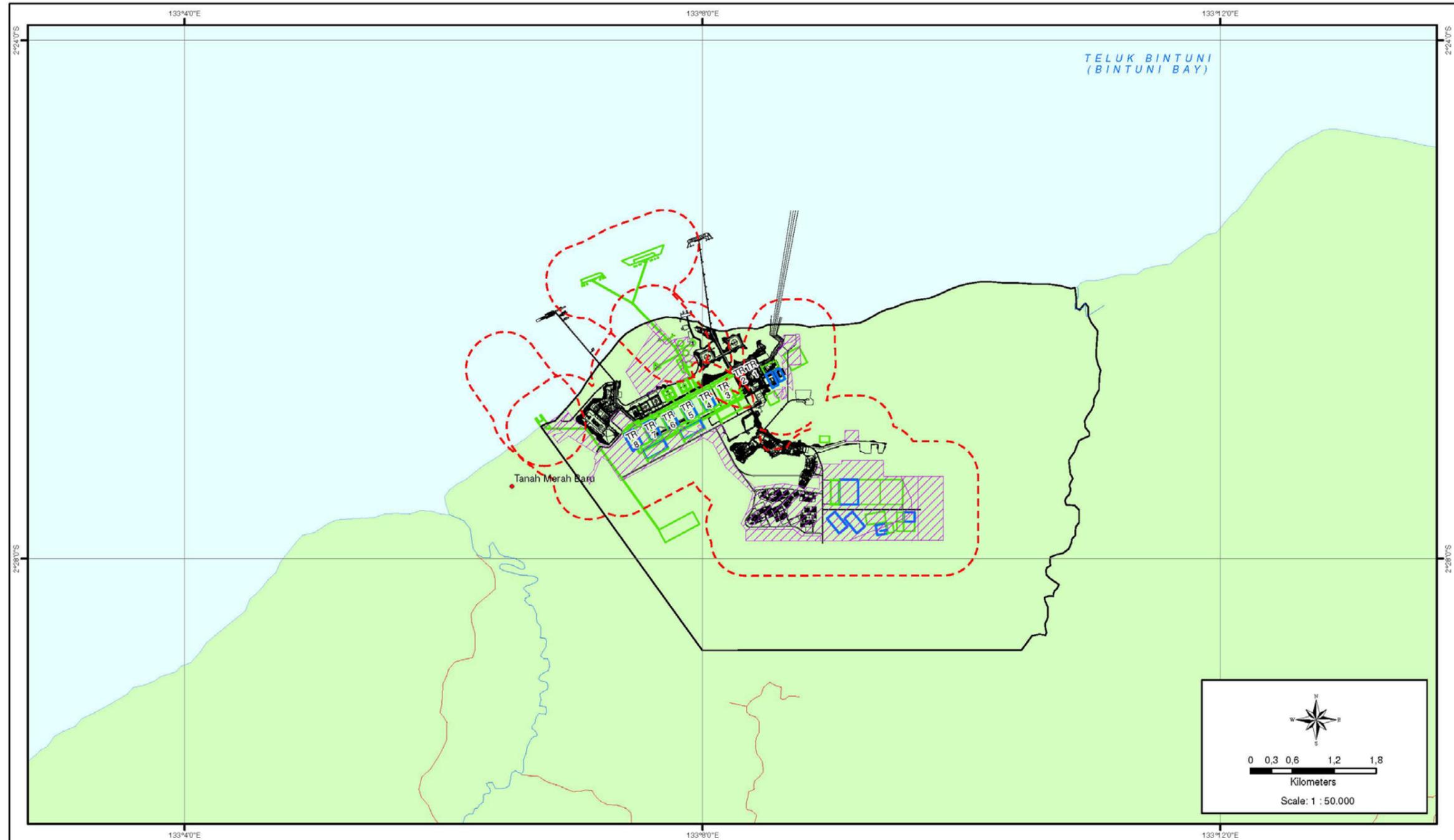
- Fasilitas yang ada saat ini / Existing Facility
- Fasilitas yang akan dibangun / Future Facility

Sumber / Map Source:
 - Overall Master Plot Plan, BP, 2012
 - Peta Rupa Bumi Indonesia, Bakosurtanal, 1999 / Indonesia Topographical Map, Bakosurtanal, 1999
 - Peta Lokal, British Petroleum, 2012 / Site Location, British Petroleum, 2012

**PETA I - 6
 BATAS EKOLOGI (KUALITAS UDARA) /
 MAP I - 6
 ECOLOGY BOUNDARY (AIR QUALITY)**

Digambar Oleh / Drawn By: PMW	Klien / Client: Tangguh Expansion Project
Diperiksa Oleh / Checked By: AH/YA	Revisi / Revision: 0
Tanggal / Date: December, 2013	No. Peta / Map Number:

Map I-6 Ecological Boundary (Air Quality)



Legenda / Legend

- Kampung / Village
- Jalan / Road
- Sungai / River
- Batas Kebisingan / Noise Boundary
- Area Penebangan Pohon / Tree Harvesting Area

Tangguh LNG

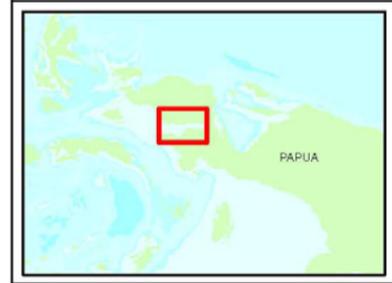
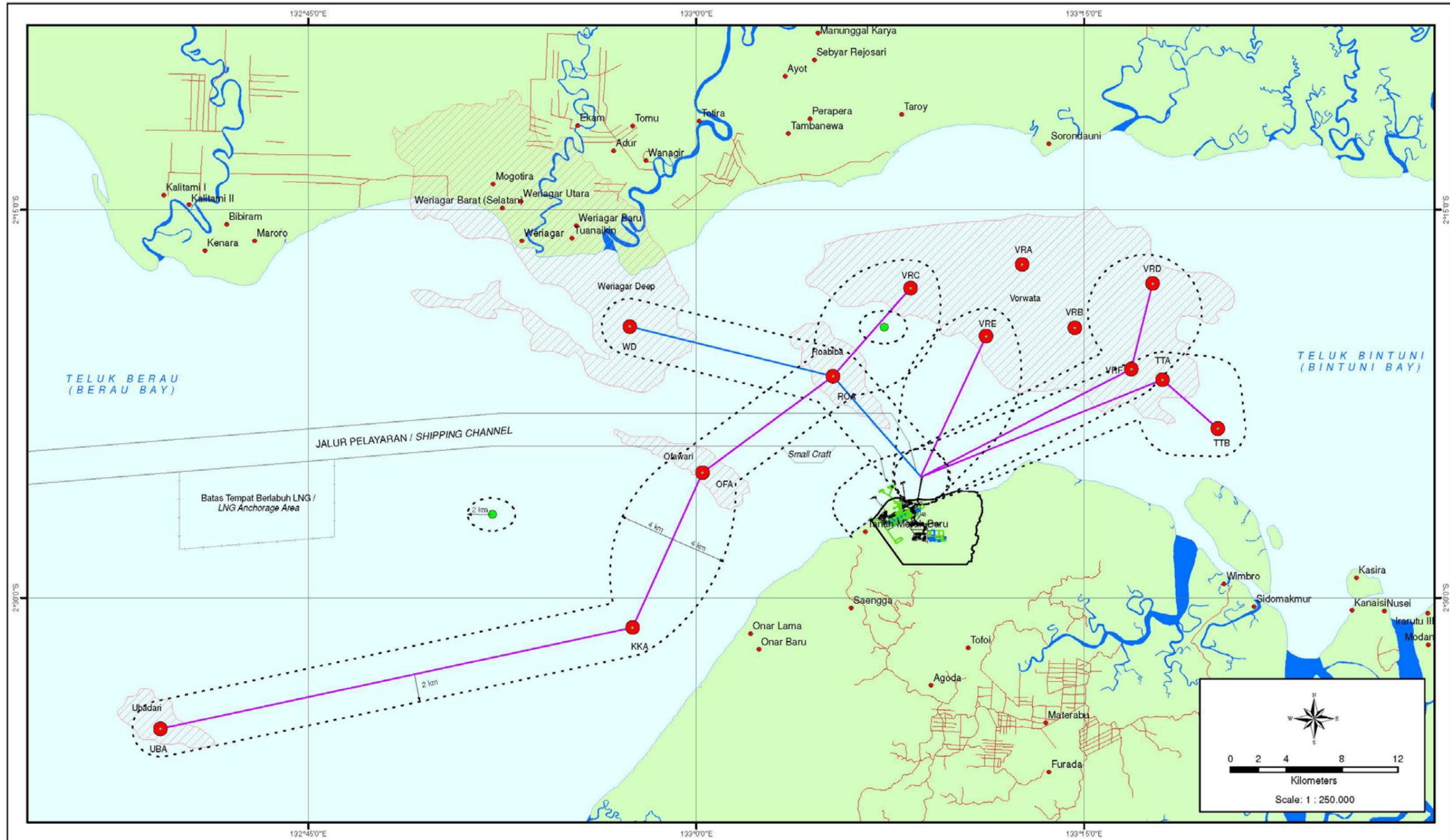
- Fasilitas yang ada saat ini / Existing Facility
- Fasilitas yang akan dibangun / Future Facility

Sumber / Map Source :
 - Overall Master Plot Plan, BP, 2012
 - Peta Rupa Bumi Indonesia, Bakosurtanal, 1999 / Indonesia Topographical Map, Bakosurtanal, 1999
 - Peta Lokasi, British Petroleum, 2012 / Site Location, British Petroleum, 2012



PETA I - 7 BATAS EKOLOGI (KEBISINGAN) / MAP I - 7 ECOLOGY BOUNDARY (NOISE)		
Digambar Oleh / Drawn By :	PMW	Klien / Client : Tangguh Expansion Project
Diperiksa Oleh / Checked By :	AH/YA	Revisi / Revision : 0
Tanggal / Date :	Desember, 2013	No. Peta / Map Number :

Map I-7 Ecological Boundary (Noise)



Legenda / Legend

- Kampung / Village
- Anjungan Lepas Pantai / Platform
- Zona Eksklusi untuk Anjungan Lepas Pantai / Exclusion Zone for Platform
- Dumping Area
- Pembangunan Pipa Transmisi Gas (Tahap Awal) / Expansion Pipeline (Initial Development)
- Pembangunan Pipa Transmisi Gas (Tahap Selanjutnya) / Future Development Pipeline of Gas Supply
- Batas Kualitas Biologi Perairan dan Air Laut / Aquatic Biology and Sea Water Quality
- Jalan / Road
- Sungai / River
- ▨ Lapangan Gas / Gas Field

Tangguh LNG

- Fasilitas yang ada saat ini / Existing Facility
- Fasilitas yang akan dibangun / Future Facility

Sumber / Map Source :

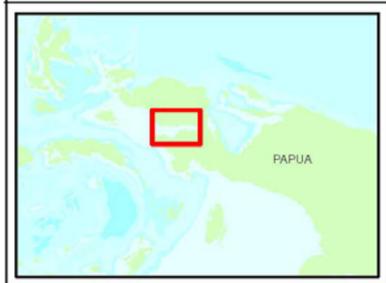
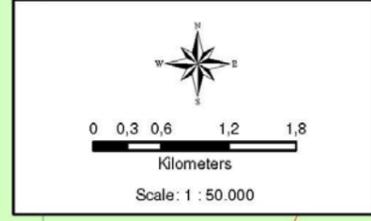
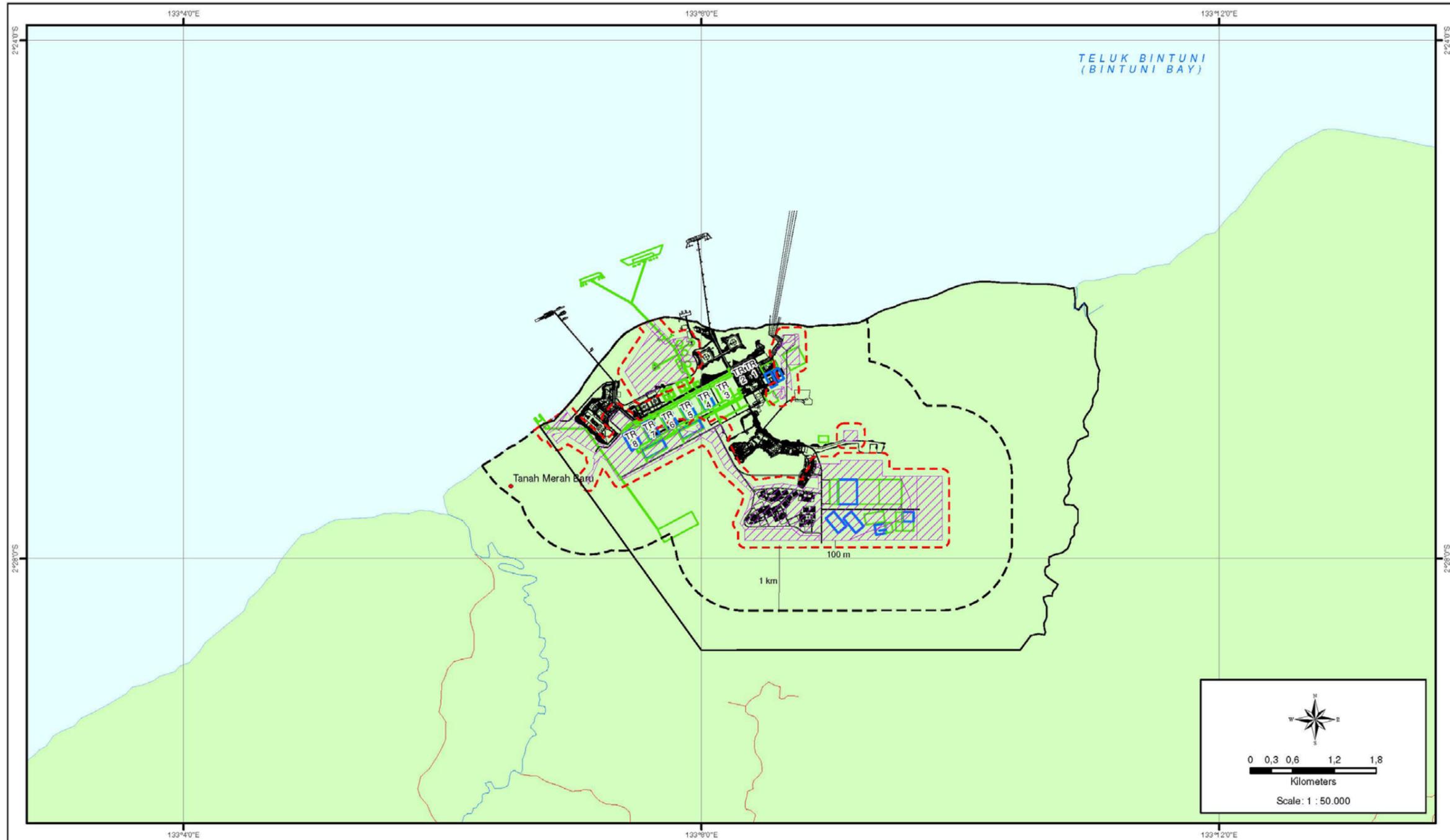
- Overall Master Plot Plan, BP, 2012
- Peta Rupa Bumi Indonesia, Bakosurtanal, 1999 / Indonesia Topographical Map, Bakosurtanal, 1999
- Peta Lokasi, British Petroleum, 2012 / Site Location, British Petroleum, 2012

PETA I - 8
BATAS EKOLOGI
(BIOTA PERAIRAN DAN KUALITAS AIR LAUT) /
MAP I - 8
ECOLOGY BOUNDARY
(AQUATIC BIOLOGY AND SEA WATER QUALITY)

Digambar Oleh / Drawn By :	PMW	Klien / Client :	Tangguh Expansion Project
Diperiksa Oleh / Checked By :	AH/YA	Revisi / Revision :	0
Tanggal / Date :	August, 2013	No. Peta / Map Number :	

ERM

Map I-8 Ecological Boundary (Marine Biota and Seawater Quality)



Legenda / Legend

- Kampung / Village
- Jalan / Road
- Sungai / River
- Area Penebangan Pohon / Tree Harvesting Area
- Fauna Terrestrial / Terrestrial Fauna
- Flora Terrestrial / Terrestrial Flora

Tangguh LNG

- Fasilitas yang ada saat ini / Existing Facility
- Fasilitas yang akan dibangun / Future Facility

Sumber / Map Source:

- Overall Master Plan, BP, 2012
- Peta Rupa Bumi Indonesia, Bakosurtanal, 1999 / Indonesia Topographical Map, Bakosurtanal, 1999
- Peta Lokasi, British Petroleum, 2012 / Site Location, British Petroleum, 2012

PETA I - 9
BATAS EKOLOGI
(FLORA DAN FAUNA TERESTRIAL) /
MAP I - 9
ECOLOGY BOUNDARY
(TERRESTRIAL FLORA AND FAUNA)

	Digambar Oleh / Drawn By: PMW	Klien / Client: Tangguh Expansion Project
	Diperiksa Oleh / Checked By: AH/YA	Revisi / Revision: 0
	Tanggal / Date: August, 2013	No. Peta / Map Number:

Map I-9 Ecological Boundary (Terrestrial Flora and Fauna)

c. Social Boundary

The social boundary is based on the ANDAL ToR (the EIS ToR) agreed by Ministry of the Environment on July 24th, 2013 (Appendix I - Deputy Minister of the Environment Decree No. 30 Year 2013) by taking into account the following:

- A condition where traditional norms and values are present in social interaction around the proposed activities site, including social systems and structures.
- The proposed activities are in conformity with social dynamics.
- A region undergoes fundamental changes (social, economic, and cultural) caused by the proposed activities.
- Communities within project and ecological boundaries;
- Communities outside project and ecological boundaries, but who would potentially affected by the fundamental changes, e.g. job opportunities and development of public and social facilities; and
- The indigenous people living on the coast of Bintuni Bay who have been affected by Tangguh LNG activities.

Aside from the above criteria, two more criteria were taken into account in the identification of the social study area boundary under the Tangguh LNG Expansion Project, among others:

- Villages potentially affected by the project's activities; and
- The presence of Indigenous Community Villages along the coast of Bintuni Bay is acknowledged as they are the places of residence of Sebyar, Simuri, Irarutu, as well as Petuanan-Petuanan Arguni, Sekar Pikipik, and Wertuwar tribes who are affected by Tangguh LNG activities.

The social boundary for EIA study of the Tangguh LNG Expansion Project took into consideration those villages that are likely to be potentially affected. However, the boundary does not reflect social management program area. Villages included in the study area boundary and potentially to be affected area are as follows:

A. Teluk Bintuni Regency

1. Babo District:

- a. Modan Village;
- b. Kanaisi Village;
- c. Nusei Village;
- d. Kasira Village;
- e. Kampung Baru Village; and
- f. Irarutu 3 Village.

2. Aroba District:
 - a. Sidomakmur Village; and
 - b. Wimbrow Village.
3. Sumuri District:
 - a. Tanah Merah Village;
 - b. Saengga (Sumuri) Village;
 - c. Tofoi Village (including Padang Agoda Village);
 - d. Materabu Village;
 - e. Furada Village;
 - f. Onar Lama Village; and
 - g. Onar Baru Village.
4. Kamundan District
 - a. Kalitami 1 Village;
 - b. Kalitami 2 Village;
 - c. Bibiram Village;
 - d. Kenara Village; and
 - e. Maroro Village.
5. Tomu District:
 - a. Totira Village;
 - b. Wanagir Village;
 - c. Adur Village;
 - d. Tomu Village;
 - e. Ekam Village;
 - f. Ayot Village;
 - g. Taroy Village;
 - h. Perapera Village;
 - i. Tambanewa Village;
 - j. Sorondauni Village; and
 - k. Sebyar Rejosari Village.
6. Aranday District:
 - a. Manunggal Karya Village;
 - b. Kecap Village;
 - c. Kampung Baru Village; and
 - d. Aranday Village.

7. Weriagar District:
 - a. Weriagar Village;
 - b. Weriagar Baru Village;
 - c. Mogotira Village;
 - d. Weriagar Selatan Village¹;
 - e. Weriagar Utara Village; and
 - f. Tuanaikin Village.

B. Fakfak Regency

1. Kokas District:
 - a. Goras Village;
 - b. Goras Selatan Village¹;
 - c. Darembang Village;
 - d. Fior Village;
 - e. Furir Village;
 - f. Andamata Village;
 - g. Arguni Village;
 - h. Taver Village;
 - i. Kinam Village;
 - j. Kokas Village;
 - k. Kampung Baru Village;
 - l. Pangwadar Village¹;
 - m. Sisir Village;
 - n. Masina Village¹;
 - o. Sekar Village;
 - p. Sosar Village¹; and
 - q. Ugar Village.
2. Bomberay District
 - a. Otoweri Village;
 - b. Salawir Village¹;
 - c. Tomage Village; and
 - d. Wamosan Village¹

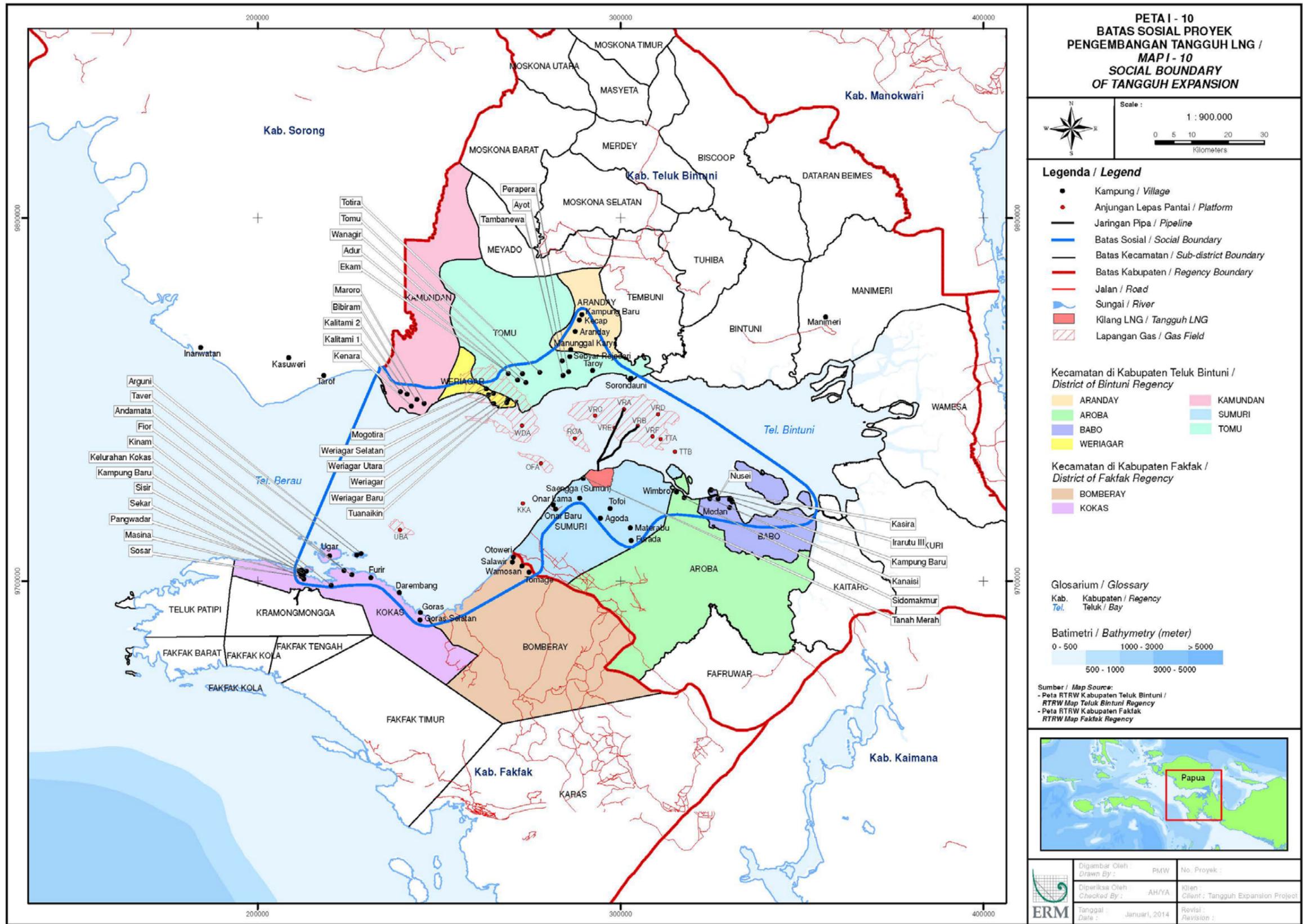
¹ Established by virtue of the breaking up of the Parent Village

Aforementioned villages will be assessed in the EIS and then analysed to identify those that will form part of social management plan under the Tangguh LNG Expansion Project.

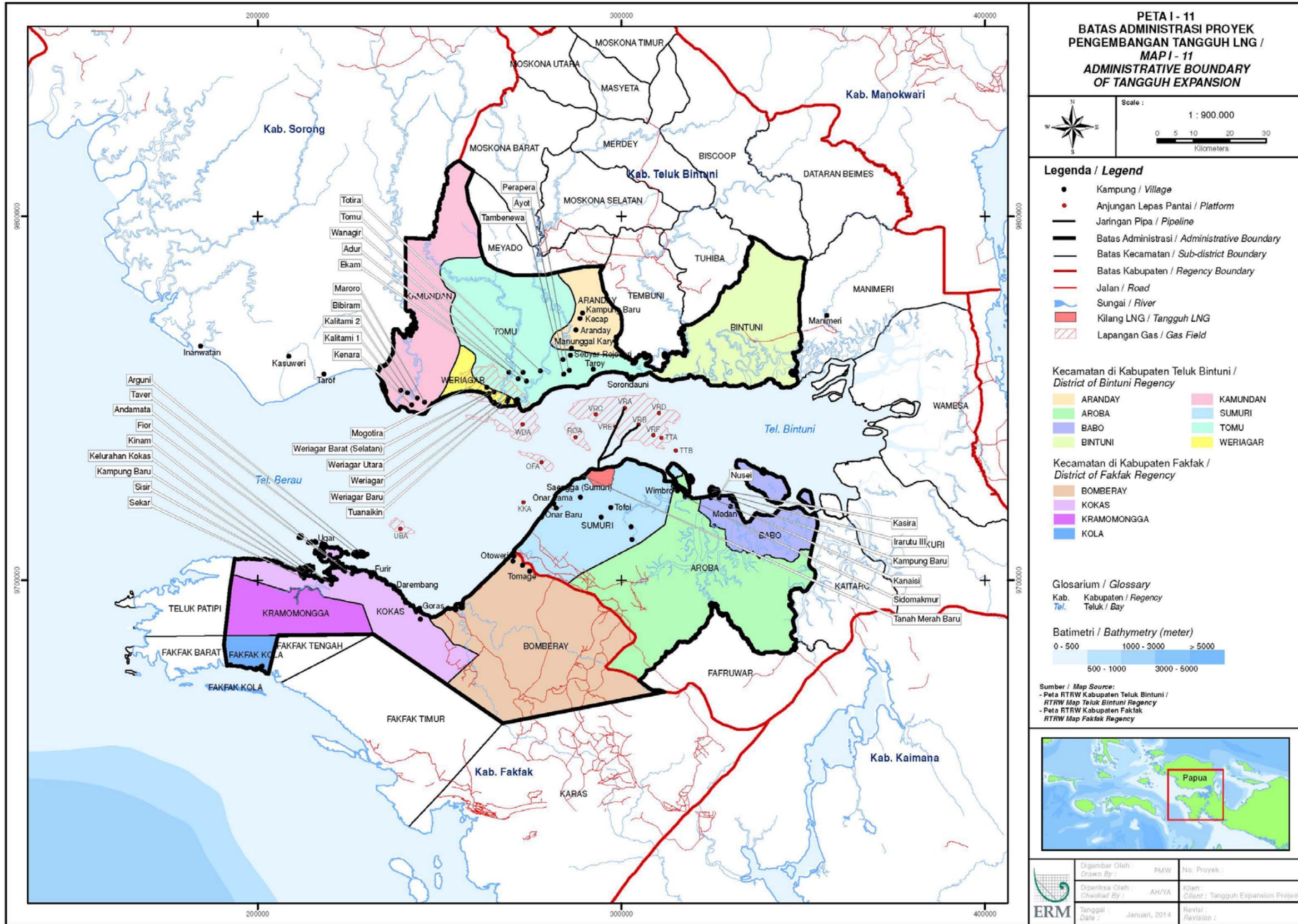
The social boundary illustrates the existing social structure/system, which may potentially be affected by the proposed project activities. The social boundary for the Tangguh LNG Expansion Project is depicted in **Map I-10**.

d. Administrative Boundary

The administrative boundary has been drawn based on the district boundaries of Teluk Bintuni Regency and Fakfak Regency, encompassing all villages potentially affected by the Tangguh LNG Expansion Project activities, as outlined above. There are 7 Districts (Babo, Aroba, Sumuri, Kamundan, Tomu, Aranday, and Weriagar) in Teluk Bintuni Regency and 2 (Kokas and Bomberay) in Fakfak Regency. The administrative boundary is depicted in **Map I-11**.



Map I-10 Tangguh LNG Expansion Project - Social Boundary



Map I-11 Tangguh LNG Expansion Project - Administrative Boundary

1.4.2 Time Frame of Impacts Assessment

The time frame of impact assessment is the time frame during which impacts take place against parameters of environmental components that were identified to be affected by project activities. Any hypothetical significant impact arising out of the scoping process as addressed in the ToR-EIS (ANDAL ToR) Document Sub Section 2.3.3 concerning Evaluation of Potential Impacts and Sub Section 2.3.4 concerning Priorities of Hypothetical Significant Impacts are assessed to identify the time frame of impacts arising out of the project activities and to use it to measure changes against baseline during the study.

The baseline condition without the Tangguh LNG Expansion Project is the current environmental baseline within the study boundary area that has been affected by ongoing activities, i.e. the operation activities of LNG Train 1 and Train 2, forest timber concessions (HPH - *Hak Penguasaan Hutan*), fishery activities, and other companies' oil and gas exploration activities. The time frame of impacts assessment to environmental components parameters that are affected by each phase of the project activities (Pre-Construction, Construction, Operation, and Post-Operation) of the proposed Gas Exploitation Project activities (Offshore Platforms and Gas Wells Drilling), Gas Transmission, LNG Plant, and Marine Facilities Activities are presented in **Table I-42** to **Table I-42**.

Table I-43 Gas Exploitation Activities (Offshore Platforms and Gas Wells Drilling)

No.	Activities	Environmental Components	Hypothetical Significant Impacts	Time Frame of Impact Assessment
<i>Construction Phase</i>				
B1	Workforce Mobilization and Demobilization	Economics	Job Opportunities	About the first 1-4 months when drilling and (new) platform installation activities commence, during construction works, and 1-3 months after each activity is completed and ready for demobilization.
			Changes in Local Business Growth (Financial Institutions, Entrepreneurship)	
		Social-Cultural	Community Perception	
			Social Tension	
B3 B4	Offshore Platform Transportation and Installation	Marine Biota	Changes in Nekton Diversity (Including Marine Mammals)	Takes place in separate space and time with estimation of around 3-6 months (up to 1 month after the activity) for the installation of each platform
		Economics	Fishery Activity Disturbance	
			Sea Transportation Accessibility Disturbance	
		Social-Cultural	Community Perception	

No.	Activities	Environmental Components	Hypothetical Significant Impacts	Time Frame of Impact Assessment
			Social Tension	
B4	Production Well Drilling	Noise	Increase in Noise Level	Takes place in separate space and time with estimation of around 3-6 months for each well drilling. For each platform, the total wells to be drilled are estimated up to 10 wells with available slots up to 16 slots. The first stage of drilling activities will be continuous over a period of about 8 years at different time and space. Impacts are estimated to occur up to one month after completion of drilling activities.
		Marine Biota	Changes in Nekton Diversity (Including Marine Mammals)	
		Economics	Fishery Activity Disturbance	
		Social-Cultural	Community Perception	
Social Tension				
B5	Alternatives of Drilling Mud and Drill Cuttings Management (Note: This impact has linkage to the Option of overboard discharge at drilling locations)	Seawater Quality	Increase in TSS Content	Takes place in separate space and time with estimation of around 3-6 months for each well drilling. For each platform, the total wells to be drilled are estimated up to 10 wells with available slots up to 16 slots. The first stage of drilling activities will be continuous over a period of about 8 years at different time and space. Impacts are estimated to occur up to one month after completion of drilling activities.
			Increase in Oil and Grease Concentrations (applicable only when using SBM)	
		Marine Biota	Decrease in Plankton Abundance	
			Decrease in Benthos Abundance	
Nekton Diversity (Including Marine Mammals)				

No.	Activities	Environmental Components	Hypothetical Significant Impacts	Time Frame of Impact Assessment
B6	Production Well Clean-Up (Flaring)	Social-Cultural	Community Perception	Takes place in separate space and time with flaring estimation around 2-3 days during the clean-up period of each well. Flaring can be carried out at the end of the drilling of each well (once every 3-6 months) or consecutively over a specific period of time (if drills are carried out in batch mode). For each platform, the total wells to be drilled are estimated up to 10 wells with available slots up to 16 slots.
			Social Tension	
Operation Phase				
C3	Existence of Offshore Platform	Marine Biota	Nekton Diversity (Including Marine Mammals)	20-30 years throughout the operation phase up to decommissioning of project facilities
		Economics	Fishery Activity	
			Sea Transportation Accessibility Disturbance	
		Social-Cultural	Community Perception	
Social Tension				

Table I-44 Gas Transmission Activities

No.	Activities	Environmental Components	Hypothetical Significant Impacts	Time Frame of Impact Assessment
Construction Phase				
B1	Workforce Mobilization and Demobilization	Economics	Job Opportunities	About the first 1-3 months when pipeline installation activities commence, 10-12 months during the works, and 1-3 months after each activity is completed and ready for demobilization.
		Social-Cultural	Community Perception	
			Social Tension	

No.	Activities	Environmental Components	Hypothetical Significant Impacts	Time Frame of Impact Assessment
B2	Sea Transportation for Workforce, Equipment, and Materials	Marine Biota	Changes in Nekton Diversity (Including Marine Mammals)	Takes place about 10-12 months at separate time and space for each pipeline installation.
		Economics	Fishery Activity	
B4	Sea Bed Trenching, Pipeline Installation, and Rock Dumping	Seawater Quality	Increase in Total Suspended Solids Content (TSS)	Takes place in separate space and time over an estimated period of 10-12 months for gas transmission pipeline installation of 30 km length with detail activities are as follows: 3-4 months for pipelines installation, 2-3 months for trenching, and 4-6 months for rock dumping.
		Marine Biota	Decrease in Benthos Abundance	
		Economics	Fishery Activity Disturbance	
			Sea Transportation Accessibility Disturbance	
		Social-Cultural	Community Perception	
Social Tension				
B8	Hydrotest Water Discharge (Dewatering)	Seawater Quality	Reduce in DO Content	Approximately 3-7 days during dewatering for each pipeline.

Table I-45 LNG Plant Activities

No.	Activities	Environmental Components	Hypothetical Significant Impacts	Time Frame of Impact Assessment
<i>Construction Phase</i>				
B1	Workforce Mobilization and Demobilization	Demographics	Changes in Population Migration (Mobility)	The first 2-4 months when LNG Train construction activities commence, about 4 years during the construction work, and 2 - 4 months after each activity is completed and ready for demobilization.
			Changes in Population Structure (Age, Education, Sex, Ethnicity, Religion)	
			Changes in Population Growth	

No.	Activities	Environmental Components	Hypothetical Significant Impacts	Time Frame of Impact Assessment
		Economics	Job Opportunities	
			Changes in Local Business Growth	
			Changes in Livelihood Patterns	
			Changes in Level of Income	
		Social Cultural	Community Perception	
			Assimilation and Acculturation	
			Changes in Social Norms and Values	
			Social Tension	
			Indigenous People Marginalization	
			Changes in Cultural Heritage	
			Vulnerable Community Groups, e.g. Women, Children, the Poor, the Elderly, and the Disabled	
		Public Services including Education	Changes in Public Services including Education	
		Public Health	Changes in Disease Patterns	
			Changes in Disease Prevalence	
			Changes in Access to Healthcare	
			Changes in Environmental Health	

No.	Activities	Environmental Components	Hypothetical Significant Impacts	Time Frame of Impact Assessment
B2	Sea Transportation for Workforce, Equipment, and Materials	Marine Biota	Changes in Nekton Diversity (Including Marine Mammals)	Approximately 3 – 4 years throughout the construction period
B3	Land Clearing	Noise	Increase in Noise Level	<p>Take places during 4 years throughout the construction period and could be continued up to operation phase, the impacts will lessen once re-vegetation activities for vacant land that is not used for permanent facilities have been completed.</p> <p>Take place during 9-13 months throughout site preparation activities up to the end of construction phase.</p> <p>Changes in drainage patterns may take place permanently; however, the derivative impacts may lessen once the construction work of a permanent drainage has been completed.</p>
		Hydrology	Increase in Surface Water Run-Off	
		Soil	Increase in Soil Erosion	
		Surface Water Quality	Increase in TSS Content	
		Terrestrial Flora	Changes in Species Structure and Composition	
			Changes in Land Cover	
			Change in Flora Species Diversity	
		Terrestrial Fauna	Changes in Fauna Species Diversity	
			Changes in Species Distribution	
Change in Wildlife Habitats				
B4	Site Preparation	Hydrology	Increase in Surface Water Run-Off	<p>Takes place during 9-13 months throughout site preparation activities up to the end of construction phase and once construction work of a permanent drainage has been completed or until site stabilization and re-vegetation activities for vacant land that is unused for permanent facilities have been completed.</p>
			Changes in Drainage Patterns	
			Changes in Creek Morphology	
			Changes in Creek Water Flow Rate	
		Soil	Increase in Soil Erosion	
		Surface Water Quality	Increase in TSS Content	

No.	Activities	Environmental Components	Hypothetical Significant Impacts	Time Frame of Impact Assessment
B5	Cut and Fill	Hydrology	Increase in Surface Water Run-Off	Takes place during 9-13 months throughout site preparation activities up to the end of construction phase. Changes in drainage patterns may take place permanently; however, the derivative impacts may lessen once the construction work of a permanent drainage has been completed.
		Soil	Increase in Soil Erosion	
		Surface Water Quality	Increase in TSS Content	
B6	Construction of the LNG Plant and its Supporting Facilities	Noise	Increase in Noise Level	Approximately 3-4 years throughout the construction period
		Terrestrial Fauna	Changes in Species Distribution	About 3-4 years throughout the construction period and could be continued up to operation phase
B7	Alternative Water Supplies: Option 1: Groundwater Abstraction	Hydrology	Decrease in Shallow Groundwater Level	About 3-4 years throughout the construction period and could be continued up to operation phase
			Seawater Intrusion	
			Land Subsidence	
		Social Cultural	Community Perception	
	Social Tension			
Option 2: Desalination	Seawater Quality	Increase in Salinity		
Operation Phase				
C1	Workforce Mobilization	Demographics	Changes in Population Migration (Mobility)	Takes place throughout the operation phase, about 20-30 years
			Changes in Population Structure (Age, Education, Sex, Ethnicity, Religion)	

No.	Activities	Environmental Components	Hypothetical Significant Impacts	Time Frame of Impact Assessment
			Changes in Population Growth	
		Economics	Job Opportunities	
			Changes in Local Business Growth	
			Changes in Livelihood Patterns	
			Changes in Level of Income (Income per Capita, Household Income, Expenditure)	
		Social Cultural	Community Perception	
			Assimilation and Acculturation	
			Changes in Social Norms and Values	
			Social Tension	
			Indigenous People Marginalization	
			Changes in Cultural Heritage	
			Vulnerable Community Groups, e.g. Women, Children, the Poor, the Elderly, and the Disabled	
		Public Services including Education	Changes in Public Services including Education	
		Public Health	Changes in Disease Patterns	
			Changes in Disease Prevalence	
			Changes in Access to Healthcare	

No.	Activities	Environmental Components	Hypothetical Significant Impacts	Time Frame of Impact Assessment
			Changes in Environmental Health	
C2	Flaring	Air Quality	Increase in CO ₂ Emissions (from LNG Plant Operations)	Takes place throughout the operation phase, about 20-30 years
			Increase in Opacity	
			Light Sighting	
		Social-Cultural	Community Perception	
			Social Tension	
C3	Electrical Power Generator (Gas Turbine)	Air Quality	Increase in CO ₂ Emission	Takes place throughout the operation phase, about 20-30 years
C4	Boiler	Air Quality	Increase in CO ₂ Emission	Takes place throughout the operation phase, about 20-30 years
C5	Acid Gas Incinerator (AGI)	Air Quality	Increase in CO ₂ Emission	Takes place throughout the operation phase, about 20-30 years
C6	Alternatives of Water Supply: Option 1: Groundwater Abstraction	Hydrogeology	Decrease in Shallow Groundwater Level	Takes place throughout the operation phase, about 20-30 years
			Seawater Intrusion	
			Land Subsidence	
		Social-Cultural	Community Perception	
	Social Tension			
Option 2: Desalination	Seawater Quality	Increase in Salinity		
C7	Wastewater Management	Seawater Quality	Increase in COD	Takes place throughout the operation phase, about 20-30 years
			Increase in Ammonia	
		Marine Biota	Decrease in Nekton Species Diversity (including Marine Mammals)	Takes place throughout the operation phase, about 20-30 years

No.	Activities	Environmental Components	Hypothetical Significant Impacts	Time Frame of Impact Assessment
<i>Post-Operation Phase</i>				
D1	Workforce Demobilization	Demographics	Changes in Population Migration (Mobility)	Takes place about 1-2 years during post-operation
			Changes in Population Structure (Age, Education, Sex, Ethnicity, Religion)	
			Changes in Population Growth	
		Economics	Job Opportunities and Unemployment	
			Changes in Local Business Growth	
			Changes in Income Levels	
			Changes in Livelihood Patterns	
		Social Cultural	Community Perception	
			Assimilation and Acculturation	
			Changes in Social Norms and Values	
			Social Tension	
			Indigenous People Marginalization	
			Changes in Cultural Heritage	
			Vulnerable Community Groups, e.g. Women, Children, the Poor, the Elderly, and the Disabled	

No.	Activities	Environmental Components	Hypothetical Significant Impacts	Time Frame of Impact Assessment
		Public Services including Education	Changes in Public Services including Education	
		Public Health	Changes in Disease Patterns	
			Changes in Disease Prevalence	
			Changes in Access to Healthcare	
		Changes in Environmental Health		
D3	Re-vegetation	Terrestrial Flora	Changes in Species Structure and Composition	Takes place about 1-2 years during post-operation
			Changes in Land Cover	
			Changes in Flora Species Diversity	
		Terrestrial Fauna	Changes in Fauna Species Diversity	Takes place about 1-2 years during post-operation
			Changes in Distribution of Species	
			Changes in Habitats of Wildlife	

Table I-46 Marine Facilities Activities

No.	Activities	Environmental Components	Hypothetical Significant Impacts	Impact Assessment Time Frame
<i>Construction Phase</i>				
B2	Sea Transportation for Workforce, Equipment, and Materials	Marine Biota	Changes in Nekton Diversity (Including Marine Mammals)	Takes place during 3-4 years throughout construction period of the marine facilities (construction of the BOF, combo dock expansion, and construction of LNG-condensate jetty 2)
		Economics	Fishery Activity Disturbance	
			Sea Transportation Accessibility Disturbance	

No.	Activities	Environmental Components	Hypothetical Significant Impacts	Impact Assessment Time Frame
		Social - Cultural	Community Perception	
			Social Tension	
B5	Dredging and Disposal of Dredge Materials	Seawater Quality	Increase in Total Suspended Solids (TSS) Content	Dredging will take place during the construction phase of the marine facilities at separate time and space. For construction of the BOF, dredging will take place in 8-12 months, continued by dredging for combo dock expansion (6-8 months) and for the LNG-condensate jetty 2 (8-10 months).
		Marine Biota	Decrease in Plankton Abundance	
			Decrease in Benthos Abundance	
		Social -Cultural	Community Perception	
Social Tension				
B6	BOF (Bulk Offloading Facility)	Social-Cultural	Community Perception	Lasts 1-2 years throughout construction period of the BOF facility.
			Social Tension	
			Changes in Cultural Heritage	
B7	LNG 2 Jetty (Combined LNG - Condensate Jetty)	Social-Cultural	Community Perception	Takes place during 2-3 years throughout construction period of the BOF facility.
			Social Tension	
			Changes in Cultural Heritage	
B8	Combo Dock Expansion	Social-Cultural	Community Perception	Takes place during 1-2 years throughout construction period of the combo dock expansion.
			Social Tension	
			Changes in Cultural Heritage	
Operation Phase				
C2	Sea Transportation for Workforce, Equipment, and Materials	Marine Biota	Changes in Nekton Diversity (Including Marine Mammals)	Takes place throughout the operational phase, about 20-30 years
		Economics	Fishery Activity Disturbance	
			Sea Transportation Accessibility Disturbance	

No.	Activities	Environmental Components	Hypothetical Significant Impacts	Impact Assessment Time Frame
		Social - Cultural	Community Perception	
			Social Tension	
C3	Maintenance, Dredging and Disposal of Dredge Materials	Seawater Quality	Increase in Total Suspended Solids (TSS) Content	Takes place for 3-6 months for any dredging works and dredging material disposal that are proposed to be done once a year or more often depending on field conditions.
		Marine Biota	Decrease in Plankton Abundance	
			Decrease in Benthos Abundance	
C4	Loading and Transportation of LNG and Condensate	Marine Biota	Changes in Nekton Diversity (Including Marine Mammals)	Takes place throughout the operation phase, about 20-30 years
			Economics	
		Sea Transportation Accessibility Disturbance		
		Social-Cultural	Community Perception	
			Social Tension	
C8	Existence of Marine Facilities	Oceanography	Changes in Wave Patterns	Takes place throughout the operation phase, about 20-30 years
			Shoreline Abrasion	