

## CHAPTER IV

### HOLISTIC EVALUATION OF ENVIRONMENTAL IMPACT

The holistic evaluation of environmental impacts in this section summarizes the results of prediction and evaluation of Hypothetical Significant Impacts (DPH), as presented comprehensively in Chapter III. Prediction and evaluation of impacts in Chapter III were made to determine the significance of impact of each DPH as to whether the impact was "negligible", "minor", "moderate", "major" or "critical". A summary of the results of evaluation of the entire DPH is shown in **Table IV-2**. The definitions of significance of impact are listed in **Table IV-1** as the relative rating of the significance of impact.

**Table IV-1 Definition of Significance of impact**

Significance of Impact	Definition
Negligible Impact	<b>Insignificant:</b> The magnitude of change is almost equal to natural variation
Minor Impact	<b>Insignificant:</b> Impact detected but not significant
Moderate Impact	<b>Significant:</b> impact can be mitigated; The impact should be mitigated where practicable
Major Impact	<b>Significant:</b> amenable to mitigation; impact must be mitigated.
Critical Impact	Intolerable; impact is not amenable to mitigation; alternatives must be identified to negate the source of impact.

Based on the criteria in **Table IV-1** and summary of the significance of the impact of all DPH in **Table IV-2**, the DPH that are minor-moderate, moderate and major are deemed as Significant Impacts as listed in **Table IV-3**.

Thorough study of the Significant Impacts of environmental components/parameters for each type of activity as the source of impact is performed using a flow chart of impact. The flow chart is used to determine the correlation (cause-effect) between source of impact and significant impacts on the environmental components/parameters, and between environmental components/parameters affected by the significant impact. Therefore every type of activity as source of impact and type of impact as key variable to be managed and monitored through technological, social and institutional approach can be identified.

**Table IV-2 The Results Summary of Hypothetical Significant Impact Prediction and Evaluation of Gas Exploitation, Gas Transmission, LNG Plant and Marine Facilities Activities**

No	Environmental Component	Parameter of Impact	Source of Impact	Nature of Impact	Type of Impact	Duration of Impact	Extent of Impact	Magnitude of Impact	Sensitivity of Receptor	Severity of Impact	Likelihood of Impact	Significance of Impact
<b>GAS EXPLOITATION ACTIVITIES</b>												
1	Noise	Increase in Underwater Noise	Production Well Drilling	Negative	Direct Impact	Short Term	Local	Medium	Medium	High	Small	Moderate (S)
2	Seawater Quality	Increase in content of Total Suspended Solids (TSS)	Overboard Discharge of Drilling Mud and Drill Cuttings	Negative	Direct Impact	Long Term	Local	Small	Medium	Medium	Medium	Minor-Moderate (S)
		Increase in concentration of Oil and Grease	Drill Cuttings Discharge of Production Well Drilling Activity	Negative	Direct Impact	Long Term	Local	Medium	Low	Low	Medium	Negligible-Minor (IS)
3	Marine Biota	Changes in Nekton Diversity (Including Marine Mammals) - Construction Phase	Transportation and Installation of Offshore Platform	Negative	Direct Impact	Short Term	Local	Small	Medium	Medium	Small	Minor (IS)
		Changes in Nekton Diversity (Including Marine Mammals) - Construction Phase	Direct Impact of: • Overboard Discharge of Drilling Mud and Drill Cuttings Derivative Impact of: • Increase in Noise from Production Well Drilling Activity	Negative	Direct Impact, Derivative Impact	Short Term	Local	Medium	Medium	High	Small	Moderate (S)
		Changes in Nekton Diversity (Including Marine Mammals) - Construction Phase - Operation Phase	Existence of Offshore Platform	Positive	Direct Impact	Long Term	Local	Small	High	Medium	High	Moderate (S)
		Decrease in Benthos Abundance	Overboard Discharge of Drilling Mud and Drill Cuttings	Negative	Direct Impact	Long Term	Local	Medium	Low	Low	Medium	Negligible-Minor (IS)
		Decrease in Plankton Abundance	Increase in Content of Total Suspended Solids (TSS)	Negative	Derivative Impact	Long Term	Local	Medium	Low	Low	Medium	Negligible-Minor (IS)
4	Economy	<i>Construction Phase</i>										
		Job Opportunities	Workforce Mobilization and Demobilization	Positive	Direct Impact	Temporary	Local	Small	High	Medium	Small	Minor (IS)
		Changes in Local Business Growth	Workforce Mobilization	Positive	Derivative Impact	Temporary	Local	Small	Medium	Medium	Medium	Moderate (S)
		Fishery Activity Disturbance	Transportation and Installation of Offshore Platform	Negative	Direct Impact	Temporary	Local	Small	High	Medium	Medium	Moderate (S)
		Decrease in Fishermen' Income	• Transportation and Installation of Offshore Platform • Existence of Offshore Platform	Negative	Derivative Impact	Temporary	Local	Small	High	Medium	Medium	Moderate (S)
		Sea Transportation Accessibility Disturbance	Transportation and Installation of Offshore Platform	Negative	Direct Impact	Temporary	Local	Small	High	Medium	Medium	Moderate (S)
		<i>Operation Phase</i>										
		Fishery Activity Disturbance	Existence of Offshore Platform	Negative	Direct Impact	Long Term	Local	Large	Medium	High	High	High
Sea Transportation Accessibility Disturbance	Gas Exploitation Activities	Negative	Direct Impact	Long Term	Local	Large	High	High	High	Medium	Major (S)	

No	Environmental Component	Parameter of Impact	Source of Impact	Nature of Impact	Type of Impact	Duration of Impact	Extent of Impact	Magnitude of Impact	Sensitivity of Receptor	Severity of Impact	Likelihood of Impact	Significance of Impact
5	Socio- Cultural	<i>Construction Phase</i>										
		Community Perception	<ul style="list-style-type: none"> <li>• Operations of LNG Train 1 and 2</li> <li>• Well Cleaning (Flaring)</li> <li>• Fishery Activity Disturbance</li> <li>• Sea Transportation Accessibility Disturbance</li> </ul>	Negative	Derivative Impact	Temporary	Local	Small	High	Medium	Medium	Moderate (S)
		Social Tension	Community Perception	Negative	Derivative Impact	Temporary	Local	Small	Medium	Medium	Medium	Moderate (S)
		<i>Operation Phase</i>										
		Community Perception	<ul style="list-style-type: none"> <li>• Operations of LNG Train 1 and 2</li> <li>• Fishery Activity Disturbance due to the Existence of Offshore Platform (Exclusion Zone)</li> <li>• Sea Transportation Accessibility Disturbance due to the Existence of Offshore Platform (Exclusion Zone)</li> </ul>	Negative	Derivative Impact	Long Term	Local	Large	High	High	Medium	Major (S)
Social Tension	Community Perception	Negative	Derivative Impact	Long Term	Local	Large	Medium	High	Medium	Major (S)		
<b>GAS TRANSMISION ACTIVITIES</b>												
1	Seawater Quality	Increase in Content of Total Suspended Solids (TSS)	Seabed Trenching, Pipeline Installation and Rock Dumping	Negative	Direct Impact	Short Term	Local	Medium	Low	Low	Medium	Negligible-Minor (IS)
		Decrease in Content of Dissolved Oxygen (DO) - Alternative 1	Overboard Discharge of Hydrotest Water	Negative	Direct Impact	Temporary	Local	Small	Low	Very Low	Small	Negligible (IS)
		Decrease in Content of Dissolved Oxygen (DO) - Alternative 2	Onshore Temporary Pond and Overboard Discharge	Negative	Direct Impact	Temporary	Local	Small	Low	Very Low	Small	Negligible (IS)
2	Marine Biota	Changes in Nekton Diversity (Including Marine Mammals)	Sea Transportation for Workforce, Equipment and Materials	Negative	Direct Impact	Short Term	Local	Small	Medium	Medium	Small	Minor (IS)
		Changes in Benthos Abundance	Seabed Trenching, Pipe Installation and Rock Dumping	Negative	Direct Impact	Short Term	Local	Small	Low	Very Low	Small	Negligible (IS)
3	Economy	<i>Construction Phase</i>										
		Job Opportunities and Unemployment	Workforce Mobilization and Demobilization	Positive	Direct Impact	Temporary	Local	Negligible	High	Low	Medium	Minor (IS)
		Fishery Activity Disturbance	<ul style="list-style-type: none"> <li>• Sea Transportation for Workforce, Equipment and Materials</li> <li>• Seabed Trenching, Pipe Installation and Rock Dumping</li> </ul>	Negative	Direct Impact	Temporary	Local	Small	High	Medium	Medium	Moderate (S)
		Sea Transportation Accessibility Disturbance	Seabed Trenching, Pipe Installation and Rock Dumping	Negative	Direct Impact	Temporary	Local	Small	High	Medium	Medium	Moderate (S)
4	Socio- Cultural	Community Perception	<ul style="list-style-type: none"> <li>• Operations of LNG Train 1 and 2 Operations</li> <li>• Fishery Activity Disturbance</li> <li>• Sea Transportation Accessibility Disturbance</li> </ul>	Negative	Derivative Impact	Temporary	Local	Small	High	Medium	High	Moderate (S)
		Social Tension	<ul style="list-style-type: none"> <li>• Community Perception</li> </ul>	Negative	Derivative Impact	Temporary	Local	Small	High	Medium	Medium	Moderate (S)

No	Environmental Component	Parameter of Impact	Source of Impact	Nature of Impact	Type of Impact	Duration of Impact	Extent of Impact	Magnitude of Impact	Sensitivity of Receptor	Severity of Impact	Likelihood of Impact	Significance of Impact
<b>LNG PLANT ACTIVITIES</b>												
1	Air Quality	Light Emission	Flaring	Negative	Direct Impact	Long Term	Local	Small	Medium	Medium	Small	Minor (IS)
		Increase in Opacity	Flaring	Negative	Direct Impact	Long Term	Local	Small	High	Medium	Small	Minor (IS)
2	Greenhouse Gases	Increase in CO <sub>2</sub> Emissions	<ul style="list-style-type: none"> <li>• Flaring</li> <li>• Electrical Power Generator (Gas Turbine)</li> <li>• Boiler</li> <li>• Acid Gas Incinerator (AGI)</li> </ul>	Negative	Direct Impact	Long Term	Global	Large	Medium	High	High	Major (S)
3	Noise	Increase in Noise Level	<ul style="list-style-type: none"> <li>• Land Clearing</li> <li>• Construction of LNG Plant and its Supporting Facilities</li> </ul>	Negative	Direct Impact	Short Term	Local	Medium	Medium	High	Medium	Major (S)
4	Hydrology	Change in Creek Morphology	Site Preparation	Negative	Direct Impact	Short Term	Local	Small	Medium	Medium	High	Moderate (S)
		Increase in Creek Water Flow Rate	Increase in Surface Water Runoff, Changes in Drainage Pattern and Creek Morphology	Negative	Derivative Impact	Permanent	Local	Large	Low	Medium	High	Moderate (S)
		Increase in Surface Water Runoff	<ul style="list-style-type: none"> <li>• Land Clearing</li> <li>• Site Preparation</li> <li>• Cut and fill</li> </ul>	Negative	Direct Impact	Short Term	Local	Medium	Medium	High	High	Major (S)
		Changes in Drainage Pattern	Site Preparation	Negative	Direct Impact	Permanent	Local	Large	Low	Medium	High	Moderate (S)
5	Hydrogeology	Decrease in Shallow Groundwater Level (Community Wells)	Groundwater Abstraction	Negative	Direct Impact	Short Term	Local	Small	Medium	Medium	Very Small	Minor (IS)
		Seawater Intrusion	Groundwater Abstraction	Negative	Direct Impact	Long Term	Local	Small	Medium	Medium	Medium	Minor-Moderate (S)
		Land Subsidence	Groundwater Abstraction	Negative	Direct Impact	Permanent	Local	Small	Low	Very Low	Very Small	Negligible (IS)
6	Soil	Increase in Soil Erosion	Increase in Surface Water Runoff	Negative	Derivative Impact	Short Term	Local	Medium	Medium	High	High	Major (S)
7	Surface Water Quality	Increase in Content of Total Suspended Solids (TSS)	Increase in Soil Erosion	Negative	Derivative Impact	Short Term	Local	Medium	High	High	High	Major (S)
8	Seawater Quality	Increase in Salinity Value	Desalination	Negative	Direct Impact	Long Term	Local	Medium	Low	Low	Medium	Negligible-Minor (IS)
		Increase in COD value	Wastewater Management	Negative	Direct impact and residual impact	Long Term	Local	Small	Low	Very Low	Small	Negligible (IS)
		Increase in Ammonia Concentration	Wastewater Management	Negative	Direct impact and residual impact	Long Term	Local	Small	Medium	Medium	Small	Minor (IS)
9	Terrestrial Flora	Changes in Land Cover	Land Clearing	Negative	Direct Impact	Permanent	Local	Medium	High	High	Small	Moderate (S)
		Changes in Structure and Composition of Flora Species	Changes in Land Cover	Negative	Derivative Impact	Permanent	Local	Medium	High	High	Small	Moderate (S)
		Change in Flora Species Diversity	Changes in Structure and Composition of Flora Species	Negative	Derivative Impact	Permanent	Local	Medium	High	High	Small	Moderate (S)

No	Environmental Component	Parameter of Impact	Source of Impact	Nature of Impact	Type of Impact	Duration of Impact	Extent of Impact	Magnitude of Impact	Sensitivity of Receptor	Severity of Impact	Likelihood of Impact	Significance of Impact
10	Terrestrial Fauna	Changes in Fauna Species Diversity	<ul style="list-style-type: none"> <li>Changes in Fauna Species Distribution</li> <li>Changes in Structure and Composition of Flora Species</li> </ul>	Negative	Derivative Impact	Permanent	Local	Medium	Medium	High	Small	Moderate (S)
		Changes in Fauna Species Distribution	<ul style="list-style-type: none"> <li>Changes in Wildlife Habitat</li> <li>Increase in Noise Level</li> </ul>	Negative	Derivative Impact	Permanent	Local	Medium	Medium	High	Small	Moderate (S)
		Changes in Wildlife Habitat	Land clearing	Negative	Direct Impact	Permanent	Local	Medium	Medium	High	Small	Moderate (S)
11	Marine Biota	Changes in Nekton Diversity (Including Marine Mammals)	Direct Impact of: <ul style="list-style-type: none"> <li>Sea Transportation for Workforce, Equipment and Materials</li> </ul> Derivative Impact of : <ul style="list-style-type: none"> <li>Increase in Ammonia Concentration</li> </ul>	Negative	Direct Impact, Derivative Impact	Long Term	Local	Medium	Medium	High	Small	Moderate (S)
<i>Construction Phase</i>												
12	Demographics	Changes in Population Migration (Mobility), Changes in Population Structure and Population Growth	Job Opportunities	Negative	Derivative Impact	Short Term	Local	Medium	High	High	Medium	Major (S)
13	Economy	Job Opportunities	Workforce Mobilization	Positive	Direct Impact	Short Term	Regional	Medium	High	High	Medium	Major (S)
		Changes in Local Business Growth	Job Opportunities	Positive	Derivative Impact	Short Term	Regional	Medium	Medium	High	Medium	Major (S)
		Changes in Livelihood Pattern	<ul style="list-style-type: none"> <li>Job Opportunities</li> <li>Changes in Local Business Growth</li> </ul>	Negative, Positive	Derivative Impact	Short Term	Local	Medium	Medium	High	High	Major (S)
		Changes in Income Level	<ul style="list-style-type: none"> <li>Job Opportunities</li> <li>Changes in Local Business Growth</li> </ul>	Negative, Positive	Derivative Impact	Short Term	Local	Medium	Medium	High	High	Major (S)
14	Socio-Cultural	Assimilation and Acculturation	Changes in Population Migration (Mobility), Changes in Population Structure and Population Growth	Negative	Derivative Impact	Short Term	Local	Medium	Medium	High	Medium	Major (S)
		Community Perception	<ul style="list-style-type: none"> <li>Job Opportunities;</li> <li>Changes in Local Business Growth</li> <li>Changes in Income Level</li> <li>Changes in Livelihood Pattern</li> <li>Seawater intrusion</li> </ul>	Negative	Derivative Impact	Short Term	Regional	Medium	Medium	High	High	Major (S)
		Social Tension	Community Perception	Negative	Derivative Impact	Short Term	Regional	Medium	Medium	High	Small	Moderate (S)
15	Education	Change in Public Services including Education	Changes in Population Migration (Mobility), Changes in Population Structure and Population Growth	Negative	Derivative Impact	Short Term	Local	Medium	Medium	High	Medium	Major (S)
16	Public Health	Changes in Disease Patterns	Changes in Population Migration (Mobility), Changes in Population Structure and Population Growth	Negative	Derivative Impact	Short Term	Regional	Medium	Medium	High	Medium	Major (S)
		Changes in Prevalence of Disease	Changes in Population Migration (Mobility), Changes in Population Structure and Population Growth	Negative	Derivative Impact	Short Term	Regional	Medium	Medium	High	Medium	Major (S)
		Changes in Healthcare Access	Changes in Population Migration (Mobility), Changes in Population Structure and Population Growth	Negative	Derivative Impact	Short Term	Local	Medium	Medium	High	Medium	Major (S)
		Changes in Environmental	Changes in Population Migration	Negative	Derivative Impact	Short Term	Local	Medium	Medium	High	Medium	Major

No	Environmental Component	Parameter of Impact	Source of Impact	Nature of Impact	Type of Impact	Duration of Impact	Extent of Impact	Magnitude of Impact	Sensitivity of Receptor	Severity of Impact	Likelihood of Impact	Significance of Impact
		Health	(Mobility), Changes in Population Structure and Population Growth									(S)
<i>Operation Phase</i>												
17	Demographics	Changes in Population Migration (Mobility), Changes in Population Structure and Population Growth	Job Opportunities	Negative	Derivative Impact	Long Term	Regional	Large	High	Very High	Medium	Major (S)
18	Economy	Job Opportunities	Workforce Mobilization	Positive	Direct Impact	Long Term	Regional	Medium	Medium	High	Medium	Major (S)
		Changes in Local Business Growth	Business Opportunities	Positive	Derivative Impact	Long Term	Regional	Medium	Medium	High	Medium	Major (S)
		Changes in Business Opportunities	Workforce Mobilization	Positive	Direct Impact	Long Term	Regional	Medium	Medium	High	Medium	Major (S)
		Changes in Livelihood Pattern	Job Opportunities	Positive	Derivative Impact	Long Term	Regional	Medium	Medium	High	Medium	Major (S)
		Changes in Income Level	Job Opportunities	Positive	Derivative Impact	Long Term	Regional	Medium	Medium	High	Medium	Major (S)
19	Socio-Cultural	Assimilation and Acculturation	Changes in Population Migration (Mobility), Changes in Population Structure and Population Growth	Negative	Derivative Impact	Long Term	Regional	Large	Medium	High	High	Major (S)
		Changes in Cultural Heritage	Changes in Population Migration (Mobility), Changes in Population Structure and Population Growth	Negative	Derivative Impact	Long Term	Local	Medium	Medium	High	Medium	Major (S)
		Community Perception	<ul style="list-style-type: none"> <li>• Job Opportunities</li> <li>• Changes in Local Business Growth</li> <li>• Changes in Local Business Opportunity</li> <li>• Changes in Income Level</li> <li>• Community expectation in gaining more benefit from Tangguh LNG ( education, health, livelihood, intreprenurship, and human resources development programs)</li> <li>• Community expectation in handling various strategic issues (Revenue Sharing, adat compensation, gas allocation, electricity, housing, region expansion, Social Program coverage area, and large scale Infrastructure development)</li> <li>• Seawater Intrusion</li> </ul>	Negative	Derivative Impact	Long Term	Regional	Large	Medium	High	High	Major (S)
		Social Tension	Community Perception	Negative	Derivative Impact	Long Term	Regional	Medium	Medium	High	Small	Moderate (S)
20	Education	Changes in Public Service including Education	Changes in Population Migration (Mobility), Changes in Population Structure and Population Growth	Negative	Derivative Impact	Long Term	Local	Medium	Medium	High	Medium	Major (S)

No	Environmental Component	Parameter of Impact	Source of Impact	Nature of Impact	Type of Impact	Duration of Impact	Extent of Impact	Magnitude of Impact	Sensitivity of Receptor	Severity of Impact	Likelihood of Impact	Significance of Impact
21	Public Health	Changes in Disease Patterns	Changes in Population Migration (Mobility), Changes in Population Structure and Population Growth	Negative	Derivative Impact	Long Term	Regional	Large	Medium	High	Medium	Major (S)
		Changes in Disease Prevalence	Changes in Population Migration (Mobility), Changes in Population Structure and Population Growth	Negative	Derivative Impact	Long Term	Regional	Large	Low	High	Medium	Major (S)
		Changes in Healthcare Access	Changes in Population Migration (Mobility), Changes in Population Structure and Population Growth	Negative	Derivative Impact	Long Term	Regional	Large	Medium	High	Medium	Major (S)
		Changes in Environmental Health	Changes in Population Migration (Mobility), Changes in Population Structure and Population Growth	Negative	Derivative Impact	Long Term	Local	Medium	Medium	High	Medium	Major (S)
<i>Post-OperationPhase</i>												
22	Demographics	Changes in Population Migration (Mobility), Changes in Population Structure and Population Growth	Job Opportunities	Negative	Derivative Impact	Long Term	Local	Medium	Medium	High	High	Major (S)
23	Economy	Job Opportunities	Workforce Demobilization	Negative	Direct Impact	Long Term	Regional	Medium	High	High	Small	Moderate (S)
		Changes in Local Business Growth	Job Opportunities	Negative	Derivative Impact	Long Term	Regional	Medium	Medium	High	High	Major (S)
		Changes in Livelihood Pattern	<ul style="list-style-type: none"> <li>Job Opportunities</li> <li>Changes in Local Business Opportunity</li> </ul>	Negative	Derivative Impact	Long Term	Local	Medium	Medium	High	Medium	Major (S)
		Changes in Level of Income	<ul style="list-style-type: none"> <li>Job Opportunities</li> <li>Changes in Local Business Opportunity</li> </ul>	Negative	Derivative Impact	Long Term	Local	Medium	High	High	Medium	Major (S)
24	Socio- Cultural	Assimilation and Acculturation	Changes in Population Migration (Mobility), Changes in Population Structure and Population Growth	Negative	Derivative Impact	Long Term	Local	Medium	Low	Low	Small	Negligible (IS)
		Changes in Cultural Heritage	Changes in Population Migration (Mobility), Changes in Population Structure and Population Growth	Positive	Derivative Impact	Long Term	Local	Medium	Low	Low	Small	Negligible (IS)
		Community Perception	<ul style="list-style-type: none"> <li>Workforce Demobilization</li> <li>Changes in Local Business Opportunity</li> <li>Changes in Local Business Growth</li> <li>Changes in Livelihood Pattern</li> <li>Changes in Income Level</li> </ul>	Negative	Derivative Impact	Long Term	Regional	Medium	Medium	High	Medium	Major (S)
		Social Tension	Community Perception	Negative	Derivative Impact	Long Term	Regional	Medium	Medium	High	Small	Moderate (S)
25	Education	Changes in Public Services including Education	Changes in Population Migration (Mobility), Changes in Population Structure and Population Growth	Positive	Derivative Impact	Long Term	Local	Medium	Medium	High	Medium	Major (S)
26	Public Health	Changes in Disease Patterns	Changes in Population Migration (Mobility), Changes in Population Structure and Population Growth	Negative	Derivative Impact	Long Term	Regional	Large	Low	Medium	Medium	Minor (IS)
		Changes in Disease Prevalence	Changes in Population Migration (Mobility), Changes in Population Structure and Population Growth	Negative	Derivative Impact	Long Term	Regional	Large	Low	Medium	Medium	Minor (IS)

No	Environmental Component	Parameter of Impact	Source of Impact	Nature of Impact	Type of Impact	Duration of Impact	Extent of Impact	Magnitude of Impact	Sensitivity of Receptor	Severity of Impact	Likelihood of Impact	Significance of Impact
		Changes in Health care Access	Changes in Population Migration (Mobility), Changes in Population Structure and Population Growth	Negative	Derivative Impact	Long Term	Regional	Large	Low	Medium	Medium	Moderate (S)
		Changes in Environmental Health	Changes in Population Migration (Mobility), Changes in Population Structure and Population Growth	Negative	Derivative Impact	Long Term	Regional	Large	Low	Medium	Medium	Minor (IS)
<b>MARINE FACILITIES ACTIVITIES</b>												
1	Oceanography	Changes in Current Pattern	Existence of Marine Facilities	Negative	Direct Impact	Long Term	Local	Small	Low	Very Low	High	Negligible (IS)
		Shoreline Abrasion	Change in Current Pattern	Negative	Derivative Impact	Long Term	Local	Small	Medium	Medium	Very Small	Minor (IS)
2	Seawater Quality	Increase in Content of Total Suspended Solids (TSS) - Dredging	Dredging during Construction and Maintenance Dredging	Negative	Direct Impact	Long Term	Local	Medium	Low	Low	High	Minor (IS)
		Increase in Content of Total Suspended Solids (TSS) - Dredge Material Disposal	Dredge Material Disposal	Negative	Direct Impact	Long Term	Local	Small	Medium	Low	High	Minor (IS)
3	Marine Biota	Changes in Nekton Diversity (Including Marine Mammals)	<ul style="list-style-type: none"> <li>Sea Transportation for Workforce, Equipment and Materials</li> <li>Loading and Transfer of LNG and Condensate</li> </ul>	Negative	Direct Impact	Long Term	Local	Medium	Medium	High	Small	Moderate (S)
		Decrease in Plankton Abundance	Dredging and Disposal of Dredge Material	Negative	Derivative Impact	Long Term	Local	Medium	Low	Low	High	Minor (IS)
		Decrease in Benthos Abundance - Dredging	Dredge Material Disposal (Construction Phase) and Maintenance Dredging in the Operations Phase	Negative	Direct Impact	Long Term	Local	Medium	Medium	High	High	Major (S)
		Decrease in Benthos Abundance- Dredge Material Disposal	Dredge Material Disposal	Negative	Direct Impact	Long Term	Local	Medium	Low	Low	High	Minor (S)
<i>Construction Phase</i>												
4	Economy	Fishery Activity Disturbance	Construction of BOF ( <i>Bulk Offloading Facility</i> )	Negative	Direct Impact	Short Term	Local	Medium	High	High	Medium	Major (S)
		Decrease in Fishermen' Income	Fishery Activity Disturbance	Negative	Derivative Impact	Short Term	Local	Medium	High	High	Medium	Major (S)
		Sea Transportation Accessibility Disturbance	Construction of BOF ( <i>Bulk Offloading Facility</i> )	Negative	Direct Impact	Short Term	Local	Medium	High	High	Medium	Major (S)
5	Socio- Cultural	Changes in Cultural Heritage	<ul style="list-style-type: none"> <li>Construction of BOF (<i>Bulk Offloading Facility</i>)</li> <li>Combo Dock Enhancement</li> </ul>	Negative	Direct Impact	Short Term	Local	Medium	High	High	Medium	Moderate (S)
		Community Perception	<ul style="list-style-type: none"> <li>Operations of LNG Train 1 and 2</li> <li>Fishery Activity Disturbance</li> <li>Sea Transportation Accessibility Disturbance</li> <li>Changes in Cultural Heritage</li> </ul>	Negative	Derivative Impact	Short Term	Local	Medium	High	High	Medium	Major (S)
		Social Tension	Community Perception	Negative	Derivative Impact	Short Term	Local	Medium	Medium	High	Small	Moderate (S)



No	Environmental Component	Parameter of Impact	Source of Impact	Nature of Impact	Type of Impact	Duration of Impact	Extent of Impact	Magnitude of Impact	Sensitivity of Receptor	Severity of Impact	Likelihood of Impact	Significance of Impact
<i>Operation Phase</i>												
6	Economy	Fishery Activity Disturbance	<ul style="list-style-type: none"> <li>Sea Transportation for Workforce, Equipment and Materials</li> <li>Loading and transfer of LNG and Condensate</li> <li>Existence of Marine Facilities</li> </ul>	Negative	Direct Impact	Long Term	Local	Large	High	Very High	Medium	Major (S)
		Sea Transportation Accessibility Disturbance	<ul style="list-style-type: none"> <li>Sea Transportation for Workforce, Equipment and Materials</li> <li>Loading and Transfer of LNG and Condensate</li> <li>Existence of Marine Facilities</li> </ul>	Negative	Direct Impact	Long Term	Local	Large	High	Very High	Medium	Major (S)
		Decrease in Fishermen' Income	<ul style="list-style-type: none"> <li>Fishery Activity Disturbance</li> <li>Sea Transportation Accessibility Disturbance</li> </ul>	Negative	Derivative Impact	Long Term	Local	Large	High	Very High	Medium	Major (S)
7	Socio- Cultural	Community Perception	<ul style="list-style-type: none"> <li>Operations of LNG Train 1 and 2</li> <li>Fishery Activity Disturbance</li> <li>Sea Transportation Accessibility Disturbance</li> </ul>	Negative	Derivative Impact	Long Term	Local	Large	Medium	High	High	Major (S)
		Social Tension	Community Perception	Negative	Derivative Impact	Long Term	Local	Small	Medium	Medium	Small	Minor (IS)

Note :  
S : Significant Impact  
IS : Insignificant Impact

**Table IV-3 Summary of Significant Impacts (Minor-Moderate, Moderate and Major) of Gas Exploitation, Gas Transmission, LNG Plant and Marine Facilities Activities**

No	Environmental Component	Parameter of Impact	Source of Impact	Nature of Impact	Type of impact	Duration of Impact	Extent of Impact	Magnitude of Impact	Sensitivity of Receptor	Severity of Impact	Likelihood of Impact	Significance of Impact
<b>GAS EXPLOITATION ACTIVITIES</b>												
1	Noise	Increase in Underwater Noise	Production Well Drilling	Negative	Direct Impact	Short Term	Local	Medium	Medium	High	Small	Moderate
2	Seawater Quality	Increase in Content of Total Suspended Solids (TSS)	Overboard Discharge of Drilling Mud and Drill Cuttings	Negative	Direct Impact	Long Term	Local	Small	Medium	Medium	Medium	Minor-Moderate
3	Marine Biota	Changes in Nekton Diversity (Including Marine Mammals) - Construction Phase	Direct Impact of: <ul style="list-style-type: none"> <li>Overboard Discharge of Drilling Mud and Drill Cuttings</li> </ul> Derivative Impact of : <ul style="list-style-type: none"> <li>Increase in Noise from Production Well Drilling activities</li> </ul>	Negative	Direct Impact, Derivative Impact	Short Term	Local	Medium	Medium	High	Small	Moderate
		Changes in Nekton Diversity (Including Marine Mammals) - Construction Phase - Operation Phase	Existence of Offshore Platform	Positive	Direct Impact	Long Term	Local	Small	High	Medium	High	Moderate
4	Economy	<i>Construction Phase</i>										
		Changes in Local Business Growth	Workforce Mobilization	Positive	Derivative Impact	Temporary	Local	Small	Medium	Medium	Medium	Moderate
		Fishery Activity Disturbance	Transportation and Offshore Platform Installation	Negative	Direct Impact	Temporary	Local	Small	High	Medium	Medium	Moderate
		Sea Transportation Accessibility Disturbance	Transportation and Offshore Platform Installation	Negative	Direct Impact	Temporary	Local	Small	High	Medium	Medium	Moderate

No	Environmental Component	Parameter of Impact	Source of Impact	Nature of Impact	Type of impact	Duration of Impact	Extent of Impact	Magnitude of Impact	Sensitivity of Receptor	Severity of Impact	Likelihood of Impact	Significance of Impact
		Decrease in Fishermen' Income	Fishery Activity Disturbance	Negative	Derivative Impact	Temporary	Local	Small	High	Medium	Medium	Moderate
<i>Operation Phase</i>												
		Fishery Activity Disturbance	Existence of Offshore Platform	Negative	Direct Impact	Long Term	Local	Large	Medium	High	High	Major
		Sea Transportation Accessibility Disturbance	Gas Production Activity	Negative	Direct Impact	Long Term	Local	Large	High	High	Medium	Major
5	Socio- Cultural	<i>Construction Phase</i>										
		Community Perception	<ul style="list-style-type: none"> <li>• Operations of LNG Train 1 and 2</li> <li>• Fishery Activity Disturbance</li> <li>• Sea Transportation Accessibility Disturbance</li> <li>• Decrease in Fishermen' Income</li> </ul>	Negative	Derivative Impact	Temporary	Local	Small	High	Medium	Medium	Moderate
		Social Tension	Community Perception	Negative	Derivative Impact	Temporary	Local	Small	Medium	Medium	Medium	Moderate
<i>Operation Phase</i>												
		Community Perception	<ul style="list-style-type: none"> <li>• Operations of LNG Train 1 and 2</li> <li>• Flaring</li> <li>• Fishery Activity Disturbance due to Existence of Offshore Platform (Exclusion Zone)</li> <li>• Transportation Accessibility Disturbance due to Existence of Offshore Platform (Exclusion Zone)</li> </ul>	Negative	Derivative Impact	Long Term	Local	Large	High	High	Medium	Major
		Social Tension	Community Perception	Negative	Derivative Impact	Long Term	Local	Large	Medium	High	Medium	Major
<b>GAS TRANSMISSION ACTIVITIES</b>												
1	Economy	<i>Construction Phase</i>										
		Fishery Activity Disturbance	<ul style="list-style-type: none"> <li>• Sea Transportation for Workforce, Equipment and Materials</li> <li>• Seabed Trenching, Pipeline Installation and Rock Dumping</li> </ul>	Negative	Direct Impact	Temporary	Local	Small	High	Medium	Medium	Moderate
		Sea Transportation Accessibility Disturbance	Seabed Trenching, Pipeline Installation and Rock Dumping	Negative	Direct Impact	Temporary	Local	Small	High	Medium	Medium	Moderate
2	Socio- Cultural	Community Perception	<ul style="list-style-type: none"> <li>• Operations of LNG Train 1 and 2</li> <li>• Fishery Activity Disturbance</li> <li>• Sea Transportation Accessibility Disturbance</li> </ul>	Negative	Derivative Impact	Temporary	Local	Small	High	Medium	High	Moderate
		Social Tension	Community Perception	Negative	Derivative Impact	Temporary	Local	Small	High	Medium	Medium	Moderate
<b>LNG PLANT ACTIVITIES</b>												
1	Greenhouse Gas	Increase in CO <sub>2</sub> Emissions	<ul style="list-style-type: none"> <li>• Flaring</li> <li>• Electrical Power Generator (Gas Turbine)</li> <li>• Boiler</li> <li>• Acid Gas Incinerator (AGI)</li> </ul>	Negative	Direct Impact	Long Term	Global	Large	Medium	High	High	Major
2	Noise	Increase in Noise Level	<ul style="list-style-type: none"> <li>• Land clearing</li> <li>• Construction of LNG Plant and its Supporting Facilities</li> </ul>	Negative	Direct Impact	Short Term	Local	Medium	Medium	High	Medium	Major
3	Hydrology	Changes in Creek Morphology	Site Preparation	Negative	Direct Impact	Short Term	Local	Small	Medium	Medium	High	Moderate
		Increase in Creek Water Flow Rate	Increase in Surface Water Runoff, Changes in Drainage Pattern and Creek Morphology	Negative	Derivative Impact	Permanent	Local	Large	Low	Medium	High	Moderate

No	Environmental Component	Parameter of Impact	Source of Impact	Nature of Impact	Type of impact	Duration of Impact	Extent of Impact	Magnitude of Impact	Sensitivity of Receptor	Severity of Impact	Likelihood of Impact	Significance of Impact
		Increase in Surface Water Runoff	<ul style="list-style-type: none"> <li>Land clearing</li> <li>Site Preparation</li> </ul>	Negative	Direct Impact	Short Term	Local	Medium	Medium	High	High	Major
		Changes in Drainage Pattern	Site Preparation	Negative	Direct Impact	Permanent	Local	Large	Low	Medium	High	Moderate
4	Hydrogeology	Seawater Intrusion	Groundwater Abstraction	Negative	Direct Impact	Long Term	Local	Small	Medium	Medium	Medium	Minor-Moderate
5	Soil	Increase in Soil Erosion	Increase in Surface Water Runoff	Negative	Derivative Impact	Short Term	Local	Medium	Medium	High	High	Major
6	Surface Water Quality	Increase in Content of Total Suspended Solids (TSS)	Increase in Soil Erosion	Negative	Derivative Impact	Short Term	Local	Medium	High	High	High	Major
7	Terrestrial flora	Changes in Land Cover	Land clearing	Negative	Direct Impact	Permanent	Local	Medium	High	High	Small	Moderate
		Changes in Structure and Composition of Flora Species	Changes in Land Cover	Negative	Derivative Impact	Permanent	Local	Medium	High	High	Small	Moderate
		Changes in Flora Species Diversity	Changes in Structure and Composition of Flora Species	Negative	Derivative Impact	Permanent	Local	Medium	High	High	Small	Moderate
8	Terrestrial Fauna	Changes in Wildlife Habitat	Land clearing	Negative	Direct Impact	Permanent	Local	Medium	Medium	High	Small	Moderate
		Changes in Fauna Species Distribution	<ul style="list-style-type: none"> <li>Changes in Wildlife Habitat</li> <li>Increase in Noise Levels</li> </ul>	Negative	Derivative Impact	Permanent	Local	Medium	Medium	High	Small	Moderate
		Changes in Fauna Species Diversity	<ul style="list-style-type: none"> <li>Changes in Fauna Species Distribution</li> <li>Changes in Structure and Composition of Flora Species</li> </ul>	Negative	Derivative Impact	Permanent	Local	Medium	Medium	High	Small	Moderate
9	Marine Biota	Changes in Nekton Diversity (Including Marine Mammals)	Direct Impact of: <ul style="list-style-type: none"> <li>Sea Transportation for Workforce, Equipment and Materials</li> </ul> Derivative Impact : <ul style="list-style-type: none"> <li>Increase in Ammonia Concentration</li> </ul>	Negative	Direct Impact, Derivative Impact	Long Term	Local	Medium	Medium	High	Small	Moderate
<i>Construction Phase</i>												
10	Demographics	Changes in Population Movement (Mobility), Changes in Population Structure and Population Growth	Job Opportunities	Negative	Derivative Impact	Short Term	Local	Medium	High	High	Medium	Major
11	Economy	Job Opportunities	Workforce Mobilization	Positive	Direct Impact	Short Term	Regional	Medium	High	High	Medium	Major
		Changes in Local Business Growth	Job Opportunities	Positive	Derivative Impact	Short Term	Regional	Medium	Medium	High	Medium	Major
		Changes in Livelihood Pattern	Job Opportunities	Negative, Positive	Derivative Impact	Short Term	Local	Medium	Medium	High	High	Major
		Changes in Level of Income	Job Opportunities	Negative, Positive	Derivative Impact	Short Term	Local	Medium	Medium	High	High	Major
12	Socio- Cultural	Assimilation and Acculturation	Changes in Population Migration (Mobility), Changes in Population Structure and Population Growth	Negative	Derivative Impact	Short Term	Local	Medium	Medium	High	Medium	Major
		Community Perception	<ul style="list-style-type: none"> <li>Job Opportunities</li> <li>Seawater Intrusion</li> </ul>	Negative	Derivative Impact	Short Term	Regional	Medium	Medium	High	High	Major
		Social Tension	Community Perception	Negative	Derivative Impact	Short Term	Regional	Medium	Medium	High	Small	Moderate
13	Education	Decreasing in Public Services including Education	Changes in Population Migration (Mobility), Changes in Population Structure and Population Growth	Negative	Derivative Impact	Short Term	Local	Medium	Medium	High	Medium	Major
14	Public Health	Changes in Disease Patterns	Changes in Population Migration (Mobility), Changes in Population Structure and Population Growth	Negative	Derivative Impact	Short Term	Regional	Medium	Medium	High	Medium	Major
		Changes in Disease Prevalence	Changes in Population Migration	Negative	Derivative Impact	Short Term	Regional	Medium	Medium	High	Medium	Major

No	Environmental Component	Parameter of Impact	Source of Impact	Nature of Impact	Type of impact	Duration of Impact	Extent of Impact	Magnitude of Impact	Sensitivity of Receptor	Severity of Impact	Likelihood of Impact	Significance of Impact
			(Mobility), Changes in Population Structure and Population Growth									
		Changes in Healthcare Access	Changes in Population Migration (Mobility), Changes in Population Structure and Population Growth	Negative	Derivative Impact	Short Term	Local	Medium	Medium	High	Medium	Major
		Changes in Environmental Health	Changes in Population Migration (Mobility), Changes in Population Structure and Population Growth	Negative	Derivative Impact	Short Term	Local	Medium	Medium	High	Medium	Major
<i>Operation Phase</i>												
15	Demographics	Changes in Population Migration (Mobility), Changes in Population Structure and Population Growth	Job Opportunities	Negative	Derivative Impact	Long Term	Regional	Large	High	Very High	Medium	Major
16	Economy	Job Opportunities	Workforce Mobilization	Positive	Direct Impact	Long Term	Regional	Medium	Medium	High	Medium	Major
		Changes in Local Business Growth	Changes in Local Business Opportunities	Positive	Derivative Impact	Long Term	Regional	Medium	Medium	High	Medium	Major
		Changes in Business Opportunities	Workforce Mobilization	Positive	Direct Impact	Long Term	Regional	Medium	Medium	High	Medium	Major
		Changes in Livelihood Pattern	Job Opportunities	Positive	Derivative Impact	Long Term	Regional	Medium	Medium	High	Medium	Major
		Changes in Level of Income	Job Opportunities	Positive	Derivative Impact	Long Term	Regional	Medium	Medium	High	Medium	Major
17	Socio- Cultural	Assimilation and Acculturation	Changes in Population Migration (Mobility), Changes in Population Structure and Population Growth	Negative	Derivative Impact	Long Term	Regional	Large	Medium	High	High	Major
		Community Perception	<ul style="list-style-type: none"> <li>• Job Opportunities</li> <li>• Changes in Local Business Growth</li> <li>• Changes in Local Business Opportunity</li> <li>• Changes in Income Level</li> <li>• Community expectation in gaining more benefit from Tangguh LNG ( education, health, livelihood, intreprenurship, and human resources development programs)</li> <li>• Community expectation in handling various strategic issues (Revenue Sharing, adat compensation, gas allocation, electricity, housing, region expansion, Social Program coverage area, and large scale Infrastructure development)</li> <li>• Seawater Intrusion</li> </ul>	Negative	Derivative Impact	Long Term	Regional	Large	Medium	High	High	Major
		Social Tension	Community Perception	Negative	Derivative Impact	Long Term	Regional	Medium	Medium	High	Small	Moderate
		Changes in Cultural Heritage	Change in Population Migration (Mobility), Changes in Population Structure and Population Growth	Negative	Derivative Impact	Long Term	Local	Medium	Medium	High	Medium	Major
18	Education	Decreasing in Public Services including Education	Changes in Population Migration (Mobility), Changes in Population Structure and Population Growth	Negative	Derivative Impact	Long Term	Local	Medium	Medium	High	Medium	Major
19	Public Health	Changes in Disease Patterns	Changes in Population Migration (Mobility), Changes in Population Structure and Population Growth	Negative	Derivative Impact	Long Term	Regional	Large	Medium	High	Medium	Major
		Changes in Disease Prevalence	Changes in Population Migration	Negative	Derivative Impact	Long Term	Regional	Large	Low	High	Medium	Major

No	Environmental Component	Parameter of Impact	Source of Impact	Nature of Impact	Type of impact	Duration of Impact	Extent of Impact	Magnitude of Impact	Sensitivity of Receptor	Severity of Impact	Likelihood of Impact	Significance of Impact
			(Mobility), Changes in Population Structure and Population Growth									
		Changes in Access to Healthcare	Changes in Population Migration (Mobility), Changes in Population Structure and Population Growth	Negative	Derivative Impact	Long Term	Regional	Large	Medium	High	Medium	Major
		Changes in Environmental Health	Change in Population Migration (Mobility), Changes in Population Structure and Population Growth	Negative	Derivative Impact	Long Term	Local	Medium	Medium	High	Medium	Major
<i>Post-Operation Phase</i>												
20	Demographics	Changes in Population Migration (Mobility), Changes in Population Structure and Population Growth	Job Opportunities	Negative	Derivative Impact	Long Term	Local	Medium	Medium	High	High	Major
21	Economy	Job Opportunities	Workforce Demobilization	Negative	Direct Impact	Long Term	Regional	Medium	High	High	Small	Moderate
		Changes in Local Business Growth	Job Opportunities	Negative	Derivative Impact	Long Term	Regional	Medium	Medium	High	High	Major
		Changes in Livelihood Pattern	Job Opportunities	Negative	Derivative Impact	Long Term	Local	Medium	Medium	High	Medium	Major
		Changes in Level of Income	Job Opportunities	Negative	Derivative Impact	Long Term	Local	Medium	High	High	Medium	Major
22	Socio- Cultural	Community Perception	Workforce Demobilization	Negative	Derivative Impact	Long Term	Regional	Medium	Medium	High	Medium	Major
		Social Tension	Community Perception	Negative	Derivative Impact	Long Term	Regional	Medium	Medium	High	Small	Moderate
23	Education	Decreasing in Public Services including Education	Changes in Population Migration (Mobility), Changes in Population Structure and Population Growth	Positive	Derivative Impact	Long Term	Local	Medium	Medium	High	Medium	Major
24	Public Health	Changes in Healthcare Access	Changes in Population Migration (Mobility), Changes in Population Structure and Population Growth	Negative	Derivative Impact	Long Term	Regional	Large	Low	Medium	Medium	Moderate
<b>MARINE FACILITIES ACTIVITIES</b>												
1	Marine Biota	Changes in Nekton Diversity (Including Marine Mammals)	• Sea Transportation for Workforce, Equipment and Materials • Loading and Transportation of LNG and Condensate	Negative	Direct Impact	Long Term	Local	Medium	Medium	High	Small	Moderate
		Decrease in Benthos Abundance	Dredge Material Disposal (Construction Phase) and Maintenance Dredging in the Operations Phase	Negative	Direct Impact	Long Term	Local	Medium	Medium	High	High	Major
<i>Construction Phase</i>												
2	Economy	Fishery Activity Disturbance	Construction of BOF (Bulk Offloading Facility)	Negative	Direct Impact	Short Term	Local	Medium	High	High	Medium	Major
		Sea Transportation Accessibility Disturbance	Construction of BOF (Bulk Offloading Facility)	Negative	Direct Impact	Short Term	Local	Medium	High	High	Medium	Major
		Decrease in Fishermen' Incomes	• Fishery Activity Disturbance • Sea Transportation Accessibility Disturbance	Negative	Derivative Impact	Short Term	Local	Medium	High	High	Medium	Major

No	Environmental Component	Parameter of Impact	Source of Impact	Nature of Impact	Type of impact	Duration of Impact	Extent of Impact	Magnitude of Impact	Sensitivity of Receptor	Severity of Impact	Likelihood of Impact	Significance of Impact
3	Socio- Cultural	Changes in Cultural Heritage	<ul style="list-style-type: none"> <li>• Construction of BOF (Bulk Offloading Facility)</li> <li>• Enhancement of Combo Dock</li> </ul>	Negative	Direct Impact	Short Term	Local	Medium	High	High	Medium	Moderate
		Community Perception	<ul style="list-style-type: none"> <li>• Operations of LNG Train 1 and 2</li> <li>• Fishery Activity Disturbance</li> <li>• Sea Transportation Accessibility Disturbance</li> <li>• Changes in Cultural Heritage</li> </ul>	Negative	Derivative Impact	Short Term	Local	Medium	High	High	Medium	Major
		Social Tension	Community Perception	Negative	Derivative Impact	Short Term	Local	Medium	Medium	High	Small	Moderate
<i>Operation Phase</i>												
4	Economy	Fishery Activity Disturbance	<ul style="list-style-type: none"> <li>• Sea Transportation for Workforce, Equipment and Materials</li> <li>• Loading and Transportation of LNG and Condensate</li> <li>• Existence of Marine Facilities</li> </ul>	Negative	Direct Impact	Long Term	Local	Large	High	Very High	Medium	Major
		Sea Transportation Accessibility Disturbance	<ul style="list-style-type: none"> <li>• Sea Transportation for Workforce, Equipment and Materials</li> <li>• Loading and Transportation of LNG and Condensate</li> <li>• Existence of Marine Facilities</li> </ul>	Negative	Direct Impact	Long Term	Local	Large	High	Very High	Medium	Major
		Decrease in Fishermen' Incomes	<ul style="list-style-type: none"> <li>• Fishery Activity Disturbance</li> <li>• Sea Transportation Accessibility Disturbance</li> </ul>	Negative	Derivative Impact	Long Term	Local	Large	High	Very High	Medium	Major
5	Socio- Cultural	Community Perception	<ul style="list-style-type: none"> <li>• Operations of LNG Train 1 and 2</li> <li>• Fishery Activity Disturbance</li> <li>• Sea Transportation Accessibility Disturbance</li> </ul>	Negative	Derivative Impact	Long Term	Local	Large	Medium	High	High	Major

Flow charts of each significant impact parameter and source of impact for Gas Exploitation (Offshore Platform and Production Well Drilling), Gas Transmission, LNG Plant and Marine Facilities activities are respectively shown in Figure IV-1, Figure IV-2, Figure IV-3 and

**Figure IV-4.** Activities not causing impacts are ignored in the flow charts.

Based on the list of significant impacts, their nature and the source of impact as shown in **Table IV-3** as well as the correlation between significant impact and the source of impact as shown in the flow charts in **Figure IV-1**, Figure IV-2, Figure IV-3 and Figure IV-4, we thus determine the significant impact either cumulative or holistic with the following definition:

1. The cumulative impact is the impact of an activity taking place along with the impact of other activities to the receptor (human or animal) or resources (environmental component, geophysical-chemical, biological, socio-economic-cultural) in the same space and time; and
2. The holistic impact is the impact originating from more than one activity or derived from various derivative impacts to receptor (human or animal) or resources (environmental components, geophysical-chemical, biological, socio-economic-cultural) in the same space and different time; or in a different space and same time; or in different time and space.

Based on the above definitions, the following are impacts classified as cumulative impacts and holistic impacts:

#### ***Cumulative Impact***

- The Flowcharts of Significant Impact respectively in Figure IV-1, Figure IV-2, and Figure IV-4 for Gas Exploitation (Offshore Platform and Production Wells Drilling), Gas Transmission and Marine Facilities activities do not indicate cumulative impact.
- The cumulative impact are identified in the LNG Plant activities as shown in the flow chart of significant impact shown in Figure IV-3, namely:
  - Parameter of "increase in CO<sub>2</sub> emissions". The CO<sub>2</sub> emissions take place simultaneously that sourced from flaring activity, Power Generator (Gas Turbine), Boiler and *Acid Gas Incinerator-AGI*, and the receptor of the impact is the same space, namely the atmosphere around Tangguh LNG. Although CO<sub>2</sub> gas is not cumulative chemically, but due to CO<sub>2</sub> is emitted simultaneously by the various operations of the LNG Plant and other activities that globally produce CO<sub>2</sub> gas, thus the amount of CO<sub>2</sub> that can be sequestered by nature is less than the amount of CO<sub>2</sub> emissions into the atmosphere. Therefore, the CO<sub>2</sub> concentration in the atmosphere will be increasingly from time to time.
  - Parameter of "increase in surface water runoff " takes place simultaneously from Land Clearing, Cut and Fill, and Site Preparation activities that can occur in the same space at the relative same time (does not have long time lag between one activity to another). The increase in surface water runoff causes a derivative impact on soil erosion increasing (secondary impact) which in turn will create a derivative impact on increase in TSS content of surface water (tertiary impact).

### *Holistic Impact*

- The Flowcharts of Significant Impact in **Figure IV-1**, Figure IV-2, Figure IV-3 and **Figure IV-4** and **Table IV-3**, show the holistic significant impacts as follows:
  - Community perception can arise from various activities of Gas Exploitation (Offshore Platform and Production Wells Drilling), Gas Transmission, LNG Plant and Marine Facilities activities as well as between activities that take place either in the same space-different time, different space-same time or in different time and different space. In addition, community perception is also a continued impact of the existence and operations of Tangguh LNG train 1 and 2. Some parameters of the direct impacts and derivative impacts that cause community perception among others are job opportunities (during workforce mobilization and demobilization), fishery activity disturbance, sea transportation accessibility disturbance, light sighting and opacity of flaring, potential seawater intrusion into groundwater, existence of offshore platforms, and changes in social norms and value as well as cultural heritage. Community perception will causes a derivative impact of social tension.
  - Changes in local business growth originates from derivative impact due to job opportunities during the construction phase. In the operation phase considerable business opportunities will arise that will also have a derivative impact on the local businesses growth. This impact can occur in different space (villages and regency cities around the Tangguh LNG, locally and regionally in Teluk Bintuni Regency, Fakfak Regency and generally in the province of West Papua, especially in the Province Capital City of Manokwari) and at different time (during construction and operation phases of the Tangguh LNG).



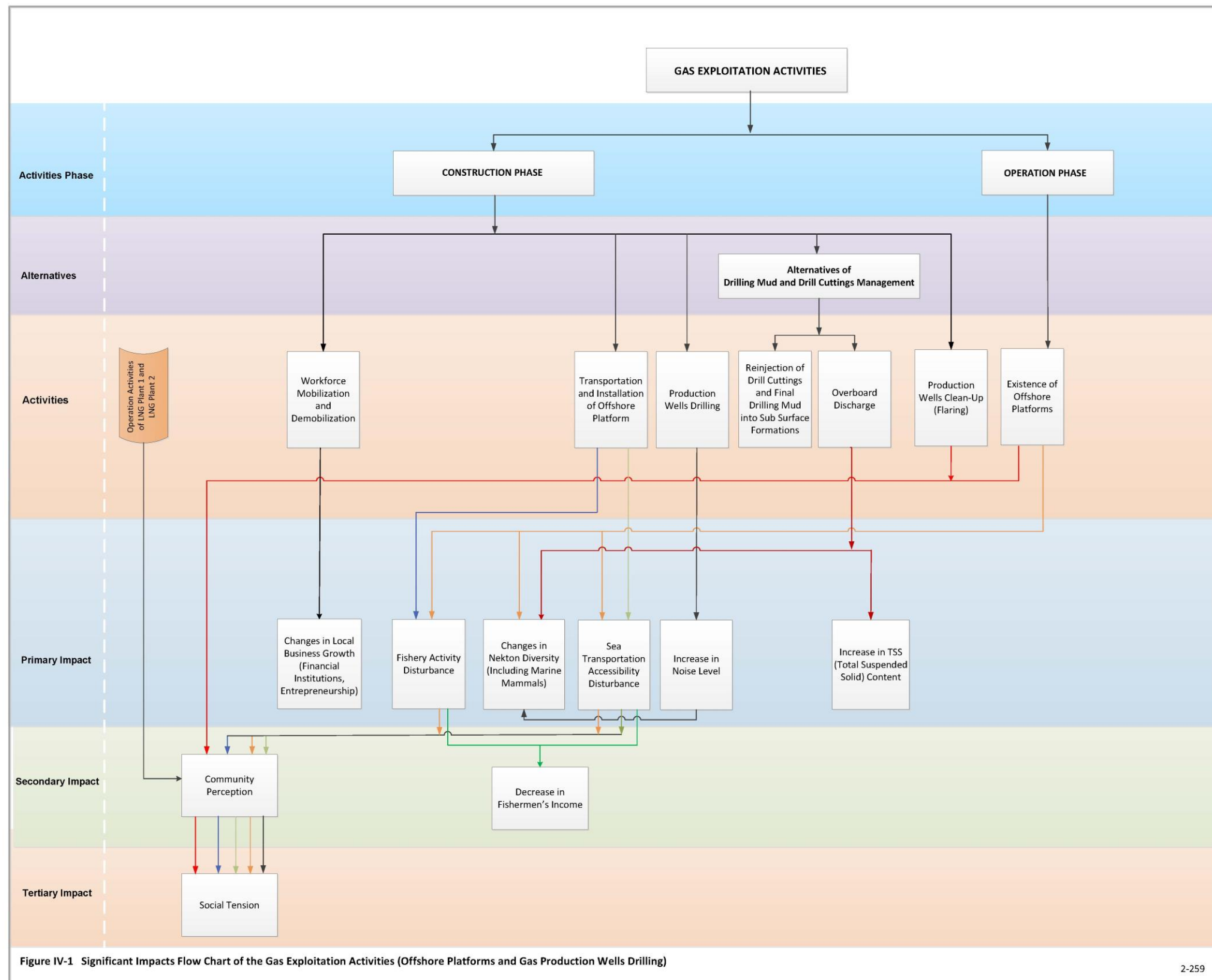


Figure IV-1 Flow Chart of Significant Impact for Gas Exploration Activities

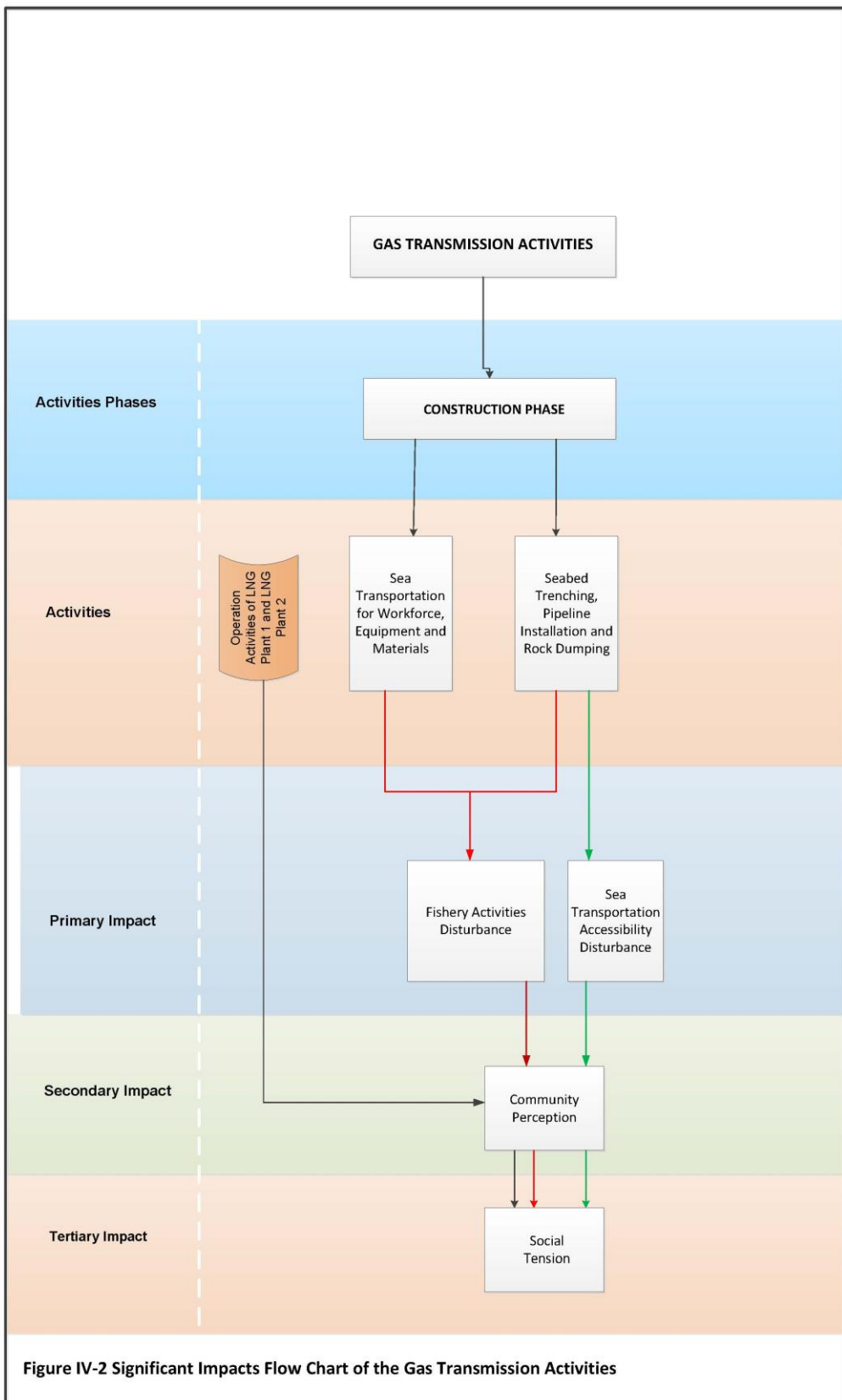


Figure IV-2 Flow Chart of Significant Impact for Gas Transmission Activities

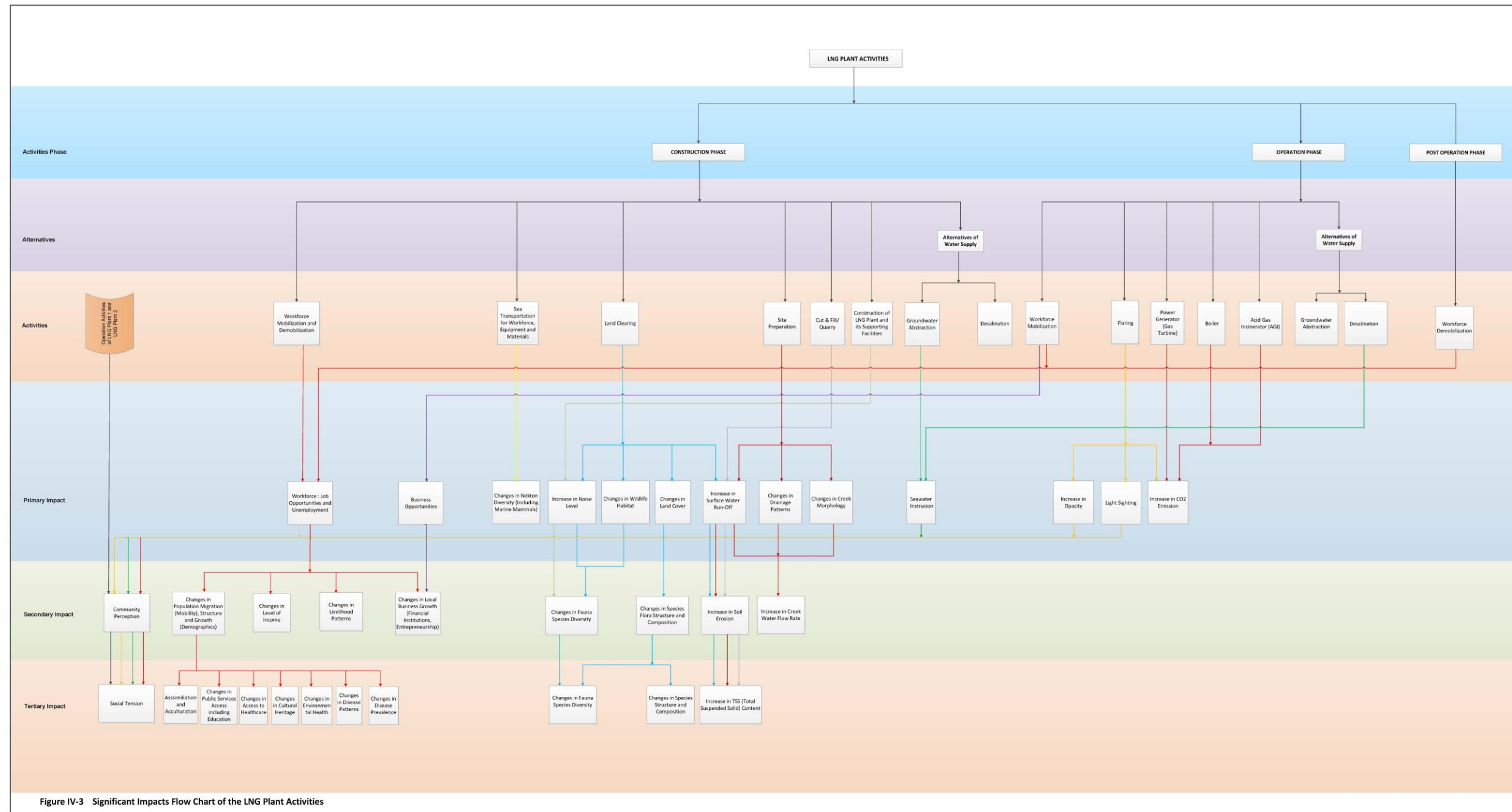
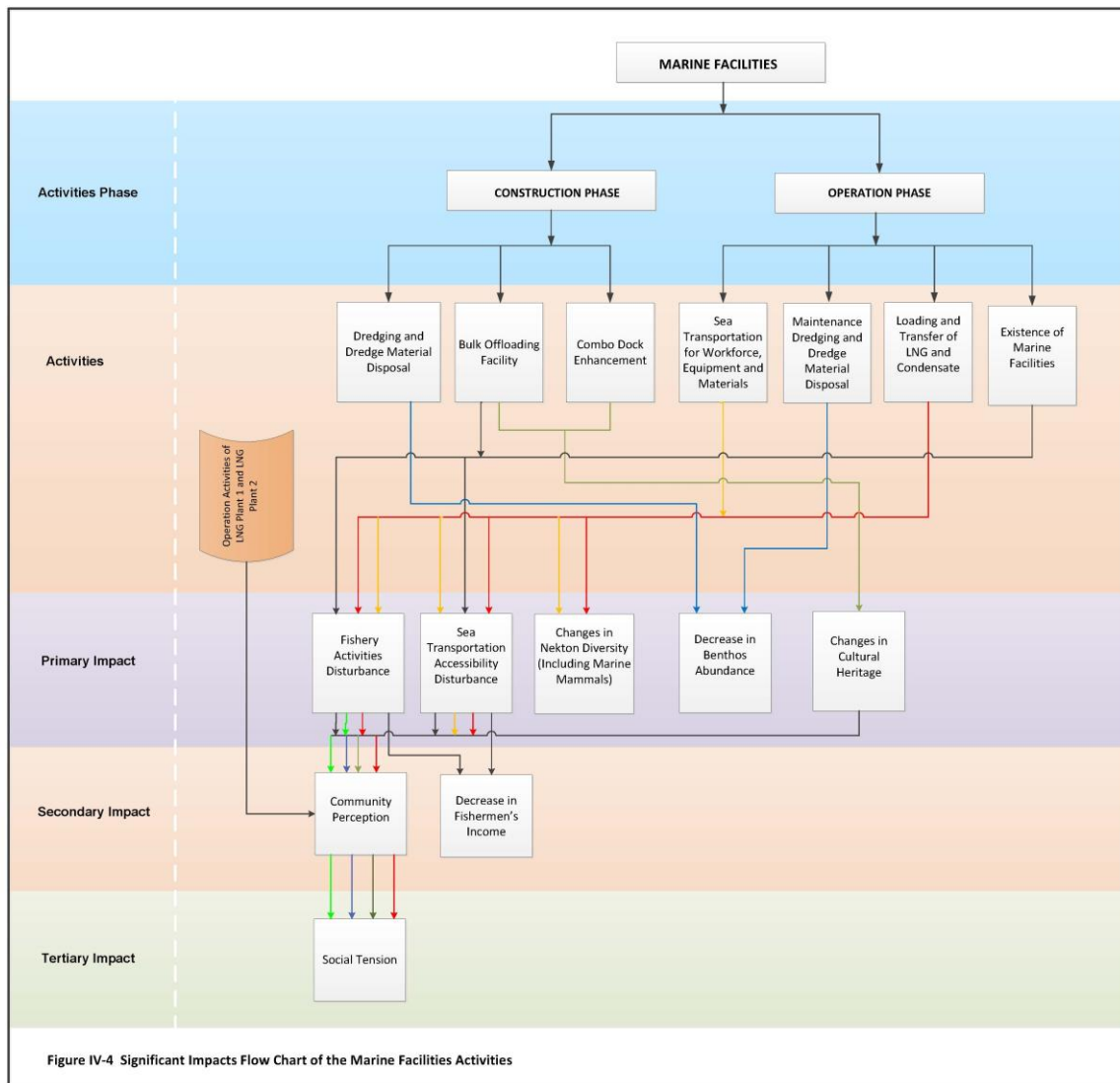


Figure IV-3 Significant Impacts Flow Chart of the LNG Plant Activities

Figure IV-3 Flow Chart of Significant Impact for LNG Plant Activities



**Figure IV-4 Flow Chart of Significant Impact for Marine Facilities Activities**

- Changes in nekton diversity (in particular marine mammals) sourced from various activities for each of the Gas Exploitation (Offshore Platform and Production Wells Drilling), LNG Plant and Marine Facilities activities as well as between activities that take place either in the same space-different time, in different space-at the same time or at different time and different space. Some parameters of the direct impacts and derivative impacts that potentially cause change in nekton diversity (in particular marine mammals), among others are sea transportation for workforce, equipment, and materials of all Tangguh LNG expansion activities (Gas Exploitation, Gas Transmission, LNG Plant and Marine Facilities); increase in underwater noise levels from production wells drilling activities; existence of offshore platforms; overboard discharge of drilling mud and drill cuttings; loading and transportation of LNG and condensate.

- Decrease in benthos abundance sourced from disposal of dredged materials from the Marine Facilities activities taking place in the same space (same discharge location) at different time (dredging will be conducted during construction phase of BOF and enhancement of combo dock while maintenance dredging will occur in the operation phase).
- Increase in Total Suspended Solids (TSS) of sea water sourced from overboard discharge of drilling mud and drill cuttings during the drilling mud and drill cuttings management of the Gas Exploitation Activities (Offshore Platform and Production Wells drilling) taking place at different time and different space of the drilling activities that is carried out in all offshore platforms proposed to be developed in the initial development stage and future development.

### *Activities with the Most Significant Impact*

Based on the Flow Charts of Significant Impact in Figure IV-1, Figure IV-2, Figure IV-3 and Figure IV-4 and **Table IV-3**, the activities of each project activity with most significant impacts are as follows:

- The Gas Exploitation activities causing the most significant impacts are respectively: (a) transportation of offshore platform into the Bintuni Bay waters causing impacts of fishery activity disturbance and sea transportation accessibility disturbance to the community taking place for a short period of time; (b) the existence of offshore platforms causing impacts of fishery activity disturbance and sea transportation accessibility disturbance for a long term period.
- The Gas Transmission activities causing the most significant impacts are respectively: (a) sea transportation for workforce, equipment, and materials; and (b) Seabed trenching, pipeline intallations and rock dumping causing impact of fishery activity disturbance and sea transportation accessibility disturbance to the community which in turn arise derivative impacts on community perception and social tension. However the impact is only temporary during the installation of gas transmission pipelines.
- The LNG Plant activities causing the most significant impacts are respectively: (a) Workforce mobilization and demobilization; (b) land clearing; (c) site preparation; and (d) cut and fill. Workforce mobilization and demobilization cause impacts on job opportunities as a direct impact will create derivative impacts toward various parameters of demography, economy, socio-culture, public services including education, and public health taking place both in the construction and operation phases. Land clearing, site preparation, cut and fill which only occur temporarily during the construction phase will cause direct impact such as increase in surface water runoff as a primary impact and subsequent derivative impact of increased soil erosion (secondary impact) and the increase in Total Suspended Solids (TSS) content of surface water (tertiary impact), which only lasts for a limited period in the Tangguh LNG site.

- The Marine Facilities activities causing the most significant impacts are respectively: (a) sea transportation for workforce, equipment and materials, especially in the operation phase; (b) construction of BOF (Bulk Offloading Facility); and (c) loading and transportation of LNG. All three of these activities directly causing impact of fishery activity disturbance, sea transportation accessibility disturbance, and disturbance in marine mammals. Fishery activity disturbance and sea transportation accessibility disturbance will subsequently create derivative impacts on community perception (secondary impact) and social tension (tertiary impact).

### *The Nature, Extent and Duration of Impact*

Based on the list of significant impacts and nature of impacts as shown in **Table IV-3**, apparently most of the impacts on the environmental components of geophysical-chemical and biological are negative except for the environmental parameter of nekton diversity that is positive due to the existence of offshore platforms. This might occur due to the legs of offshore platforms can serve as FAD (*rumpon*).

In terms of socio-economic impacts, several positive impacts are job opportunities; changes in local businesses growth; business opportunities; and changes in livelihood patterns. As for the rest, most of the impacts on parameters of demography, economy, socio-culture, public services including education and public health are negative.

In terms of the extent of impact, most impacts on geophysical-chemical and biological parameters take place locally, i.e. limited to the project site. From modeling results, the impacts of land clearing and site preparation only take place in the Tangguh LNG project site, the impact of overboard discharge of drilling mud and drill cuttings only takes place in maximum radius of about 500 m from the outfall, the noise impact from BOF construction takes place in a radius of about 1 km from the source.

Some impacts on the economy, socio-culture, public services including education, and public health are local impacts limited to the villages at the shoreline of Bintuni Bay within the study area boundary. Regional extent of impacts (beyond the study area boundary) but limited to Fakfak Regency, Teluk Bintuni Regency and Manokwari as a capital city of the West Papua Province are impacts on job opportunities; local businesses growth; business opportunities; changes in income level; changes in population migration (mobility), changes in population structure and population growth; assimilation and acculturation; community perception, social tension, changes in disease pattern, changes in disease prevalence; and changes in access to healthcare.

In terms of the extent, it was identified an impact to be global, namely increase in CO<sub>2</sub> emission. CO<sub>2</sub> emission is global as these gases can disperse globally in the atmosphere. Though the extent of impact is global, but only impact on the Bintuni Bay waters is noted as scope of this study.

In terms of duration of impact, as shown as Figure IV-1, Figure IV-2, Figure IV-3 and Figure IV-4 also **Table IV-3**, most impacts on geophysical-chemical and biological only takes place in the construction phase that is short-term such as increase in surface water runoff, increase in soil erosion, terrestrial fauna, and so forth; only disturbance to marine mammals is carried-over from the construction phase to the operation phase and is long-term. The impacts on demography, socio-culture, economy, public services including education, and public health in general are long-term, i.e. taking place from the construction phase to the operation phase, including job opportunities; local businesses growth; changes in population migration (mobility); business opportunities; changes in income level; assimilation and acculturation, changes in disease patterns and disease prevalence.

In terms of significance of impact, no many significant impacts on environmental components of geophysical-chemical and biological (classified as minor-moderate, moderate and major) were identified both in the construction and operation phases. In the operation phase only CO<sub>2</sub> emission and disturbance to marine mammals were classified as significant. On the other hand, almost all demographic, economic, socio-cultural, public services including education, and public health parameters either in the construction phase or the operational phase continue to have significant impact, i.e most of the impacts are "major" categorized.