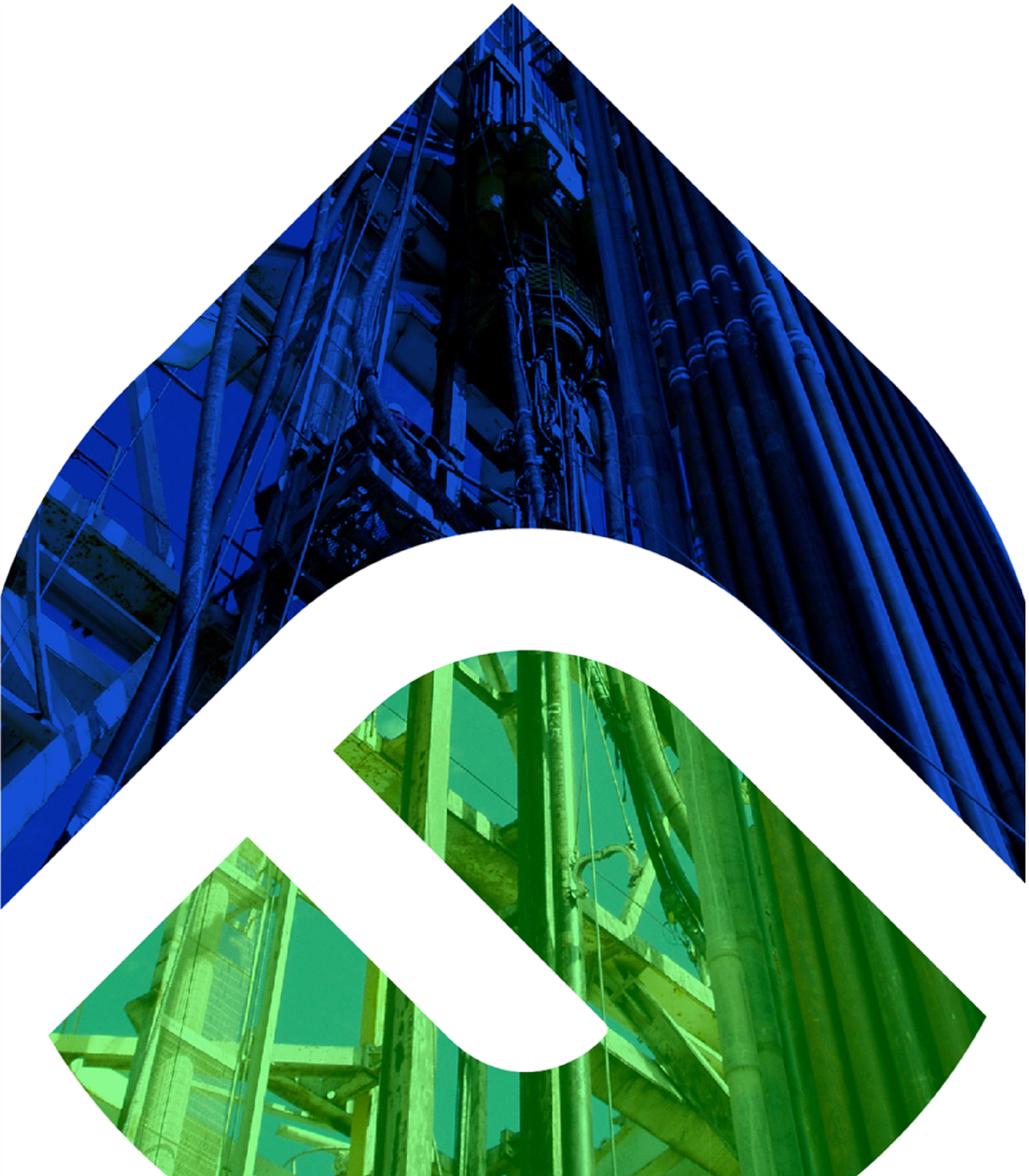
KTJ Development Project

Environmental Impact Statement

20th May 2026



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Acronyms

Acronym	Meaning
AEP	Australian Energy Producers
AIMS	Australian Institute of Marine Science
ALARP	As Low As Reasonably Practicable
AMN	National Maritime Authority
AMP	Australian Marine Park
AMSA	Australian Maritime Safety Authority
ANP	Autoridade Nacional do Petróleo
ANZG	Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2018)
API	American Petroleum Institute gravity
APPEA	Australian Petroleum Production & Exploration Association
APORTIL	Administrasaun Portuariu Timor-Leste / Timor-Leste Port Administration
ASEAN	The Association of Southeast Asian Nations
AUDINJ	Auditory Injury (AUDINJ) Onset Criteria
AUV	Autonomous Underwater Vehicle
BAOAC	Bonn Agreement Oil Appearance Code
BIA	Biologically Important Area
BMS	Business Management System
BoM	Bureau of Meteorology
BOP	Blowout Preventer
BOPD	Barrels of Oil Per Day
BP	Boiling Point
BTEXN	Benzene, Toluene, Ethylbenzene, Xylenes, Naphthalene
BU	Branch Unit
CAPEX	Capital Expenditure
CCS	Carbon Capture and Storage
CEFAS	Centre for Environment, Fisheries and Aquaculture Science
CHARM	Chemical Hazard and Risk Management
CHPN	Commonwealth Heritage Place – Natural
CMMS	Computerised Maintenance Management System
COLREGS	International Regulations for Preventing Collisions at Sea 1972
CTD	Conductivity, Temperature, and Depth
DA	Development Area
DP	Dynamic Positioning
DST	Drill Stem Test
EBS	Environmental Baseline Survey
ECMWF	European Centre for Medium-Range Weather Forecasts
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EMBA	Environment that may be affected
EMP	Environmental Management Plan

ENSO	El Niño–Southern Oscillation
ENVID	Environmental Risk Identification Workshop
ERA5	ECMWF Reanalysis v5
ESD	Emergency Shutdown
ESP	Electric Submersible Pump
ESP	Education Sector Plan
FADS	Fish Aggregating Devices
FDP	Field Development Plan
FEED	Front-End Engineering and Design
FID	Final Investment Decision
FPSO	Floating Production, Storage and Offloading
GHG	Greenhouse Gas
GOR	Gas–Oil Ratio
GP	Geophysical
GPGT	Geophysical and Geotechnical
GT	Geotechnical
HAZID	Hazard Identification
HAZOP	Hazard and Operability Study
HFO	Heavy Fuel Oil
HS	Halona Serena
HSE	Health, Safety, Environment
HUC	Hook up and Commissioning
HXT	Horizontal Xmas Tree
IAPP	International Air Pollution Prevention Certificate
IBRA	Interim Biogeographic Regionalisation for Australia
IFO	Intermediate Fuel Oil
ILT	In-Line Tee
ILO	International Labour Organization
IMCRA-MESO	Integrated Marine and Coastal Regionalisation of Australia – Meso-scale
IMCRA-PROV	Integrated Marine and Coastal Regionalisation of Australia – Provincial
IMF	International Monetary Fund
IMO	International Maritime Organization
IMP	Integrated Master Plan
IMR	Inspection, Maintenance and Repair
IMS	Invasive Marine Species
INETL, I.P.	Instituto Nacional de Estatística de Timor-Leste, Instituição Pública
IRPA	Individual Risk Per Annum
ITCZ	Inter-Tropical Convergence Zone
ITF	Indonesian Throughflow
IUCN	International Union for Conservation of Nature
IUU	Illegal, Unreported and Unregulated fishing
JPDA	Joint Petroleum Development Area
KEF	Key Ecological Feature
KOICA	Korea International Cooperation Agency

KTJ	Kuda Tasi–Jahal Project
LC50	Lethal Concentration 50%
LFPR	Labor Force Participation Rate
LLI	Long Lead Item
LNG	Liquefied Natural Gas
LOWC	Loss of Well Control
MAHs	Monoaromatic Hydrocarbons
MARPOL	International Convention for the Prevention of Pollution from Ships
MBES	Multibeam Echosounder
MCC	MCC Sustainable Futures
MCS	Master Control Station
MDO	Marine Diesel Oil
MMA	Marine Management Area
MODU	Mobile Offshore Drilling Unit
MoH	Ministry of Health
MOU	Memorandum of Understanding
MP	Marine Park
MPW	Ministry of Public Works
MR	Marine Reserve
MSDS	Material Safety Data Sheet
mSS	Metres Subsea
MTD	Maritime Transport Department (Timor-Leste)
NOAA	National Oceanic and Atmospheric Administration (US)
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
NR	Nature Reserve
NRC	National Research Council (US)
NRMR	Natural Resource Management Region
NWBM	Non Water-Based Mud
OBM	Oil-based muds
OCNS	Offshore Chemical Notification Scheme
OIM	Offshore Installation Manager
OMS	Operating Management System
OOC	Oil On Cuttings
OPEP	Oil Pollution Emergency Plan
OPGGS Act	Offshore Petroleum and Greenhouse Gas Storage Act 2006
OSPAR Commission	Oslo Paris Commission
OSV	Offshore Support Vessels
OWC	Oil–Water Contact
PAHs	Polycyclic Aromatic Hydrocarbons
PCP	Public Consultation Plan
PDPM	Project Delivery Process Manual
PER	Public Environment Report
PLONOR	Poses Little Or No Risk
PMS	Planned Maintenance System

PPP	Public-Private Partnership
PSC	Production Sharing Contract
PSD	Particle Sized Distribution
PSV	Pressure Safety Valve
PSZ	Petroleum Safety Zone
PTW	Permit to Work
PW	Produced Water
P&A	Plug and abandonment
ROV	Remotely Operated Vehicle
RMR	Riserless Mud Recovery
RSB	Reefs, Shoals and Banks
SAP	Sampling and Analysis Plan
SCE	Solids Control Equipment
SBM	Synthetic based muds
SOLAS	International Convention for the Safety Life of Sea
SSS	Side-scan sonar
SCM	Subsea Control Module
SDP	Strategic Development Plan
SIMAP	Spill Impact Mapping
SIS	Safety Instrumented System
SISCa	Serviço Integrado de Saúde Comunitária
SKM	Sinclair Knight Merz
SOPEP	Shipboard Oil Pollution Emergency Plan
SoW	Scope of Work
SPCS	Subsea Production Control System
SSXT	Subsea Christmas Tree
STCW	International Convention on Standards of Training, Certification and Watchkeeping for Seafarers 1978
SUDU	Subsea Umbilical Distribution Unit
TL-FCS	Timor-Leste Fish Consumption Survey
TLP	Tension Leg Platform
TLSSC	Timor-Leste South Submarine Cable
TOR	Terms of Reference
TPH	Total Petroleum Hydrocarbons
TRH	Total Recoverable Hydrocarbons
TSS	Total Suspended Solids
TTS	Temporary Threshold Shift
UNDP	United Nations Development Programme
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
UNICEF	United Nations Children's Fund
UNPF	United Nations Population Fund
UNSDGs	United Nations Sustainable Development Goals
USBL	Ultra-Short Baseline
UTA	Umbilical Termination Assembly

VMS	Vessel Monitoring System
WAMOPRA	Western Australian Marine Oil Pollution Risk Assessment
WASH	Water, Sanitation, and Hygiene
WBS	Work Breakdown Structure
WBM	Water based muds
WHO	World Health Organization
WTO	World Trade Organization

Disclaimer

Revision History

Revision	Date	Author	Amendment
A	18/05/2026	MCC Sustainable Futures	Issued for Final Review
0	20/05/2026	MCC Sustainable Futures	Submitted to ANP Rev 0

Authorisation

Designation	Name	Date	Signature
Reviser	Gillian Goby – MCC Sustainable Futures	19/05/2026	Gillian Goby
Approver	Aaron Bond – Finder Energy	19/05/2026	

1. EXECUTIVE SUMMARY

1.1 Introduction

PSC 19-11 in the Bonaparte Basin, offshore Timor-Leste contains four undeveloped oil fields, including the fully appraised Kuda Tasi and Jahal fields, which will enable a fast-track FPSO-based development targeting FID in mid-2026 and first oil in late 2027. The Finder and Timor Gap Joint Venture has advanced key technical, commercial, and funding workstreams and plans to undertake a safe, compliant field development.

The Kuda Tasi and Jahal oil fields will be initially developed via three oil production subsea wells in ~400m water depth. The subsea wells will be connected to and controlled by flowlines and umbilicals to the Petrojarl FPSO that will be permanently moored on location via a turret mooring system.

Petroleum Activities in PSC 19-11 fall under Decree Law 2019/25 “Transition of Petroleum Titles and Regulation of Petroleum Activities from the Joint Petroleum Development Area” and the associated Interim Administrative Guidelines for the JPDA – Guideline # 5 “Guideline for the preparation of Environmental Impact Assessments of petroleum activities”. An Environmental Impact Assessment (EIA) has been conducted to assess major impacts for the proposed development including drilling, construction, installation and operation and to assist in the design of any additional environmental studies.

1.1.1 Objective of EIS

The objective of this EIS is to identify, predict and evaluate the potential environmental, social and economic impacts associated with all phases of the KTJ Project, and to demonstrate how these impacts will be avoided, minimised or managed to acceptable levels. The EIS provides the technical basis for informed decision-making by the regulator, supports the approval process for the project, and ensures that environmental protection, stakeholder concerns and regulatory obligations are fully integrated into project planning. It also establishes the baseline conditions, assesses feasible alternatives, and outlines the control measures and management commitments required to reduce risks to ALARP (As Low As Reasonably Practicable) throughout the project lifecycle.

1.2 Summary of EIS Activities

1.2.1 Scope of EIS

The scope of this Environmental Impact Statement (EIS) encompasses all activities associated with the KTJ Project across its full lifecycle, including geophysical and geotechnical (GPGT) surveys, environmental baseline surveys, development drilling, subsea infrastructure installation, Floating Production, Storage and Offloading (FPSO) connection, construction, installation and commissioning, operations, and eventual decommissioning. The EIS assesses the potential environmental, social and economic impacts of these activities within defined spatial and temporal boundaries, covering the physical, ecological, social, cultural and economic environments, as well as climate change considerations. The assessment also includes evaluation of feasible project alternatives, planned and unplanned activities, cumulative impacts, and the identification of control measures to reduce risks to ALARP. Public consultation, stakeholder engagement, and proposed monitoring programs form part of the scope to ensure that community values, regulatory requirements and environmental protection objectives are fully addressed.

1.2.2 Methodology of EIS

The Environmental Impact Statement (EIS) was prepared using a structured, multi-stage assessment framework consistent with Timor-Leste’s environmental regulatory requirements and international best practice. The methodology integrates baseline environmental and socio-economic studies, a systematic alternatives assessment, detailed impact evaluation, and extensive stakeholder consultation to ensure a comprehensive understanding of the project's potential effects.

The assessment began with defining the scope of the EIS, including the project's spatial and temporal boundaries, key activities across all project phases (surveys, drilling, installation, operations, and decommissioning), and the environmental and social components requiring evaluation. Baseline conditions were established using existing datasets, targeted environmental surveys (physical, ecological, social, and economic), and climate change projections to characterise the receiving environment and identify sensitive receptors.

A multi-criteria alternatives analysis was undertaken to evaluate feasible development options, considering environmental, technical, safety, and economic factors. This process informed the selection of the preferred development concept and ensured that environmental risks were reduced to ALARP while maintaining technical and economic viability.

Potential impacts were then assessed using a risk-based methodology, consistent with the approach outlined in Section 9 of the EIS. Each planned and unplanned activity was evaluated for its likelihood and consequence, taking into account receptor sensitivity, existing conditions, and the effectiveness of proposed control measures. Where detailed design information was not yet available, conservative assumptions and industry-standard practices were applied to ensure robust and precautionary assessment outcomes.

The EIS also incorporates social and economic assessments, climate change considerations, and cumulative impact analysis to provide a holistic understanding of the project's implications. Stakeholder consultation formed a core component of the methodology, with engagement activities used to identify community concerns, validate baseline information, and inform the development of mitigation and management measures.

Overall, the EIS methodology provides a transparent, evidence-based framework that supports informed decision-making and demonstrates how environmental and social risks associated with the KTJ Project have been identified, assessed, and managed.

1.3 Alternatives and Justifications of the Project

The Timor-Leste Strategic Development Plan (SDP) 2011–2030 is the country's overarching long-term blueprint for national development after independence. It sets out a 20-year vision to transform Timor-Leste into a prosperous, upper-middle-income country by 2030. The plan is built on three core pillars—social capital, infrastructure, and economic development—focusing on improving health and education, delivering critical infrastructure such as roads, ports and power, and fostering a diversified private sector beyond oil and gas. While petroleum remains the primary economic driver in the near to medium term, the plan emphasises using these revenues to build sustainable industries, particularly in agriculture and tourism, strengthen institutions, and create jobs, with the ultimate goal of achieving broad-based economic resilience and improved living standards by 2030.

The KTJ Project, with approximately 25 MMbbl of recoverable oil, directly supports Timor-Leste's Strategic Development Plan by converting near-term petroleum resources into tangible national value through revenue generation, infrastructure development, and local capacity building. As a capital-efficient development, KTJ can deliver early cash flow to the state, contributing to the Petroleum Fund and enabling continued government investment in priority social and infrastructure programs (such as the Tasi Mane Project), while also creating local employment and supply-chain opportunities aligned with the SDP's focus on economic diversification and private sector growth. Importantly, with Bayu-Undan now depleted, KTJ Project and its accelerated development will mean it's the next offshore field into production. This provides a continuation of petroleum production and sector and fills the gap prior to the development of the Sunrise Project.

In addition, the government of Timor-Leste's Petroleum and Mineral Resources program (SDP Section 4.3) prioritises sustaining upstream production, maximising value from existing resources, and ensuring timely and efficient field development to maintain revenue continuity. The KTJ Project aligns directly with these priorities through its accelerated development approach and utilization of existing FPSO infrastructure to enable early production while minimizing the project's capital expenditure (CAPEX).

Lastly, the KTJ Project is a scalable and pragmatic development which could become the enabler project for the upside potential in PSC 19-11, such as Krill, Squilla or the low-risk exploration prospects. The KTJ Project leverages the redeployed infrastructure in the FPSO and aligns with the government's objective of maximising value from existing resources while managing capital intensity, thereby reinforcing energy sector sustainability and supporting the broader transition from resource dependence toward a more resilient, diversified economy.

A structured alternatives assessment was undertaken to identify a technically feasible, economically viable, and environmentally responsible development approach for the KTJ fields. Given the 400 m water depth and distance offshore, fixed platform solutions were not viable, and subsea tie-back to a centrally moored FPSO was identified as the only development option capable of delivering the fields economically. Reuse of a previously deployed FPSO further reduces environmental footprint and capital intensity.

A qualitative multi-criteria analysis—considering HSE, technical feasibility (including expandability), and economic performance—was applied across key development elements, including FPSO location, subsea architecture, well orientation, drilling fluids, artificial lift, flowlines, chemical selection, gas and water handling, lower completions, and decommissioning approaches. The preferred concept represents the option that reduces environmental and safety risks to ALARP while remaining technically robust and economically sustainable. The EIA/EIS will further assess the impacts of the selected development concept, applying conservative assumptions where detailed design is still evolving.

1.4 Environmental Description

1.4.1 Physical Components

The physical environment of the KTJ Development Area is characterised by offshore tropical marine conditions with distinct seasonal influences on climate, rainfall, winds and sea state. Oceanographic conditions, including currents and water column characteristics, together with regional cyclonic weather systems, are important considerations for project planning, operational safety and environmental risk management. The seabed setting reflects the geology of the Laminaria High area and includes marine sediments, bathymetric variation and seabed features relevant to infrastructure placement and impact assessment. Existing air quality and marine water quality are generally consistent with an open offshore environment, providing the baseline against which potential project-related changes will be assessed.

1.4.2 Ecological Components

The ecological environment of the KTJ Development Area comprises offshore marine habitats and species assemblages that are characteristic of the broader Timor Sea region. Key ecological values include benthic habitats and communities, with generally low-relief seabed environments that provide habitat for epifauna and infauna, as well as limited occurrences of sensitive receptors such as corals and seagrass where suitable conditions exist. The area also supports a range of marine fauna, include migratory and protected species, and overlaps with regionally important fisheries that are socially and economically significant. Protected areas and national parks in the wider region provide important the conservation context for the assessment, and together these ecological components establish the baseline for evaluating potential project-related impacts and defining appropriate management measures.

1.4.3 Economic Components

The economic environment relevant to the KTJ Project reflects the broader livelihoods and industry profile of Timor-Leste, with key sectors including employment, fishing, tourism, seaport and shipping activities, agriculture and forestry, and other emerging or supporting industries. Fishing remains an especially important economic activity in the wider region, both as a source of livelihoods and as a sector that may interact with offshore project activities, while maritime transport and port operations are also relevant given the movement of vessels, equipment and supplies. Tourism, agriculture, forestry and other industries provide additional economic context for understanding regional development patterns and potential indirect effects of the project. Together, these economic components establish the baseline for assessing potential project-related economic opportunities, constraints and interactions with existing resource users.

1.4.4 Social Components

The social environment relevant to the KTJ Project reflects the broader community profile and governance context of Timor-Leste, including demographics and population composition, living standards, health status, education, transport and infrastructure, religion, social structures and local governance, and cultural components. These factors provide important context for understanding how offshore project activities may interact with communities through employment, service demand, mobility, information sharing and stakeholder expectations. Social structures, local governance arrangements and cultural values are particularly important in shaping consultation approaches and ensuring that project engagement is appropriate, inclusive and responsive to local priorities. Together, these social components establish the baseline for assessing potential social impacts, identifying opportunities for positive contribution and informing effective mitigation and stakeholder management measures.

1.5 Public Consultation

Stakeholder engagement is a crucial component of the EIA process and for the KTJ Project has been guided by the Finder KTJ Public Consultation Plan approved by Autoridade Nacional do Petróleo (ANP). Recognising the importance of Public Consultation, Finder acknowledges its role in informing the community about the nature of the project, including its direct and indirect impacts on the public and the environment. The consultation provides an opportunity for Finder to disseminate technical and non-technical information on the project to interested parties, local communities, relevant stakeholders as well as an opportunity for the public to provide input, opinions and ideas regarding the project and to ensure that interested parties are well-informed of the proposed activity. Consultation also provides an opportunity to gather project-relevant information and stakeholder input for incorporation into the EIA and future EMPs.

The objective of the public consultation is to ensure stakeholders received sufficient information before the project activities commence, addressing any questions or concerns they may have.

To-date one-to-one consultations have been undertaken with high priority stakeholders including:

- Ministry of Agriculture, Livestock, Fisheries, and Forestry, including Direção Nacional da Quarantina e Biosegurança,
- Ministry of Tourism and Environment
- Ministry of Transportation and Communications
- Ministry of Finance (Customs)
- Ministry of Interior (Servicos da Immigrasaun)
- Ministry of defense (Autoridade Maritima Nacional/ National Maritime Authority (AMN)).

A public consultation notice has been issued, with notices in media outlets during May and a public meeting will be held on 2 June 2026. Further details on Public Consultation are provided in Section 13.

1.6 Potential Impacts and Control Measures

The proposed activity has the potential to result in a range of environmental impacts and risks, both planned and unplanned. The following tables summarise the potential environmental impacts and risks associated with the project and their associated control measures.

Table 1-1: Control Measures – Surveys

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
Planned Events				
Seabed and benthic habitat disturbance	Disturbance to the seabed from vessel and survey activities.	Temporary or permanent direct loss of benthic habitat and associated biota. Temporary and localised increase in water turbidity as a direct result of sediment disturbance.	Direct	Monitor inventory deployed to the field and track removal of equipment during activity. Position of infrastructure not on any sensitive seabed features (as informed by EBS) Equipment installed at pre-approved locations within Development Area
Light emissions	Artificial lighting: Navigational and deck lighting on the support vessels will generate light emissions.	Disorientation, attraction or repulsion. Disruption to natural behavioural patterns and cycles. Localised light glow may attract light-sensitive species, in turn affecting predator-prey dynamics.	Direct	Lighting in accordance with International Regulations for Preventing Collisions at Sea 1972 (COLREGS), Navigation Act 2012, vessel class requirements and in allowing safe operation and activities (including emergency lighting).
Noise emissions	Machinery and equipment operations on decks and working areas of vessels. Remotely Operated Vehicle (ROV) Thruster and propeller sound from vessels. Helicopter operations in emergency.	Injury to hearing or other organs. Behavioural disturbance. Masking or interfering with biologically important sounds.	Direct	Immersible equipment planned maintenance system in place to ensure it is operating efficiently and not producing excessive noise. Vessel planned maintenance system in place to ensure it is operating efficiently and not producing excessive noise. Environmental Induction includes environmental requirements as required. Restrict vessel operating speeds in the Development Area (DA) to 8 knots or less in the vicinity of marine fauna. Trained crew monitor for whales during daylight hours for 30 minutes prior to commencing geophysical (GP) operations (only for those activities that may have behavioural impact threshold). Vessel planned maintenance system in place to ensure it is operating efficiently and not producing excessive noise.
Atmospheric emissions	Sources of atmospheric emissions include:	Localised, and temporary decrease in air quality; and	Direct	International Air Pollution Prevention (IAPP) certificate valid. Vessels compliant with MARPOL Annex VI.

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
	• Power generation and process heating; • Engine exhausts; and • Fugitive emissions. • Helicopter operation in emergencies.	Contribution to global greenhouse gas (GHG) effect.		Low sulphur diesel to be used in accordance with Mobile Offshore Drilling Unit (MODU) / vessel specific procedures (under International Maritime Organization (IMO) requirements).
Interaction with other users	The presence of the 500 m radius Petroleum Safety Zone (PSZ) for restricted and controlled vessel access. Vessel physical presence in and out of the Development Area.	Disruption to commercial activities, including: Exclusion of commercial vessels from Development Area Potential reduction of commercial fish catches due to exclusion from licensed permits (where relevant) Support vessels present an obstacle and potential navigational hazard for shipping traffic *Illegal fishing captured as an unplanned event and not discussed here.*	Direct	Vessels marked on charts (500m zone) (Maritime Transport Department) communication. Relevant stakeholders (inc. the Australian Maritime Safety Authority (AMSA)) communication
				Vessel navigational and communication equipment installed, maintained and operated.
				Recovery of all deployed equipment
				In accordance with Regulation: Report and secure from the ANP an authorization to enter the contract area and authorisation from the Maritime Transport Department (MTD) to enter Timor-Leste Exclusive Economic Zone (EEZ) water for vessels, and aircraft for the activity. Report to the ANP the position / location and activity of such vessels and aircraft.
				Employ radio system for real-time communication.
				Vessel lighting in accordance with COLREGS, Navigation Act 2012, vessel class requirements and in allowing safe operation and activities (including emergency lighting).
				Ongoing communications with ANP throughout operations to prevent conflicts.
				Communication as per stakeholder management plan which defines relevant persons, responsibilities and timeframes for notifications
Operational discharges	Liquid discharges generated from vessels and routinely discharged to the marine environment include:	Potential impacts to marine fauna via: Changes to the water quality through nutrient enrichment and increased biological oxygen demand;	Direct	Oily water filtering and monitoring equipment fitted and maintained. Direct oily water from deck washing and drainage systems to an onboard oily water separator before discharge. The oil concentration in discharged water must not exceed 15ppm, in accordance with the Protection of the Sea (Prevention of Pollution from Ships) Act 1983 (MARPOL requirements).
				Garbage record book maintained (MARPOL)

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
	Slops water (Deck drainage, bilge water, tank washing) Cooling water Desalination Brine Treated Sewage Greywater Putrescible food waste	Impact to predator-prey dynamics. Changes in temperature, salinity, toxicity of water		Brine will only be discharged to sea if the oil-in-water content does not exceed 15ppm in accordance with Protection of the Sea (Prevention of Pollution from ships) Act 1983 D MARPOL Annex I (as appropriate for vessel classification) D Regulations for the Prevention of Pollution by oil. If brine has oil-in-water content over 15ppm, the brine will be contained and treated to <15ppm or disposed of onshore.
				All sewage to be treated and discharged in accordance with MARPOL. Implementation of a preventative maintenance schedule as per Manufacturer's specification for sewerage treatment & macerator equipment and recording in the rig maintenance management system.
				Garbage that has been ground to particles <25mm: >3NM from the nearest land in accordance to MARPOL Annex IV and Protection of the Sea (Prevention of Pollution from Ships) Act 1983, prior to discharge.
				Fuels, oils, and chemicals to be stored within contained and bunded areas and in accordance with their Material Safety Data Sheet (MSDS).
				Contaminated drainage from decks, machinery spaces or bunded areas will be treated through a MARPOL approved oily-water separator prior to discharge to achieve MARPOL oil-in-water content (15ppm).
				All chemicals planned for discharge to the marine environment will be managed as per Chemical Register and approved by ANP prior to use.
Unplanned Events				
Marine pest introduction	Potential for vessels to transfer IMS from international or Australian waters into the Development Area through ballast water or from vessel hulls	Localised impact on native marine fauna and flora, including: Competition, predation or displacement of native species; Alteration of natural ecological processes; Introduction of pathogens with the potential to impact human and/or ecological health;	Direct	Legislative requirements are adhered to - biofouling and ballast.

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
		Reduction and/or competition with commercial fish and aquaculture species		
Interaction with fauna	Movement of support vessels, and helicopters in the Development Area that may physically interact with or disrupt fauna	Potential risk of ship collision with cetaceans and marine reptiles (Emergency) Helicopter strike on seabirds Behavioural changes for marine fauna	Direct	Support vessels will observe speed restrictions in Development Area and in vicinity of whales - as per noise Environmental Induction includes environmental requirements as required. Restrict vessel operating speeds in the DA to 8 knots or less in the vicinity of whales. Trained crew monitor for whales during daylight hours for 30 minutes prior to commencing GP operations (only for those that may have behavioural impact threshold). Marine fauna collisions reported to ANP.
Interaction with other users (IUU and FADS)	Movement of support vessels and helicopters in the Development Area that may physically interact with or disrupt other illegal users of the sea	Potential risk of ship collision other small fishing vessels that are illegally in the area	Direct	Relevant stakeholders communication. Environmental Induction will include the possibility of other illegal users Vessel navigational and communication equipment installed, maintained and operated. In accordance with Regulation: Report and secure from the ANP an authorization to enter the Development Area and authorisation from MTD to enter Timor-Leste EEZ waters for vessels and aircraft for the activity. Report to the ANP the position / location and activity of such vessels and aircraft. Employ radio system for real-time communication. Recovery of all deployed equipment Vessel lighting in accordance with COLREGS, Navigation Act 2012, vessel class requirements and in allowing safe operation and activities (including emergency lighting). Report third-party vessel entry to the area
Unplanned release of solids	Release of solid wastes may occur as a result of overfull and/or uncovered bins, incorrectly disposed items or spills during	Solid waste items have the potential to pollute marine habitats and injure or kill fauna through ingestion or exposure.	Direct	Waste generated during operations will be managed in accordance with the waste Management Plan Environmental Induction cover off waste management Planned Maintenance System (PMS) on crane and lifting equipment to ensure fit for purpose Lift plans in place for the specific activity

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
	transfer of waste between vessels	Marine fauna entanglement risk in waste plastics, which can also be ingested when mistaken as prey.		Competent crew undertake lifts under a permit to work system
				Recovery of dropped objects where the environmental consequence is not negligible and it is safe to do so
Unplanned release of (non-hydrocarbon) liquids	There may be accidental releases/ discharges to the marine environment of a variety of potentially hazardous materials and chemicals (liquid) which are stored and utilised or produced on vessels/MODU/FPSO.	Localised decline in water quality Ingestion or physical contact with chemical compounds within the water column or sediment Accumulation and biomagnification of chemicals within the food chain	Direct	Drilling fluid bunkering and transfers will be conducted in accordance with the bunkering and transfer procedures.
				Spill response kits
				Hose integrity checks
Unplanned release of hydrocarbons (diesel) – vessel collision	Release of diesel may occur from vessel collision within the Development Area during surveys. The worst-case diesel spill scenario is due to collision of a vessel with a third-party vessel resulting in damage to a fuel oil tank and diesel released to the ocean. The maximum worst-case credible spill volume of diesel has been calculated as 400 m3 based on the largest fuel oil tank on the proposed vessels, though it is considered more likely that smaller vessels would be used.	Decrease in water quality Potential toxicity and smothering impacts to fauna Direct/indirect toxic or physiological effects on benthic habitats Pygmy blue whales may occur within the spill area	Direct	Shipboard Oil Pollution Emergency Plan valid and tested to ensure ability to respond to spills as required by MARPOL
				Vessel crew will be adequately qualified, trained, and competent in accordance with Flag State regulations, to navigate vessels
				Ongoing communications with ANP throughout operations to prevent conflicts.
				No heavy fuel oil (HFO)/intermediate fuel oil (IFO) planned to be used
				Vessels to have stocks of spill response kits/bins available and accessible onboard to respond to an onboard spill as per their Shipboard Oil Pollution Emergency Plan (SOPEP)
				In the event of a Tier 2 or Tier 3 oil spill implement the Oil Pollution Emergency Plan (OPEP) to reduce environmental impacts due to spill
				Drills and exercises undertaken in accordance with the OPEP and SOPEP
				Bulk liquids transferred in accordance with bulk transfer procedure to reduce the risk of a release to sea.
				Prevent third-party vessel entry to the immediate area around FPSO and MODU unless authorised by Offshore Installation Manager (OIM)/vessel masters
				OPEP describes minimum competency requirements of incident response personnel
				Vessels will be equipped with approved navigation systems in accordance with COLREGS

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
	GPGT EMP assumes no bunkering.			Hydrocarbon and chemical storage areas will have appropriate loss prevention features such as spill containment bunds.
				In accordance with Regulations, Finder will: Report and secure from the ANP an authorization to enter the Timor-Leste EEZ waters for vessels and aircraft of which are acquired for drilling operations. Report daily to the ANP the position / location and activity of such vessels and aircraft. Attain ANP approval for movement of MODU.
				Monitor and communicate with vessels approaching MODU/FPSO to reduce the risk of vessel collision.
				Communication as per stakeholder management plan which defines relevant persons, responsibilities and timeframes for notifications
				Vessels, MODU and Development marked on charts (500m zone) (Maritime Transport Department) communication. Relevant stakeholders (inc. AMSA) communication
				Vessel navigational and communication equipment installed, maintained and operated.
				Recovery of all deployed equipment
				MODU will be positioned in accordance with the MODU Position Plan; Anchors will be deployed and retrieved in accordance with the MODU Position Plan.
				MODU Marine Operations Manual including-A 500m radius petroleum safety zone will be maintained around the around the MODU. Vessel Master's will obtain the permission of the OIM, or on tour Barge Supervisor, before entering or leaving the 500m safety zone around the MODU.
				Rig move and rig deployment procedures.
				In accordance with Regulation: Report and secure from the ANP an authorization to enter the contract area and authorisation from MTD to enter Timor-Leste EEZ water for vessels, MODU, FPSO and aircraft for the activity. Report to the ANP the position / location and activity of such vessels and aircraft.
				Employ radio system for real-time communication.

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
				Vessel lighting in accordance with COLREGS, Navigation Act 2012, vessel class requirements and in allowing safe operation and activities (including emergency lighting).
				Berthing handbook

Table 1-2: Control Measures – Drilling

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
Planned Events				
Seabed and benthic habitat disturbance	Disturbance to the seabed from drilling activities.	Temporary or permanent direct loss of benthic habitat and associated biota. Temporary and localised increase in water turbidity as a direct result of sediment disturbance.	Direct	Monitor inventory deployed to the field and track removal of equipment during activity.
				Follow standard procedures for MODU move, anchoring, deployment, and retrieval to minimise anchor damage, chain drag on seabed.
Light emissions	Artificial lighting: Navigational and deck lighting on the support vessels will generate light emissions. From support vessels and MODU.	Disorientation, attraction or repulsion. Disruption to natural behavioural patterns and cycles. Localised light glow may attract light-sensitive species, in turn affecting predator-prey dynamics.	Direct	Lighting in accordance with COLREGS, Navigation Act 2012, vessel class requirements and in allowing safe operation and activities (including emergency lighting).
Noise emissions	Machinery and equipment operations on decks and working areas of vessels. Remotely Operated Vehicle (ROV) Thruster and propeller sound from vessels. Helicopter operations in emergency.	Injury to hearing or other organs. Behavioural disturbance. Masking or interfering with biologically important sounds.	Direct	Environmental Induction includes environmental requirements as required.
				Restrict vessel operating speeds in the DA to 8 knots or less in the vicinity of whales.
				Vessel planned maintenance system in place to ensure it is operating efficiently and not producing excessive noise.
				Planned maintenance system on MODU in place to ensure it is operating efficiently and not producing excessive noise.

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
	Drilling and MODU activity			
Atmospheric emissions	Sources of atmospheric emissions include: • Power generation and process heating; • Engine exhausts; and • Fugitive emissions. • Helicopter operation in emergencies. • Drilling flaring •	Localised, and temporary decrease in air quality; and Contribution to global GHG effect.	Direct	International Air Pollution Prevention (IAPP) certificate valid.
				Vessels compliant with MARPOL Annex VI.
				Low sulphur diesel to be used in accordance with MODU / vessel specific procedures (under IMO requirements).
				Compliance with Drill Stem Test (DST) / flaring program and well clean-up plan.
				Management of flaring equipment maintenance and inspection in Computerised Maintenance Management System (CMMS)
Interaction with other users	The presence of the 500 m radius Petroleum Safety Zone (PSZ) for restricted and controlled vessel access. Vessel physical presence in and out of the Development Area.	Disruption to commercial activities, including: Exclusion of commercial vessels from Development Area Potential reduction of commercial fish catches due to exclusion from licensed permits (where relevant) Support vessels/MODU present an obstacle and potential navigational hazard for shipping traffic *Illegal fishing captured as an unplanned event and not discussed here.*	Direct	Vessels and MODU marked on charts (500m zone) (Maritime Transport Department) communication. Relevant stakeholders (inc. AMSA) communication
				Vessel navigational and communication equipment installed, maintained and operated.
				Recovery of all deployed equipment
				MODU will be positioned in accordance with the MODU Position Plan; Anchors will be deployed and retrieved in accordance with the MODU Position Plan.
				MODU Marine Operations Manual including-A 500m radius petroleum safety zone will be maintained around the around the MODU. Vessel Master's will obtain the permission of the OIM, or on tour Barge Supervisor, before entering or leaving the 500m safety zone around the MODU.
				Rig move and rig deployment procedures.
				In accordance with Regulation: Report and secure from the ANP an authorization to enter the contract area and authorisation from MTD to enter Timor-Leste EEZ water for vessels, MODU, FPSO and aircraft for the activity. Report to the ANP the position / location and activity of such vessels and aircraft.
				Employ radio system for real-time communication.
				Vessel lighting in accordance with COLREGS, Navigation Act 2012, vessel class requirements and in allowing safe operation and activities (including emergency lighting).

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
				Ongoing communications with ANP throughout operations to prevent conflicts.
				Monitor and communicate with vessels approaching MODU to reduce the risk of vessel collision.
				Communication as per stakeholder management plan which defines relevant persons, responsibilities and timeframes for notifications
Operational discharges	Liquid discharges generated from vessels and routinely discharged to the marine environment include: Slops water (Deck drainage, bilge water, tank washing) Cooling water Desalination Brine Treated Sewage Greywater Putrescible food waste	Potential impacts to marine fauna via: Changes to the water quality through nutrient enrichment and increased biological oxygen demand; Impact to predator-prey dynamics. Changes in temperature, salinity, toxicity of water	Direct	Oily water filtering and monitoring equipment fitted and maintained. Direct oily water from deck washing and drainage systems to an onboard oily water separator before discharge. The oil concentration in discharged water must not exceed 15ppm, in accordance with the Protection of the Sea (Prevention of Pollution from Ships) Act 1983 (MARPOL requirements).
				Garbage record book maintained (MARPOL)
				Brine will only be discharged to sea if the oil-in-water content does not exceed 15ppm in accordance with Protection of the Sea (Prevention of Pollution from ships) Act 1983 D MARPOL Annex I (as appropriate for vessel classification) D Regulations for the Prevention of Pollution by oil. If brine has oil-in-water content over 15ppm, the brine will be contained and treated to <15ppm or disposed of onshore.
				All sewage to be treated and discharged in accordance with MARPOL. Implementation of a preventative maintenance schedule as per Manufacturer's specification for sewerage treatment & macerator equipment and recording in the rig maintenance management system.
				Garbage that has been ground to particles <25mm: >3NM from the nearest land in accordance to MARPOL Annex IV and Protection of the Sea (Prevention of Pollution from Ships) Act 1983, prior to discharge.
				MODU will have secondary containment including a functioning deck drainage system.
				Fuels, oils, and chemicals to be stored within contained and bunded areas and in accordance with their MSDS.
				Contaminated drainage from decks, machinery spaces or bunded areas will be treated through a MARPOL approved oily-water separator prior to discharge to achieve MARPOL oil-in-water content (15ppm).
				All chemicals planned for discharge to the marine environment will be managed as per Chemical Register and approved by ANP prior to use.
Drilling discharges	Discharge of drilling fluids, cuttings at seabed and sea surface during the activity	Potential impacts to marine fauna via: Changes to the water quality;	Direct	All chemicals planned for discharge to the marine environment will be managed as per Chemical Register and approved by ANP prior to use.
				Cuttings management system is installed and functional to ensure discharges overboard are minimised and maximum volumes available for re-use

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
		Changes in temperature, salinity, toxicity of water Changes in sediment quality at seabed		Drilling fluids Management Plan adhered to for the use, management, handling and disposal.
				Treatment of SBM coated cuttings (if used) to target residual base fluid on cuttings as per drilling fluids management plan.
				Well sections that require SBM will be drilled using a closed riser system in accordance with the Drilling Well Plan.
				MODU Permit to work procedure, including all pit dump valves have locks and a permit to work is required to open them [planned and unplanned discharge].
				MODU Pit / tank cleaning procedures to include all SBM to be recovered to a containment tank for onshore disposal and/or future reuse.
				Minimise inventories of chemicals and bulk products to reduce wastage.
				Transport and storage dry cement in bulk storage tanks and the volume of cement used will be planned in accordance with the basis of design.
				Onboard separation of drilling muds for reuse as much as practicable to minimise drilling fluids discharge to the marine water.
				A designated and proper storage area for chemical and hazardous materials must be provided on the rig.
				The storage area should be sheltered and bunded to prevent rainwater collection and to contain spills.
				Use less hazardous alternative chemicals, whenever possible.
				Handling of chemicals and hydrocarbons should comply with strict procedures, including transfer and disposal procedures.
				Spill kits, absorbents and containers to be made available for clean-up of spills or leaks on deck.
Unplanned Events				
Marine pest introduction	Potential for drilling activities to transfer IMS from international or Australian waters into the Development Area.	Localised impact on native marine fauna and flora, including: Competition, predation or displacement of native species; Alteration of natural ecological processes; Introduction of pathogens with the potential to impact human and/or ecological health;	Direct	Legislative requirements are adhered to - biofouling and ballast.

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
		Reduction and/or competition with commercial fish and aquaculture species		
Interaction with fauna	Movement of support vessels, and helicopters in the Development Area that may physically interact with or disrupt fauna	Potential risk of ship collision with cetaceans and marine reptiles (Emergency) Helicopter strike on seabirds Behavioural changes for marine fauna	Direct	Support vessels will observe speed restrictions in Development Area and in vicinity of whales - as per noise Environmental Induction includes environmental requirements as required. Restrict vessel operating speeds in the DA to 8 knots or less in the vicinity of whales. Marine fauna collisions reported to ANP
Interaction with other users (IUU and FADS)	Movement of support vessels and MODU presence, and helicopters in the Development Area that may physically interact with or disrupt other illegal users of the sea	Potential risk of ship collision other small fishing vessels that are illegally in the area	Direct	Relevant stakeholders communication. Environmental Induction will include the possibility of other illegal users Vessel navigational and communication equipment installed, maintained and operated. In accordance with Regulation: Report and secure from the ANP an authorization to enter the Development Area and authorisation from MTD to enter Timor-Leste EEZ waters for vessels and aircraft for the activity. Report to the ANP the position / location and activity of such vessels and aircraft. Monitor and communicate with vessels approaching MODU to reduce the risk of vessel collision. Employ radio system for real-time communication. Recovery of all deployed equipment Vessel lighting in accordance with COLREGS, Navigation Act 2012, vessel class requirements and in allowing safe operation and activities (including emergency lighting). Report third-party vessel entry to the area
Unplanned release of solids	Release of solid wastes may occur as a result of overfull and/or uncovered bins, incorrectly disposed items or spills during transfer of waste between vessels and MODU.	Solid waste items have the potential to pollute marine habitats and injure or kill fauna through ingestion or exposure. Marine fauna entanglement risk in waste plastics, which can also be ingested when mistaken as prey.	Direct	Environmental Induction cover off waste management PMS on crane and lifting equipment to ensure fit for purpose Lift plans in place for the specific activity Competent crew undertake lifts under a permit to work system Recovery of dropped objects where the environmental consequence is not negligible and it is safe to do so

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
Unplanned release of (non-hydrocarbon) liquids	There may be accidental releases/ discharges to the marine environment of a variety of potentially hazardous materials and chemicals (liquid) which are stored and utilised or produced on vessels/MODU.	Localised decline in water quality Ingestion or physical contact with chemical compounds within the water column or sediment Accumulation and biomagnification of chemicals within the food chain	Direct	Drilling fluid bunkering and transfers will be conducted in accordance with the bunkering and transfer procedures.
				Spill response kits
				Hose integrity checks
Unplanned release of hydrocarbons (diesel) – vessel collision	Release of diesel may occur from vessel collision within the Development Area during drilling. The worst-case diesel spill scenario is due to collision of a vessel with a third-party vessel resulting in damage to a fuel oil tank and diesel released to the ocean. The maximum worst-case credible spill volume of diesel has been calculated as 400 m3 based on the largest fuel oil tank on the proposed vessels, though it is considered more likely that smaller vessels would be used.	Decrease in water quality Potential toxicity and smothering impacts to fauna Direct/indirect toxic or physiological effects on benthic habitats Pygmy blue whales may occur within the spill area	Direct	Shipboard Oil Pollution Emergency Plan valid and tested to ensure ability to respond to spills as required by MARPOL
				Vessel crew will be adequately qualified, trained, and competent in accordance with Flag State regulations, to navigate vessels
				Ongoing communications with ANP throughout operations to prevent conflicts.
				No HFO/IFO planned to be used
				Vessels to have stocks of spill response kits/bins available and accessible onboard to respond to an onboard spill as per their SOPEP
				In the event of a Tier 2 or Tier 3 oil spill implement the OPEP to reduce environmental impacts due to spill
				Drills and exercises undertaken in accordance with the OPEP and SOPEP
				Bulk liquids transferred in accordance with bulk transfer procedure to reduce the risk of a release to sea.
				Prevent third-party vessel entry to the immediate area around MODU unless authorised by OIM/vessel masters
				OPEP describes minimum competency requirements of incident response personnel
				Vessels will be equipped with approved navigation systems in accordance with COLREGS
				Hydrocarbon and chemical storage areas will have appropriate loss prevention features such as spill containment bunds.
				In accordance with Regulations, Finder will: Report and secure from the ANP an authorization to enter the Timor-Leste EEZ waters for vessels and aircraft of which are acquired for drilling operations. Report daily to the ANP the position / location and activity of such vessels and aircraft. Attain ANP approval for movement of MODU.

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
				Monitor and communicate with vessels approaching MODU to reduce the risk of vessel collision.
				Communication as per stakeholder management plan which defines relevant persons, responsibilities and timeframes for notifications
				Vessels and MODU marked on charts (500m zone) (Maritime Transport Department) communication. Relevant stakeholders (inc. AMSA) communication
				Vessel navigational and communication equipment installed, maintained and operated.
				Recovery of all deployed equipment
				MODU will be positioned in accordance with the MODU Position Plan; Anchors will be deployed and retrieved in accordance with the MODU Position Plan.
				MODU Marine Operations Manual including-A 500m radius petroleum safety zone will be maintained around the around the MODU. Vessel Master's will obtain the permission of the OIM, or on tour Barge Supervisor, before entering or leaving the 500m safety zone around the MODU.
				Rig move and rig deployment procedures.
				In accordance with Regulation: Report and secure from the ANP an authorization to enter the contract area and authorisation from MTD to enter Timor-Leste EEZ water for vessels, MODU and aircraft for the activity. Report to the ANP the position / location and activity of such vessels and aircraft.
				Employ radio system for real-time communication.
				Vessel lighting in accordance with COLREGS, Navigation Act 2012, vessel class requirements and in allowing safe operation and activities (including emergency lighting).
Unplanned release of hydrocarbons (crude) – LOWC	Unplanned release of crude from subsea well due to loss of well control.	Decline in water quality. May cause chemical (e.g., toxic) and physical (e.g., coating of emergent habitats, oiling of wildlife at sea surface) impacts to marine species.	Direct	Crews will be adequately qualified, trained, and competent in well control techniques and will be supervised
				Implement OPEP in the event of a spill of hydrocarbons to the marine environment
				Drills and exercises undertaken in accordance with the OPEP
				OPEP describes minimum competency requirements of incident response personnel
				MODU crew will be adequately qualified, trained, and competent trained, in accordance with Flag State regulations, to navigate MODU

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
				Overall well activity management processes and life cycle activities undertaken including well integrity performance monitoring and well integrity incidents excursion management in accordance with Drilling Management System – 'Well Integrity Manual' and the Application to Drill
				A Permit to Work (PTW) system is implemented to assure competent personnel and implementation of relevant procedures during activities
				MODU well control equipment is maintained in accordance with the MODU PMS
				Maintain contract with tertiary well control provider
				Implementation of the Blowout Contingency Plan
				In the event of a Tier 2 or Tier 3 oil spill implement the OPEP
				Maintain a register of available and capable MODU to respond to LOWC
				Installation of Blow Out Preventer (BOP) system that can be closed rapidly in the event of an uncontrolled influx of formation fluids or completion fluids and which allows the well to be circulated safely by venting the gas at surface.
				Implement the Incident Management Team Response Plan in the event of a spill of hydrocarbons to the marine environment
				Continuous monitoring of pressure reading during drilling to detect any abnormal pressures.
				Maintaining well bore pressure by effectively estimating formation fluid pressures and strength of subsurface formations.
				Periodical test and maintenance on the BOP during the operations.
				BOP verification testing undertaken in accordance with ANP accepted Application for Approval to Drill.
				All well design and control activities to be undertaken in accordance with an approved Application for Approval to Drill.
				Shallow Hazard Study undertaken prior to drilling activity.
				Intervention actions to be undertaken in the event of loss of well control in accordance with the "Source Control Plan".
				Finder can access the 2022 Mutual Aid MOU (Australian Energy Producers (AEP), formally Australian Petroleum Production & Exploration Association (APPEA)) as the Development Area falls within the offshore region defined in the MOU. The purpose of the MOU is to facilitate and expedite the mobilisation of a relief well
				Well Design and Delivery Process includes: Engineering Basis of Design Well Design Envelope, including Well Control System and BOP control system. Casing Shoe Setting Criteria Kick Tolerance

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
				Well Barriers All permeable zones containing hydrocarbons or over-pressured water which are intersected by a well shall be isolated from the surface by a minimum of two barriers. The well barriers will be verified as appropriate to the required function and location. Shallow Hazard Study Critical Well Review
				Well Control Manual includes original equipment manufacturer specifications, including BOP stack and shear ram capability. Operates and inspected to API or applicable Industry Standards. Drill pipe shearing capability verified. BOP system is installed and tested in accordance with American Petroleum Institute (API) standard 53: Blowout Prevention Systems for Drilling Wells
				Selection of drilling fluid to maintain required hydrostatic pressure / success in managing pore pressure.
				Implementation of the DST / Well Clean-up Plan if required, to include: Emergency Shut Down Continuous propane pilot light at the burner Use of appropriate well clean-up equipment
				Implementation of the Well Clean-Up Plan if required, to include: Well clean-up procedures, including pre-start communications meetings, Hazard Identification (HAZID) and Hazard and Operability Study (HAZOP) reporting. Flowing of hydrocarbons to surface, to commence well clean-up will only be allowed during day light hours. Continuous monitoring of hydrocarbon falls out during flare watch.

Table 1-3: Control Measures – Development (installation, commissioning and operations)

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
Planned Events				
Seabed and benthic			Direct	Monitor inventory deployed to the field and track removal of equipment during activity.

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
habitat disturbance	Disturbance to the seabed from development activities.	Temporary or permanent direct loss of benthic habitat and associated biota. Temporary and localised increase in water turbidity as a direct result of sediment disturbance.		Position of infrastructure not on any sensitive seabed features (as informed by EBS) Equipment installed at pre-approved locations within Development Area Establish and maintain a comprehensive and accurate inventory of subsea infrastructure and locations.
Light emissions	Artificial lighting: Navigational and deck lighting on the support vessels will generate light emissions. From support vessels and FPSO.	Disorientation, attraction or repulsion. Disruption to natural behavioural patterns and cycles. Localised light glow may attract light-sensitive species, in turn affecting predator-prey dynamics.	Direct	Lighting in accordance with COLREGS, Navigation Act 2012, vessel class requirements and in allowing safe operation and activities (including emergency lighting).
Noise emissions	Machinery and equipment operations on decks and working areas of support vessels and FPSO. ROV Thruster and propeller sound from vessels. Helicopter operations in emergency.	Injury to hearing or other organs. Behavioural disturbance. Masking or interfering with biologically important sounds.	Direct	Vessel planned maintenance system in place to ensure it is operating efficiently and not producing excessive noise. Environmental Induction includes environmental requirements as required. Vessel and FPSO planned maintenance system in place to ensure it is operating efficiently and not producing excessive noise.
Atmospheric emissions	Sources of atmospheric emissions include: • Power generation and process heating; • Engine exhausts; and • Fugitive emissions. • Helicopter operation in emergencies. • Development flaring	Localised, and temporary decrease in air quality; and Contribution to global GHG effect.	Direct	International Air Pollution Prevention (IAPP) certificate valid. Vessels compliant with MARPOL Annex VI. Low sulphur diesel to be used in accordance with MODU / vessel specific procedures (under IMO requirements). Management of flaring equipment maintenance and inspection in CMMS Implement leak detection and repair programs.

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
Interaction with other users	The presence of the 500 m radius Petroleum Safety Zone (PSZ) for restricted and controlled vessel access. Vessel physical presence in and out of the Development Area.	Disruption to commercial activities, including: Exclusion of commercial vessels from Development Area Potential reduction of commercial fish catches due to exclusion from licensed permits (where relevant) Support vessels/FPSO present an obstacle and potential navigational hazard for shipping traffic *Illegal fishing captured as an unplanned event and not discussed here.*	Direct	Vessels and Development marked on charts (500m zone) (Maritime Transport Department) communication. Relevant stakeholders (inc. AMSA) communication
				Vessel navigational and communication equipment installed, maintained and operated.
				Recovery of all deployed equipment
				Rig move and rig deployment procedures.
				Employ radio system for real-time communication.
				Vessel lighting in accordance with COLREGS, Navigation Act 2012, vessel class requirements and in allowing safe operation and activities (including emergency lighting).
				Berthing handbook
				Ongoing communications with ANP throughout operations to prevent conflicts.
				Monitor and communicate with vessels approaching FPSO to reduce the risk of vessel collision.
				Communication as per stakeholder management plan which defines relevant persons, responsibilities and timeframes for notifications
Operational discharges	Liquid discharges generated from vessels and routinely discharged to the marine environment include: Slops water (Deck drainage, bilge water, tank washing) Cooling water Desalination Brine Treated Sewage Greywater Putrescible food waste Produced formation water	Potential impacts to marine fauna via: Changes to the water quality through nutrient enrichment and increased biological oxygen demand; Impact to predator-prey dynamics. Changes in temperature, salinity, toxicity of water	Direct	Oily water filtering and monitoring equipment fitted and maintained. Direct oily water from deck washing and drainage systems to an onboard oily water separator before discharge. The oil concentration in discharged water must not exceed 15ppm, in accordance with the Protection of the Sea (Prevention of Pollution from Ships) Act 1983 (MARPOL requirements).
				Garbage record book maintained (MARPOL)
				Waste generated during operations (on the FPSO) will be managed in accordance with the waste Management Plan
				Brine will only be discharged to sea if the oil-in-water content does not exceed 15ppm in accordance with Protection of the Sea (Prevention of Pollution from ships) Act 1983 D MARPOL Annex I (as appropriate for vessel classification) D Regulations for the Prevention of Pollution by oil. If brine has oil-in-water content over 15ppm, the brine will be contained and treated to <15ppm or disposed of onshore.
				All sewage to be treated and discharged in accordance with MARPOL. Implementation of a preventative maintenance schedule as per Manufacturer's specification for sewerage treatment & macerator equipment and recording in the rig maintenance management system.

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
				Garbage that has been ground to particles <25mm: >3NM from the nearest land in accordance to MARPOL Annex IV and Protection of the Sea (Prevention of Pollution from Ships) Act 1983, prior to discharge.
				Fuels, oils, and chemicals to be stored within contained and bunded areas and in accordance with their MSDS.
				Contaminated drainage from decks, machinery spaces or bunded areas will be treated through a MARPOL approved oily-water separator prior to discharge to achieve MARPOL oil-in-water content (15ppm).
				All chemicals planned for discharge to the marine environment will be managed as per Chemical Register and approved by ANP prior to use.
				Produced water treatment management plan in place (details in future EMP).
Unplanned Events				
Marine pest introduction	Potential for development activities to transfer IMS from international or Australian waters into the Development Area.	Localised impact on native marine fauna and flora, including: Competition, predation or displacement of native species; Alteration of natural ecological processes; Introduction of pathogens with the potential to impact human and/or ecological health; Reduction and/or competition with commercial fish and aquaculture species	Direct	Legislative requirements are adhered to - biofouling and ballast.
Interaction with fauna	Movement of support vessels, and helicopters in the Development Area that may physically interact with or disrupt fauna	Potential risk of ship collision with cetaceans and marine reptiles (Emergency) Helicopter strike on seabirds Behavioural changes for marine fauna	Direct	Support vessels will observe speed restrictions in Development Area and in vicinity of whales - as per noise
				Environmental Induction includes environmental requirements as required.
				Restrict vessel operating speeds in the DA to 8 knots or less in the vicinity of whales.
				Marine fauna collisions reported to ANP
Interaction with other	Movement of support vessels and FPSO		Direct	Relevant stakeholders communication.
				Environmental Induction will include the possibility of other illegal users

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
users (IUU and FADS)	presence, and helicopters in the Development Area that may physically interact with or disrupt other illegal users of the sea	Potential risk of ship collision other small fishing vessels that are illegally in the area		Vessel navigational and communication equipment installed, maintained and operated. In accordance with Regulation: Report and secure from the ANP an authorization to enter the Development Area and authorisation from MTD to enter Timor-Leste EEZ waters for vessels and aircraft for the activity. Report to the ANP the position / location and activity of such vessels and aircraft. Monitor and communicate with vessels approaching FPSO to reduce the risk of vessel collision. Employ radio system for real-time communication. Recovery of all deployed equipment Vessel lighting in accordance with COLREGS, Navigation Act 2012, vessel class requirements and in allowing safe operation and activities (including emergency lighting). Report third-party vessel entry to the area
Unplanned release of solids	Release of solid wastes may occur as a result of overfull and/or uncovered bins, incorrectly disposed items or spills during transfer of waste between vessels and FPSO.	Solid waste items have the potential to pollute marine habitats and injure or kill fauna through ingestion or exposure. Marine fauna entanglement risk in waste plastics, which can also be ingested when mistaken as prey.	Direct	Waste generated during operations will be managed in accordance with the waste Management Plan Environmental Induction cover off waste management PMS on crane and lifting equipment to ensure fit for purpose Lift plans in place for the specific activity Competent crew undertake lifts under a permit to work system Recovery of dropped objects where the environmental consequence is not negligible and it is safe to do so
Unplanned release of (non-hydrocarbon) liquids	There may be accidental releases/ discharges to the marine environment of a variety of potentially hazardous materials and chemicals (liquid) which are stored and utilised or produced on vessels/FPSO.	Localised decline in water quality Ingestion or physical contact with chemical compounds within the water column or sediment Accumulation and biomagnification of chemicals within the food chain	Direct	Spill response kits Hose integrity checks
Unplanned release of hydrocarbons	Release of diesel may occur from vessel collision within the Development Area	Decrease in water quality Potential toxicity and smothering impacts to fauna	Direct	Shipboard Oil Pollution Emergency Plan valid and tested to ensure ability to respond to spills as required by MARPOL Vessel crew will be adequately qualified, trained, and competent in accordance with Flag State regulations, to navigate vessels

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
(diesel) – vessel collision	during operations. The worst-case diesel spill scenario is due to collision of a vessel with a third-party vessel resulting in damage to a fuel oil tank and diesel released to the ocean. The maximum worst-case credible spill volume of diesel has been calculated as 400 m3 based on the largest fuel oil tank on the proposed vessels, though it is considered more likely that smaller vessels would be used.	Direct/indirect toxic or physiological effects on benthic habitats Pygmy blue whales may occur within the spill area		Ongoing communications with ANP throughout operations to prevent conflicts.
				No HFO/IFO planned to be used
				Vessels to have stocks of spill response kits/bins available and accessible onboard to respond to an onboard spill as per their SOPEP
				In the event of a Tier 2 or Tier 3 oil spill implement the OPEP to reduce environmental impacts due to spill
				Drills and exercises undertaken in accordance with the OPEP and SOPEP
				Bulk liquids transferred in accordance with bulk transfer procedure to reduce the risk of a release to sea.
				Prevent third-party vessel entry to the immediate area around FPSO unless authorised by OIM/vessel masters
				OPEP describes minimum competency requirements of incident response personnel
				Vessels will be equipped with approved navigation systems in accordance with COLREGS
				Hydrocarbon and chemical storage areas will have appropriate loss prevention features such as spill containment bunds.
				In accordance with Regulations, Finder will: Report and secure from the ANP an authorization to enter the Timor-Leste EEZ waters for vessels and aircraft of which are acquired for drilling operations. Report daily to the ANP the position / location and activity of such vessels and aircraft.
				Monitor and communicate with vessels approaching FPSO to reduce the risk of vessel collision.
				Communication as per stakeholder management plan which defines relevant persons, responsibilities and timeframes for notifications
				Vessels and Development marked on charts (500m zone) (Maritime Transport Department) communication. Relevant stakeholders (inc. AMSA) communication
				Vessel navigational and communication equipment installed, maintained and operated.
				Recovery of all deployed equipment
				In accordance with Regulation: Report and secure from the ANP an authorization to enter the contract area and authorisation from MTD to enter Timor-Leste EEZ water for vessels, FPSO and

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
				aircraft for the activity. Report to the ANP the position / location and activity of such vessels and aircraft.
				Employ radio system for real-time communication.
				Vessel lighting in accordance with COLREGS, Navigation Act 2012, vessel class requirements and in allowing safe operation and activities (including emergency lighting).
				Berthing handbook
Unplanned release of hydrocarbons (crude) – LOWC	Unplanned release of crude from subsea well due to loss of well control.	Decline in water quality. May cause chemical (e.g., toxic) and physical (e.g., coating of emergent habitats, oiling of wildlife at sea surface) impacts to marine species.	Direct	Implement OPEP in the event of a spill of hydrocarbons to the marine environment
				Drills and exercises undertaken in accordance with the OPEP
				OPEP describes minimum competency requirements of incident response personnel
				In the event of a Tier 2 or Tier 3 oil spill implement the OPEP
				Implement the Incident Management Team Response Plan in the event of a spill of hydrocarbons to the marine environment
Unplanned release of hydrocarbons (crude) - FPSO	Release of crude from FPSO	Decline in water quality. May cause chemical (e.g., toxic) and physical (e.g., coating of emergent habitats, oiling of wildlife at sea surface) impacts to marine species.	Direct	Permit-to-work documentation is complete and signed off to ensure offtake is undertaken
				Monitoring of hawser
				Static tow in place
				In the event of a tank breach, crude is transferred from damaged tank to an alternative tank if available
				Vessel crew qualified in accordance with competency system
				The Safety Instrumented System (SIS) are tested according to the assurance plan which is planned and managed using CMMS
				Emergency Shutdown (ESD) push buttons located in the central control room and throughout the FPSO tested and fit for purpose
				ESDVs are regularly tested and fit for purpose
				Hydrocarbon containing equipment is inspected and maintained and found fit for purpose
				Pressure Safety Valves (PSVs) undergo inspection(s) as per CMMS
				A Permit to Work (PTW) system is implemented to assure competent personnel and implementation of relevant procedures during offtake.
				Facility Berthing Handbook details offtake procedure including hose requirements
				Lifting Operations Procedure includes offtake hose deployment and storage

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
				Asset integrity and maintenance inspections of facilities and critical equipment undertaken as planned
				Implement OPEP in the event of a spill of hydrocarbons to the marine environment
				Implement the Incident Management Team Response Plan in the event of a spill of hydrocarbons to the marine environment
				Shipboard Oil Pollution Emergency Plan valid and tested to ensure ability to respond to spills as required by MARPOL
				Vessel crew will be adequately qualified, trained, and competent in accordance with Flag State regulations, to navigate vessels
				Ongoing communications with ANP throughout operations to prevent conflicts.
				No HFO/IFO planned to be used
				Vessels to have stocks of spill response kits/bins available and accessible onboard to respond to an onboard spill as per their SOPEP
				Drills and exercises undertaken in accordance with the OPEP and SOPEP
				Bulk liquids transferred in accordance with bulk transfer procedure to reduce the risk of a release to sea.
				Prevent third-party vessel entry to the immediate area around FPSO unless authorised by OIM/vessel masters
				OPEP describes minimum competency requirements of incident response personnel
				Vessels will be equipped with approved navigation systems in accordance with COLREGS
				Hydrocarbon and chemical storage areas will have appropriate loss prevention features such as spill containment bunds.
				In accordance with Regulations, Finder will: Report and secure from the ANP an authorization to enter the Timor-Leste EEZ waters for vessels and aircraft of which are acquired for drilling operations. Report daily to the ANP the position / location and activity of such vessels and aircraft.
				Monitor and communicate with vessels approaching FPSO to reduce the risk of vessel collision.
				Communication as per stakeholder management plan which defines relevant persons, responsibilities and timeframes for notifications
				Vessels and Development marked on charts (500m zone) (Maritime Transport Department) communication.

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
				Relevant stakeholders (inc. AMSA) communication
				Vessel navigational and communication equipment installed, maintained and operated.
				Recovery of all deployed equipment
				In accordance with Regulation: Report and secure from the ANP an authorization to enter the contract area and authorisation from MTD to enter Timor-Leste EEZ water for vessels, FPSO and aircraft for the activity. Report to the ANP the position / location and activity of such vessels and aircraft.
				Employ radio system for real-time communication.
				Vessel lighting in accordance with COLREGS, Navigation Act 2012, vessel class requirements and in allowing safe operation and activities (including emergency lighting).
Unplanned release of hydrocarbons (crude) – flowline rupture		Unplanned release of crude due to flowline rupture. Pygmy blue whales may migrate through area of entrained oil > No shoreline contact	Direct	Planned subsea and offshore maintenance in accordance with CMMS.
				Emergency shutdown systems and shutdown/safety valves are routinely tested and maintained to ensure integrity and function is maintained as per CMMS
				Implementation of control measures for dropped objects that reduce the risk of objects entering the marine environment: Lifting equipment certification and inspection Lifting crew competencies Heavy-lift procedures Preventive maintenance on cranes. Lifting operations managed in accordance with Vessel work instructions or procedures. Objects dropped overboard are recovered (if possible) to mitigate the environmental consequences from objects remaining in the marine environment, unless the environmental consequences are negligible, or safety risks are disproportionate to the environmental consequences.
				Implement OPEP in the event of a spill of hydrocarbons to the marine environment
				In the event that the integrity of a flowline is compromised or there is an unplanned hydrocarbon release from the facility, systems are initiated to activate the Isolation of the flowline

2. DETAILS OF THE PROJECT PROPONENT

2.1 Details of the Proponent

Operator

Finder Timor-Leste B.V., R.P.

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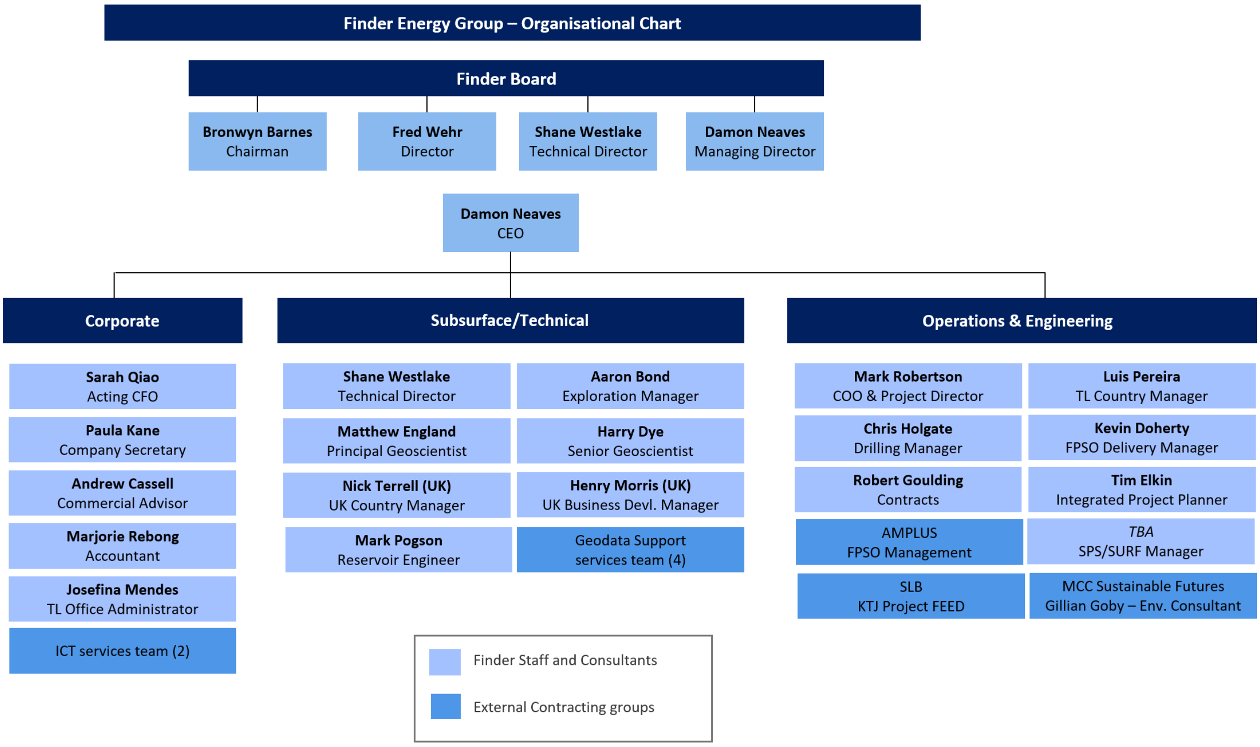
2.2 Company Organization Structure



2.3 Contact Person

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3. DETAILS OF EIS AND EMP CONSULTANTS

Item	Details
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Item	Details
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3.1.1 MCC Sustainable Futures

MCC Sustainable Futures (MCC) are a Perth based consultancy that specialise in Environmental Impact Assessment (EIA) with extensive experience in Environmental Management and Offshore Environmental Approvals for the oil and gas sector.

MCC brings decades of experience, with their senior personnel each having more than 20 years' expertise in environmental impact assessment (EIA), supporting major projects through complex regulatory and approvals pathways underpinned by strong technical capability and strategic approvals advice. Our team has advised a broad range of clients across the energy, resources, infrastructure and government sectors, delivering robust, defensible and practical approval outcomes for projects of all scales and complexities. We combine detailed knowledge of regulatory frameworks with a pragmatic understanding of project delivery. MCC is recognised for producing high-quality EIA documentation, leading stakeholder and regulator engagement, and delivering approvals that are timely, proportionate, and aligned with project objectives.

MCC have a broad range of energy clients, operating in West Australia and the Timor Sea, with EIA and regulatory approvals experience on Northern Endeavour, Bayu Undan, Buffalo, and Chuditch developments/projects. MCC also supported Santos on the large-scale Barossa Project in all phases including design and regulatory approvals which is in Australian waters with overlap of potential impacts into Timor Leste waters. The team has also worked on most of Australia's offshore assets with direct operator experience and knowledge of all offshore assets within the portfolios of Santos (including legacy Apache and ConocoPhillips), Beach, Inpex and Jadestone. The team has firsthand experience with many of the offshore assets of Chevron, Woodside (including legacy BHPB), and Esso either in the design, installation or operational phases, and can bring the lessons and learning to the development of the EIS and subsequent EMPs.

MCC is Finder Energy's Lead EIA consultant, tasked with the development of all required environmental approvals documents. MCC have an MOU to partner with local Timor-Leste environment consultancy, Halona Serena who are in country – leading on social and economic inputs and public consultation.

Key Personnel

At MCC, we believe that putting the best team forward for the project is paramount to ensuring that project objectives can be met. As a small specialist consultancy, we have a core team of personnel with the ability to scale resources up and down as required.

A summary of the team nominated for this scope is provided below, including addressing fitness for scope of services requirements. The following personnel form the core team responsible for preparing the EIS.

Gillian Goby – Project Director

Gillian is a Principal Marine Specialist with over 25 years' experience in EIA & Regulatory Approvals. She has worked extensively in the WA offshore environment for various key sector clients since 2006 providing strategic and technical advice for regulatory approvals. She has worked as the lead marine scientist on major coastal development projects, port upgrades as well as offshore upstream drilling projects, and downstream liquefied natural gas (LNG) projects, including high profile strategic EIAs. Gillian has also successfully led the writing and assessment teams Public Environment Report (PERs), EIS's, EIAs under the (EPBC Act), and for Environment Plans (EPs), and OPEPs assessed by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) under the Offshore Petroleum and Greenhouse Gas Storage Act 2006 (OPGGS Act).

In addition, Gillian has industry experience in; Strategic assessment and program planning; Environmental Risk Assessment; Scientific Monitoring programme design and implementation; Habitat Assessment and Mapping, EIAs; Community consultation and stakeholder engagement; Threatened Species Monitoring and Management; Protected Area Management; Climate Change Vulnerability Assessment and Adaptation Planning.

Gillian is highly organised and has extensive people and project management experience. She has excellent communication and negotiations skills and is client focused. Gillian is a team player with people and program leadership experience. Gillian is committed to challenging status quo, continued learning and harnessing opportunity. Gillian works with integrity and professionalism to achieve positive environmental outcomes.

Role: Project Director, EIS Technical Reviewer

Lucy Muir – Senior Environmental Specialist

Lucy has over 17 years' experience working as a senior environmental consultant in the oil and gas industry with an in-depth knowledge of the marine environment.

Lucy has been involved in the preparation and implementation of Environment Plans (EPs) since the inception of NOPSEMA in 2012. She has an excellent understanding of the expectations of regulators in the offshore industry and is well-versed in ongoing changes to the regulatory regime that operators are required to adhere to. She has worked on Environment Plans for a number of operators in WA including the Timor Sea, with a more recent focus on those in the decommissioning and late life asset space, but historically was heavily involved in the preparation of basin wide seismic EPs, large developments such as Santos' Barossa, Woodside's Browse and Shell's Crux developments, as well as other geophysical surveys, therefore she has a clear understanding of the potential impacts. She also provides environmental approvals and strategic advice to Jadestone Energy covering both the Montara and Stag assets.

Lucy is an experienced environmental risk identification workshop (ENVID) facilitator with excellent communication and personnel liaison skills. She has also provided advice on the structure and strategy for approvals to multiple clients, including multi-well, multi-permit campaign EPs.

Role: Technical review and input to EIS, ENVID Facilitator

Melissa Petrie – Senior Advisor

Melissa Petrie is a senior marine scientist with over 15 years of experience in environmental management, regulatory approvals and marine ecological studies, bringing strong capability in stakeholder consultation and the development of high quality environmental assessment documentation. Her work spans the preparation of numerous EISs, PERs, EPBC referrals, EPs and OPEPs, supported by extensive engagement with regulators, community groups and industry stakeholders across complex projects in Western Australia and nationally .

Melissa has delivered consultation focused approvals for major clients including Jadestone, ConocoPhillips, Finder Energy, ENI and the Department of Defence, providing responses to public and regulatory comments and managing multi-party engagement processes to support EP and SAP submissions. She has developed and implemented strategic communication plans for resource companies and managed a number of large-scale submission analysis processes. As part of these processes, Melissa has successfully integrated and managed feedback from politically motivated groups as well as marginalised stakeholders. She also has significant experience in environmental management and programme delivery, encompassing risk assessments, ENVID workshops, project management and policy development.

Melissa's marine monitoring expertise includes leading extensive coral health, water quality, sediment and benthic habitat surveys across largescale offshore programs for Chevron, BHP, INPEX and Vermilion, often managing multidisciplinary field teams, logistics, HSE requirements and data analysis workflows. Together, these skills position Melissa as a highly capable technical lead for consultation driven environmental assessment and marine monitoring programs.

Role: Consultation Liaison

Melissa Townsend – Environmental Scientist

Melissa Townsend is a highly detail-oriented senior marine scientist with over 14 years of experience delivering rigorous EIAs, regulatory approvals documentation, and ecological evaluations for major coastal and offshore projects. Her work spans complex existing-environment reviews, ENVID development, gap analyses, protected-matters searches, and technical writing for Operations and EPs across clients such as Jadestone, Santos, Shell, Chevron, Woodside and BHP.

She brings exceptional precision to compiling, analysing and QAQC-verifying ecological datasets, including coral health assessments, benthic habitat mapping, water quality assessments and biodiversity searches and consistently ensures regulatory alignment and scientific accuracy across all deliverables. Her attention to detail is demonstrated through her leadership in quality-controlled monitoring programs, her training and oversight of analysts, and her production of high-quality technical reports for both government and industry. This depth of experience makes her a dependable specialist for approvals pathways, ecological assessments, and technically robust environmental documentation.

Melissa also leads the annual compliance reporting for our clients, ensuring robust evidence collation and a pragmatic approach to data reporting, whilst meeting regulatory requirements.

Role: Lead EIS Author

Georgia Radley-Kohrs – Graduate Environmental Advisor

Georgia began working at MCC Sustainable Futures as a Graduate Environment Advisor in 2025, working as a part of the Environment team. Since joining MCC, she has quickly developed her consultation abilities and skillset in various areas to produce efficient, high-quality results.

At MCC, Georgia works across two teams: Environment and Sustainability. In the Environment team, she provides technical support during the development of Environment Plans and OPEPs, assists during stakeholder consultation, facilitates ENVID preparation and delivery, and aids in the management of commitment registers.

Role: Support Author on the EIS

3.1.2 Halona Serena (HS)

Halona Serena (HS) is a leading Timor-Leste–based environmental consultancy with a dedicated focus on environmental assessments and impact management. Over the years, HS has accumulated extensive experience across a diverse range of onshore and offshore projects, demonstrating its ability to deliver high-quality environmental solutions in complex operational contexts. Key projects include the Betano Drilling Category A project, the TIMORGAP Pualaca Block Seismic Survey in Natarbora, the Sunda Gas Chuditch-2 Appraisal Drilling, and the Laleia Solar PV assessment. For the appraisal drilling, HS was hired by SGBU as the Environmental Consultant to prepare TOR, EIS, and EMP for Chuditch-2 Appraisal Drilling for Environmental Licensing purpose. These projects highlight HS's capacity to manage environmental assessments across different industries, including oil and gas, renewable energy, and infrastructure development.

HS is supported by a multidisciplinary team of experts, including environmental scientists, engineers, sociologists, and economists, as well as a specialized oil spill modelling group. This diverse expertise allows HS to provide comprehensive environmental, social, and economic assessments, ensuring that all aspects of project impacts are carefully considered and mitigated.

Importantly, HS is the only local company in Timor-Leste with proven experience in Category A Environmental Impact Assessment (EIA) services for both offshore and onshore projects. This unique positioning enables HS to add significant value to project teams by combining local knowledge, regulatory understanding, and technical expertise. The company's deep familiarity with Timor-Leste's environmental legislation, cultural context, and stakeholder engagement requirements ensures that every project is approached with both technical rigor and social responsibility, supporting sustainable and compliant development outcomes.

Key Personnel

Maria do Ceu Rosales – Owner and Director Halona Serena

As an Environmental Scientist with more than 7 years' experience predominantly in environmental assessment, management, and public procurement. Maria has led environmental studies on a variety of environmental assessments and feasibility studies specifically for water resources management and worked on a variety of projects from small-scale to large projects, including marine environmental monitoring project for Tibar Port mega project, Pualaca Block Seismic Survey Project, appraisal drilling in Chuditch-2, and establishing more than five water and sanitation projects to the rural communities.

Role: Consultant and Public Consultation Liaison

Awinash Dulip – Advisor

With 35 years' experience in EHS and specifically in Environment management around EIA, EIS and EMP development, and environment monitoring in Oil & Gas and the Mining sector. Awinash has worked with various governments, private companies, organizations, funding institutions and as a member of the Timor Leste ANP regulatory authority. With Awinash's experience and knowledge, he and HS team successfully assist SGBU in obtaining the Environmental Licensing for the Chudicth-2 Appraisal Drilling project.

Role: Social and Economic Consultant

Pascoela Sequeira – Consultant

With 8 years of experience as a Process Engineer in TIMORGAP for the process plant design of Futures Timor-Leste LNG Plant and her knowledge as chemical engineer, Pascoela has contributed greatly to the success of HS in obtaining environmental licensing for projects such as Pualaca Block Seismic Survey and Chuditch-2 appraisal drilling. Additionally, she has successfully finalized terminal evaluation for a solar energy project in Timor-Leste under the United Nations Development Programme (UNDP) as a national consultant.

Role: Supporting Consultant

4. PROJECT DESCRIPTION

4.1 Project Overview

The Kuda Tasi and Jahal offshore Oil Field Development Project (KTJ Project), is located within Production Sharing Contract PSC-TL-SO-T 19-11 (PSC 19-11) within the prolific Laminaria High oil province in the Bonaparte Basin, offshore Timor-Leste. The PSC 19-11 and KTJ Project Joint Venture comprises Finder Timor-Leste B.V. (Finder) as Operator, and partner TIMOR GAP PSC 11-106 Unipessoal Limitada (TIMOR GAP).

PSC 19-11 is located approximately 160 km (86 nm) off the south coast of Suai, Timor-Leste and contains four discovered undeveloped oil fields, including the fully appraised Kuda Tasi and Jahal oil fields, enabling rapid progress to production with additional upside provided by low-risk appraisal and exploration opportunities (Figure 4-1).

The PSC Joint Venture and working interests are shown in Table 4-1.

Table 4-1: Titleholders

Company	Working Interest
Finder Timor-Leste B.V. (Operator)[1]	40.53%
Finder PSC 19-11 Pty Ltd[1]	25.47%
TIMOR GAP PSC 11-106 Unipessoal Limitada[2]	34.00%

[1] Together Finder Energy

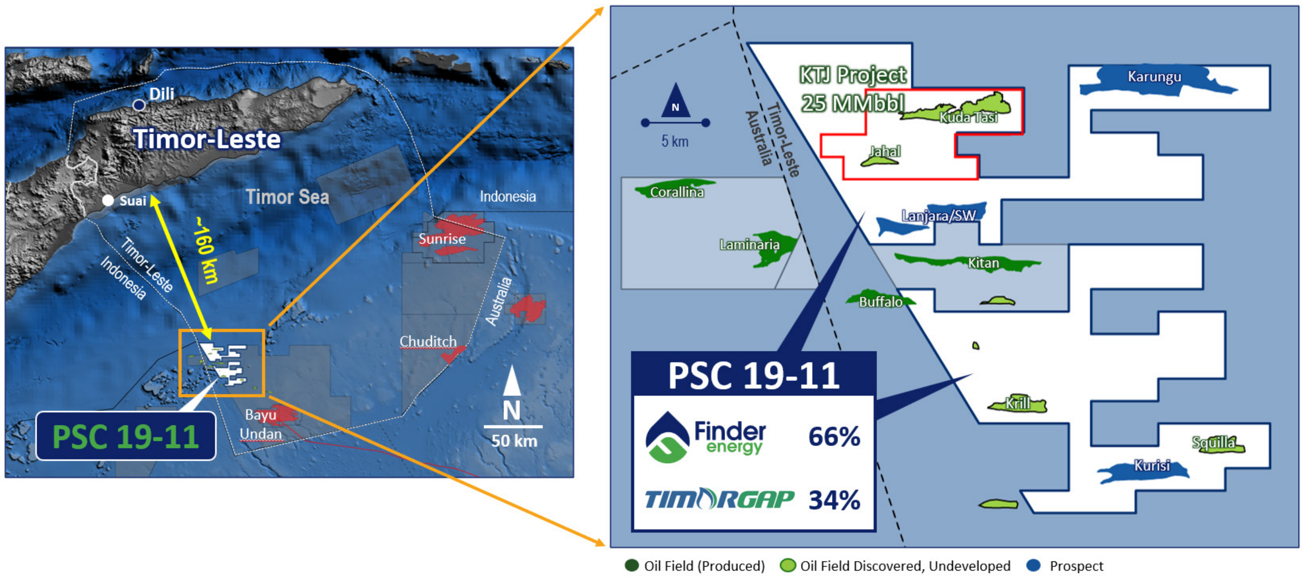


Figure 4-1: PSC 19-11 Location

The Joint Venture's key objectives for PSC 19-11 are to fast-track the development of the Kuda Tasi and Jahal Oil Fields (KTJ Project) by achieving Final Investment Decision (FID) in mid-2026 and producing first oil by the end of 2027. Over the last year Finder has significantly advanced key work streams to support the fast-track development of the KTJ Project, including technical studies such as 3D seismic reprocessing, subsurface evaluation, well and SURF FEED study acceleration, purchase of the Petrojarl 1 FPSO, negotiations with rig contractors as well as processes to secure development capex funding. The KTJ oil fields will be the first oil fields in Timor-Leste to reach production since Kitan in 2011, and the first since ratification of the maritime boundaries to place the oil fields fully in Timor-Leste jurisdiction.

4.2 Project Category

Petroleum Activities in PSC 19-11 fall under Decree Law 2019/25 "Transition of Petroleum Titles and Regulation of Petroleum Activities from the Joint Petroleum Development Area" and the associated Interim Administrative Guidelines for the JPDA – Guideline # 5 "Guideline for the preparation of Environmental Impact Assessments of petroleum activities". An Environmental Impact Assessment has been conducted to assess major impacts for the proposed development including drilling, construction, installation and operation and to assist in the design of any additional environmental studies, should such be required.

Finder is required to prepare and submit a Terms of Reference (TOR) and Environmental Impact Statement (EIS) for review and approval by the ANP. The TOR has been accepted by ANP dated 06 May 2026 and is the basis for preparing the Environmental Impact Statement (EIS) and subsequent Environmental Management Plans (EMP).

4.3 Nature of the Project

The development concept for the KTJ Project is based on redeployment of a Floating Production, Storage and Offloading (FPSO) facility to process and store oil prior to offloading to shuttle tankers. Redeploying an FPSO reduces environmental impact by reusing existing offshore infrastructure, avoiding the significant embodied carbon associated with new vessel construction, reducing raw material consumption, extending asset life, and shortening development schedules. This circular-economy approach lowers lifecycle emissions while enabling a more capital-efficient field development. Three production wells (one at Jahal and two at Kuda Tasi) will be tied to subsea production equipment, flowlines and the FPSO.

The KTJ Project is a phased development, with timing and progression dependent on the outcomes of technical studies, regulatory approvals, and internal investment decision gates. The main phases are:

- Environmental Baseline Surveys
- Geophysical and Geotechnical Surveys
- Drilling of 3 production wells
- Installation of subsea infrastructure
- Operations
- Decommissioning

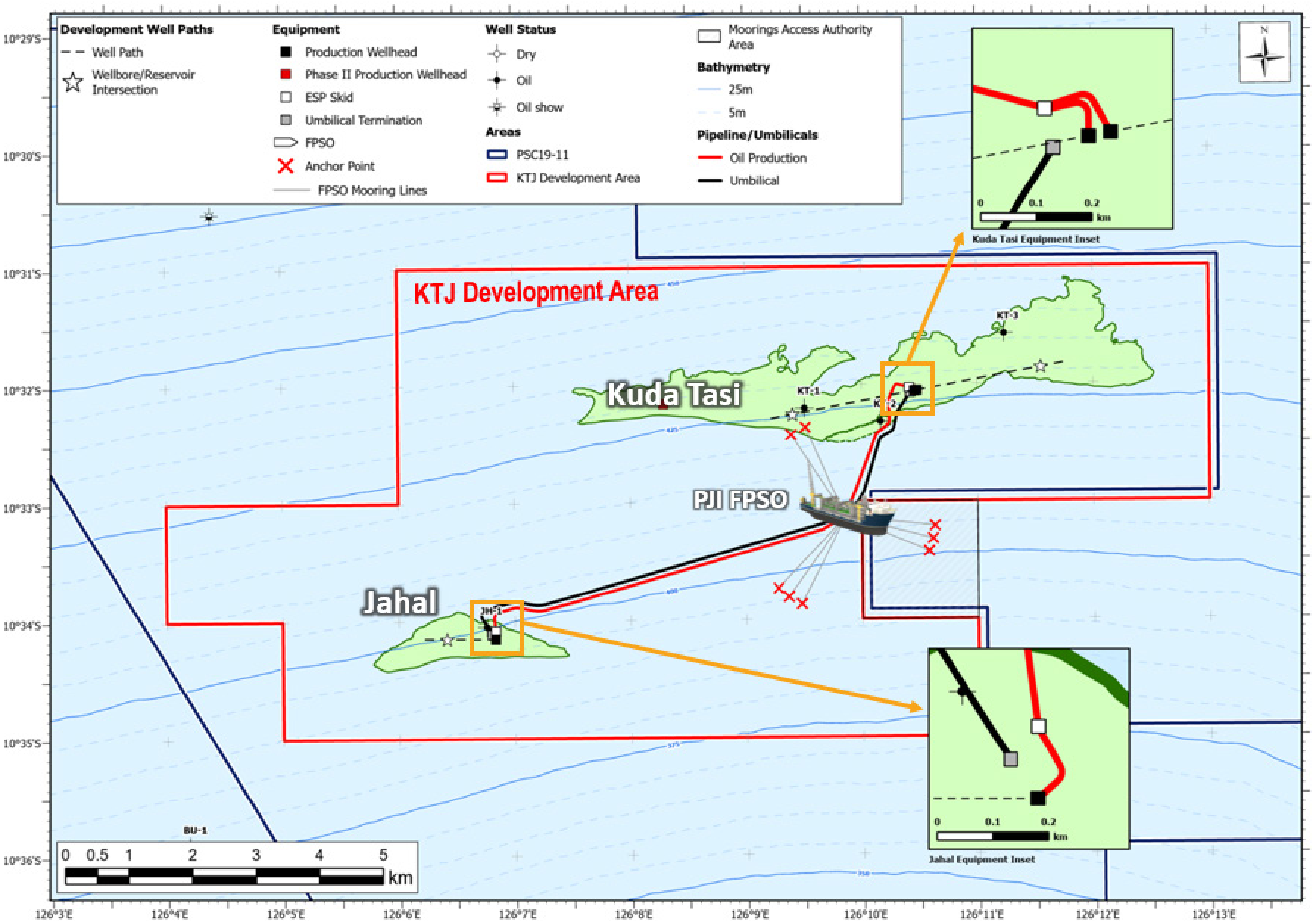


Figure 4-2: Project Development Area - (red box), including access area (black with grey hash fill) and KTJ Project Field Layout within PSC 19-11

4.3.1 Environmental Baseline Surveys

Environmental Baseline Surveys (EBS) may be undertaken at any time of year and will include a range of survey activities described in Revision 2 of the KTJ Project Scope of Work (SoW) submitted to ANP (Appendix A). The SoW was accepted by ANP on 29th April 2026 (ANP Reference: ANP/HSE/S/26/090).

The EBS will be undertaken in accordance with the SoW, which sets out the sampling design, methods and analytical requirements. Indicative survey types are summarised below, with full methodology provided in Appendix A.

Finder is committed to undertaking a comprehensive EBS covering the entire scope of the KTJ development prior to the drilling activity. The results of this EBS will be used to validate the baseline conditions as described in the EIS and inform the EMPs for each phase[1].

EBS sampling locations are shown in Figure 4-3 and include a structured network of sediment, epibenthic imagery and water-column sampling sites across the Development Area (DA) and KTJ Access Authority. Sediment sampling will be undertaken within radial arrays centred on the Kuda Tasi wellheads, the Jahal wellhead and the FPSO location, with additional sampling at each FPSO anchor spread and at six reference sites positioned near the western and eastern boundaries of the Development Area.

The radial arrays comprise transects aligned with predominant current directions and spaced on a logarithmic scale (250 m, 500 m, 1000 m and 2000 m) to characterise spatial patterns in sediment biogeochemistry and to support statistical and power analyses for future monitoring. Seabed imagery will be collected at all sediment

[1] As per Item 5 in ANP/HSE/S/26/071 letter of approval for a phased environmental approval strategy

sampling locations and along representative transects in areas where physical disturbance may occur (e.g., pipeline routes and anchor points).

Water-column characterisation will be undertaken at five key locations – two reference sites, the FPSO, and the Kuda Tasi and Jahal wellheads – using Conductivity, Temperature, and Depth (CTD) profiling and water sampling to document baseline physico-chemical conditions. Together, these sampling components provide a comprehensive spatial dataset to characterise baseline environmental conditions and support future impact detection.

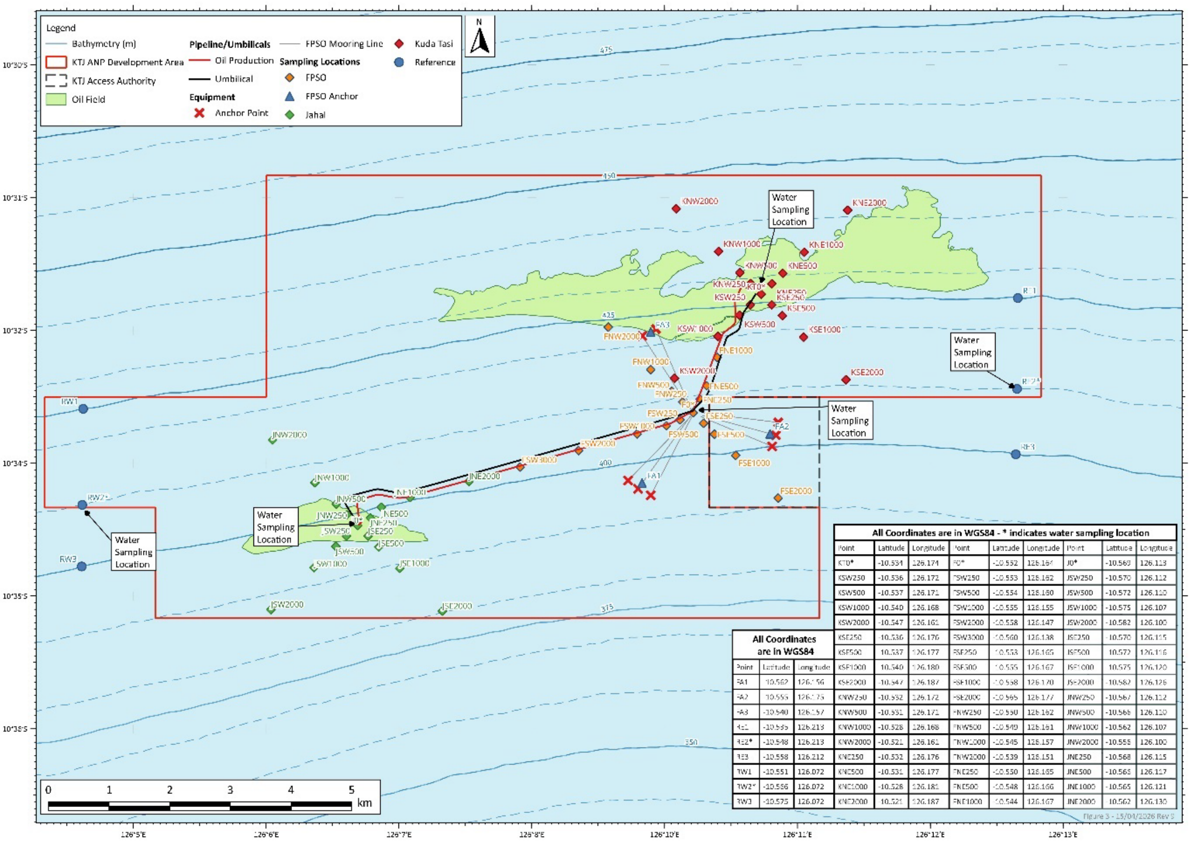


Figure 4-3: EBS proposed sampling locations

Water sampling

Water column characteristics will be determined from continuous measurements of physical and chemical parameters from the sea surface to the seabed. To meet ANP requirements, water samples will be taken at a limited number of representative sites. The key objectives of the monitoring will be to:

- Determine the broad physico-chemical characteristics through the water column within the Kuda Tasi and Jahal fields and the FPSO location.
- Assess differences in water quality across the Development Area (e.g. concentrations of Contaminants of Potential Concern [metals and hydrocarbons] and nutrients) and differences in associated biota (phytoplankton and zooplankton).

Water quality

Water profiling uses a range of sensors to measure parameters such as water temperature, conductivity, turbidity, pH, and dissolved oxygen level at various depths throughout the water column. The profiler is lowered through the water column, either manually or using a winch, to the desired depth. Once the required depth is reached, the instrument is retrieved and the recorded data is downloaded for analysis.

As part of the EBS, water-column characterisation will be undertaken to determine the broad physico-chemical conditions within the Kuda Tasi and Jahal fields and at the FPSO location.

Sediment quality & Benthic infauna

Sediment samples will be collected according to an approved Sampling and Analysis Plan (SAP). Benthic infauna will be collected at the same locations. The sediment component of the EBS is designed to provide a broad-scale understanding of the biogeochemical properties of sediments across the Development Area. This baseline characterisation will support future assessments of Project-related changes and allow for minor refinements to infrastructure placement during final design.

The key objectives of the sediment and benthic infauna sampling are to assess spatial variability in sediment biogeochemistry and to identify the presence of any Contaminants of Potential Concern relevant to the development, operation and decommissioning of the KTJ Project.

Benthic video transects

Imagery of the epibenthic macrofaunal community at each of the sediment sampling locations will enable an assessment to be made of the variability in community composition within the survey area. The ROV or other camera equipment will be used to record benthic habitat within the Development Area according to an approved SAP.

Opportunistic marine fauna surveys.

Adequately trained vessel crew will record and report on any opportunistic marine fauna including turtles cetaceans, seabirds and seas snakes. Identification (to highest possible taxonomic resolution) and range from the vessel will be determined using range-finding binoculars, and photographs taken using a digital SLR with telephoto lens. All observations will be included in the daily field reports and technical reports.

Noise & vibration data collection.

Opportunistic collection of underwater noise and vibration data has been included in the EBS SoW as an option. However, collecting underwater noise & vibration measurements are not feasible to collect during Geotechnical and Geophysical (GPGT) survey activities as they would most likely just pick up the emissions from the survey vessel and associated activities as there are no other activities in the vicinity of survey area.

4.3.2 Geophysical and Geotechnical Surveys

The GPGT surveys may comprise a number of individual or combined campaigns to inform future KTJ development activities, including pipeline, flowline and umbilical design and installation, subsea structure foundation design and installation, and FPSO and MODU mooring design and installation. The surveys may also provide information on existing infrastructure and support environmental studies. The proposed survey types are listed below.

Geophysical Surveys

Geophysical surveys collect acoustic data to map seabed features and shallow sub-seabed layers. A range of industry-standard systems may be used, selected based on seabed conditions and required resolution and penetration. These systems operate at different sound levels and frequencies and may be deployed anywhere within the Development Area.

Proposed survey techniques include multibeam echosounder (MBES), side scan sonar, sub-bottom profilers, magnetometers and Ultra-Short Baseline (USBL) positioning systems. Geophysical equipment may be deployed from a survey vessel using hull-mounted systems, towfish, towed catamarans, or ROVs/ Autonomous

Underwater Vehicles (AUVs). Equipment may operate at various depths in the water column, ranging from near-surface to tens of metres above the seabed, depending on the system used.

Multibeam Echosounder

MBES combines depth (bathymetry) and reflectivity (backscatter) for comprehensive seafloor imaging to inform the location of infrastructure and identify any hazards. This will inform the positioning of subsea infrastructure, including wells, FPSO mooring and future pipeline routes.

MBES transmit sound energy and analyse the return signal (echo) from the seabed or other objects. The sound waves are transmitted from a transducer mounted on the hull of the survey vessel, an ROV or AUV to produce a fan-shaped coverage of the seabed. The coverage area on the seabed depends on the equipment used, the settings of the equipment and the depth of the water.

Side Scan Sonar

Side scan sonar creates high-resolution images of the seafloor to map large areas, detect underwater objects (e.g. subsea infrastructure, shipwrecks, debris), identify seafloor hazards, characterize seabed materials, and support offshore construction and installation activities and infrastructure location. Side scan sonar works by sending sound waves out to the sides from transducers on towfish or AUV, revealing objects through their shadows and backscattered signals, effectively creating detailed visual maps of the seabed.

Sub-bottom profilers

Sub-bottom profilers are used to create detailed images of sediment and rock layers beneath the seafloor, helping to map geology, find buried structures, assess hazards for construction (including unstable sediments or gas saturated sediments) and locate shipwrecks or artifacts. It works by sending sound pulses into the seabed, which reflect off different layers and return to the vessel, revealing subsurface structures non-intrusively. This will inform the positioning of subsea infrastructure, including wells, FPSO mooring and future pipeline routes.

Magnetometers

A magnetometer is used to detect ferrous materials on or buried under the seabed by measuring small variations in the earth's magnetic field. This will be used to detect anchors, chains, buried pipelines or cables or identify other magnetic anomalies that may require further investigation prior to installation and construction activities.

USBL positioning systems

Ultra-Short Baseline (USBL) is a method of underwater acoustic positioning which is used to calculate the position of underwater targets. It will be used to locate and monitor ROV and AUV during deployment, and for positioning structures and equipment in future activities. It works by sending acoustic pings that transponders on targets reply to, allowing monitoring of locations in real-time for safety and operational efficiency.

Geotechnical Surveys

The geotechnical surveys will be performed using standard industry equipment and will consist of in situ testing and the recovery of soil/rock samples at locations within the Development Area to ground truth existing geophysical data and provide geotechnical data for engineering design.

The geotechnical survey methods that are expected to be used during the GPGT Surveys include but are not limited to those described below.

Penetration Testing

Penetration testing involves pushing a penetrometer (probe) into the seabed at a constant rate of penetration, and continuously measuring resistance, friction and pore pressure. It is used to determine the engineering properties and stratification of seabed soils to inform the design and safe installation of pipelines and other infrastructure.

Cored Borehole

Some boreholes will be required at the proposed mooring locations and proposed structure foundation sites to recover physical samples at greater depths than can be achieved using piston core sampling. Drilling mud is generally used in the process, in order to lubricate the drill bit, keep the borehole stable and hopefully preclude the necessity for casing. Seawater is the primary constituent of geotechnical drilling fluids. In suitable seabed sediments the base fluid (seawater) can be used as the drilling fluid. However, occasionally one or more drilling fluid additives are mixed with the base fluid to produce a drilling fluid with the appropriate properties for the seabed conditions. If drilling fluids are required Finder will seek advance approval from ANP for their use.

Piston Core /Gravity Core and Vibrocore Sampling

Coring retrieves undisturbed seafloor sediment to assess source rock potential, verify hydrocarbon presence, and gather geotechnical data for designing offshore infrastructure like platforms and pipelines. It uses a weighted tube with a piston or relies on gravity that creates suction for intact cores in soft sediment, revealing stratigraphy, sediment stability crucial for infrastructure placement. A vibrocore achieves a similar sample to a piston core but rather than using free fall momentum to drive the core barrel into the seabed, a vibrocore uses a motor above the barrel to vibrate the corer and the weight helps drive the barrel into the sediment. The sample is typically more disturbed, but the method produces better seabed penetration in coarser sediments where a piston corer is of limited use.

Box Core and Grab Sampling.

Box core samplers are designed to recover bulk, undisturbed samples of soft surficial material. Data from box cores will provide properties of near-surface sediments on the seafloor, which is crucial for the safe placement and anchoring of offshore facilities, pipelines, and other infrastructure.

4.3.3 Drilling

Drilling for the KTJ Project will involve construction of three subsea production wells, two in the Kuda Tasi field and one in the Jahal field, using a floating Mobile Offshore Drilling Unit (MODU), with the Eneos Hakuryu-5 currently under consideration. The Kuda Tasi wells will be constructed from a common drill centre to improve operational efficiency, simplify seabed infrastructure and minimise environmental impact. The wells will target the Laminaria Formation reservoirs, the same reservoir system intersected in the original Kuda Tasi and Jahal discoveries and in nearby fields including Kitan, Elang-Kakatua, Buffalo and Laminaria-Corallina. Each well will be drilled and completed for long-term production to the FPSO. The average drilling and completion duration is expected to be 50-55 days per well.

Well Design

The Kuda Tasi and Jahal wells are designed to drill at approximately 60° inclination through the Laminaria reservoir to maximise reservoir contact and production efficiency. Jahal comprises a single well and completion, while the two Kuda Tasi wells are arranged as a drill-centre with wellheads spaced ~50 m apart to minimise rig moves. Total depths are approximately 3,598 mTVDSS (4,513 mMD) for the Kuda Tasi wells and 3,421 mTVDSS (3,888 mMD) for Jahal, with each well drilled to ~200 m below the top of the Laminaria Formation.

The well design is planned to be compliant with the Interim Regulations issued under Article 37 of the Interim Petroleum Mining Code. Further details are provided in the following sections. The objectives and criteria used in the proposed design of the wells are:

1. Construct wells with long term integrity, that will facilitate production requirements, safely, on time and budget while minimising environmental impact.
2. Mitigate against losses in the overburden by drilling a long riserless section and setting surface casing in the Jamieson formation.
3. Mitigate against losses while drilling below the surface casing shoe by top setting the reservoir with production casing and reducing the mud weight for the reservoir.
4. Provide effective annular isolation thus allowing selective production from different reservoir zones by cementing a relatively short production liner.
5. Allow selective production without the requirement for well intervention by utilising a smart upper completion that allows individual reservoir zones to be choked back or shut off entirely.
6. Facilitate low cost, high integrity final abandonment by constructing the well to allow for a straightforward abandonment.

Well Construction

Well construction activities will be carried out using a MODU. The MODU would be expected to be temporarily anchored to the seabed and may be equipped with dynamic positioning (DP) systems for positioning and stabilisation during extreme weather events. The estimated duration for drilling and completion of each of the three wells is approximately 50–55 days per well. This does not include additional time for unexpected delays and extreme weather events.

The well construction sequence and under pinning rationale is shown below:

1. Drill 42" x 26" hole section; Run and cement 36" conductor to the mudline. The exact conductor length will be determined by structural analysis in the detailed design phase, and will provide a foundation pile to support all well loads including casing, production tree, rig BOP and a accommodate potential loading from a capping stack in the highly unlikely event of a loss of well control event. The use of a 36" conductor will 'future proof' the well for fatigue and to allow for rigs with larger BOPs to safely connect to the well.
2. Drill 17 1/2" hole section; drill riserless with seawater + sweeps to section TD ~ 20 m into Jamieson formation at ~3040m TVD. In the KT wells this section will build to ~36° inclination. Run and cement 13 3/8" casing and HPWHH to approximately 500 m above the casing shoe. Drilling riserless mitigates against losses in the shallow limestone formations. Cementing to surface is impractical and 500 m of cement will provide adequate annulus isolation to facilitate drilling ahead into hydrocarbon bearing formations. In addition, this annular cement could potentially be used as part of the final abandonment barrier for the well. This length of annular cement meets statutory requirements.
3. Install and test Horizontal Xmas Tree (HXT) and Blow Out Preventer (BOP).
4. Drill 12 1/4" hole section; drill hole section increasing inclination to 60°, landing into top of Laminaria Reservoir. Run and cement 9 5/8" casing to approximately 500 m above the casing shoe. Increasing the inclination to 60° provides greater reservoir exposure in the next hole section) compared to a vertical well; hence enhances well productivity. Top setting the reservoir allows the mud weight to be reduced in the next hole section therefore minimising the probability of losses. It also provides a mitigation against the possibility of losses between the surface casing shoes and the reservoir as the 9 5/8" casing shoe can be set slightly shallower than planned in this instance. Cementing 500 m above the casing shoe ensures that the

production packer is set in cemented casing and sets the well up for a straightforward final abandonment. This length of annular cement meets statutory requirements.

5. Drill 8 1/2" hole section; drill at a prescribed 60° through Laminaria and Plover reservoir sections. Run and cement 7" liner for cased hole completion. The liner will be fully cemented to the top of liner to provide zonal isolation allowing for selective production. Liner lap length will be a minimum of 30 m in length, fully cemented with a liner top packer acting as a secondary sealing mechanism.
6. Completion; The cemented liner will be perforated and the wellbore cleaned up and displaced to completion fluid.
7. A smart upper completion will be installed to allow future water shut off from the lower reservoir zones without the requirement for well intervention. Artificial lift will be provided by an electrical submersible pump situated on a seabed mounted manifold at the mudline.
8. The wells may be cleaned up back to the MODU before commencing production to the FPSO. Otherwise, the wells will be circulated clean to a diesel cushion, but with flowback cleanup later to the FPSO.

Drill Cuttings

Drilling of the wells will produce drill cuttings and mud that will be discharged either to the seabed or the sea surface. Drill cuttings will range in size from clay-sized particles to coarse gravel and will have angular configuration. Their chemistry and mineralogy will reflect that of the geologic strata penetrated during drilling. Drill cuttings will contain small amounts of liquid and solid drilling fluid components, in addition to formation solids.

The estimated generation of well cuttings and disposal points for the Kuda Tasi and Jahal wells is summarised in Table 4-2.

Table 4-2: Indicative cuttings volumes per well

Hole Size (inches)	Section Start (mMD)	Section TD (mMD)	Depth of Discharge	Volume of Cutting (m3)	Mud Type	Well Construction Phase
Kuda Tasi (each Well)						
42	450	505	Seabed	49.2	Seawater and high-vis sweeps	Conductor
17.5	505	3515	Seabed	467.1	Seawater and high-vis sweeps	Surface Casing
12.25	3515	4140	Sea surface	47.5	WBM*	Production Casing
8.5	4140	4440	Sea surface	11.0	WBM*	Production Liner
			TOTAL	**574.8**		
Jahal						
42	422	472	Seabed	44.7	Seawater and high-vis sweeps	Conductor
17.5	472	3018	Seabed	395.1	Seawater and high-vis sweeps	Surface Casing
12.25	3018	3230	Sea surface	16.1	WBM*	Production Casing
8.5	3230	3888	Sea surface	24.1	WBM*	Production Liner
			TOTAL	**480.0**		
Notes:	* WBM is base case, however final Mud Type will be defined in the detailed drilling engineering phase and outlined in Drilling EMP					

Drilling fluids (also known as drilling muds) are an essential component of the rotary drilling process. The most important functions of the drilling fluids used in the drilling of the wells will be to transport cuttings to the surface; to balance subsurface and formation pressures preventing a blowout; and to cool, lubricate, and support part of the weight of the drill bit and drill pipe.

During drilling, the drilling fluid will be pumped from the mud tanks down the hollow drill pipe and through nozzles in the drill bit. The flowing mud will sweep the crushed rock cuttings from beneath the bit and carry them back up the annular space between the drill pipe and the borehole or casing to the surface. The mud will then be passed through solids control equipment (an integrated system of shale shaker screens, hydro cyclones and centrifuges) to separate the cuttings and the drilling fluids. It will then be circulated back to the mud tanks in a closed system where the cycle will be repeated. There are three different broad classes of drilling fluid systems:

- Water based muds (WBMs), where the continuous fluid phase is water;
- Synthetic based muds (SBMs), where the continuous fluid phase is a well characterised synthetic organic compound; and
- Oil-based muds (OBMs), where the continuous fluid phase is oil.

At this stage only WBM is planned to be used for drilling of all hole sections, although SBM is still being reviewed as an option for the deeper and deviated hole sections. Final drilling fluid selection, fluid volumes, and chemicals will be undertaken in the next detailed engineering phase. Full details of this would be provided in the Drilling EMP and Drilling Application to Drill for approval of use by ANP.

The EIA includes the assessment of the potential impacts from discharge of drill cuttings and drilling muds. Appropriate management measures will be described in the Drilling EMP, once details of drilling fluid selection, fluid volumes, and chemical components are known.

Secondary data used to inform the description of the existing environment of the KTJ Project Development Area in this EIS indicates that the soft sediments at 400-440 m water depths are likely to have benthic habitats/communities representative of the epibenthic macrofaunal communities and infauna found across soft sediments in similar water depths in the Timor Sea—i.e., epibenthic fauna dominated by hermit crabs, echinoderms and demersal fishes; and low abundance, low diversity benthic infauna dominated by polychaetes and crustaceans. There are no indications that any hard substrates and associated epibenthic faunal communities (e.g., deep sea corals and sponges) occur at the KTJ Project location.

Hence, with regards to potential impacts to benthic habitats/communities from the discharge of drill cuttings and drilling muds, it is highly likely that no sensitive receptors occur within the potential footprint of drill cuttings dispersion and settlement on the seabed.

If the EBS finds sensitive benthic habitats/communities within the KTJ Project Development Area, Finder commits to revising the EIS. Additionally, Finder commits to undertaking drill cuttings dispersion modelling based on final confirmed well locations, drilling fluid system, fluid and cuttings volumes, discharge depth and rates. The Drilling EMP will be revised to reflect the results of this drill cuttings dispersion modelling, and management measures that will be implemented to eliminate or reduce potential impacts to benthic habitats/communities.

Well Flowbacks

Once drilled and completed, the wells will be suspended for production. Prior to suspension, they may be flowed to the MODU to clean out the wellbore. A well test package of separator, flare boom and other required equipment will be specified and installed on the MODU if required. Alternatively, once the wells are connected to the subsea production system, the well flowback and clean up may be conducted through the FPSO.

If a well flowback is required, the wellbore and reservoir fluids will be produced to the test separator. Oil, associated gas and completion fluids are expected to be produced and separated. Any produced completion fluids will be separated at the test separator, cleaned and disposed of overboard following <15 ppm standard a. A quantity of hydrocarbon (oil and gas) will be flared as part of the well flowback and cleanup process.

Finder is undertaking further reviews of this phase and further details will be provided in the relevant EMPs for drilling or commissioning.

Post-Drilling Survey

Following completion of drilling activities, a post-drilling survey will be undertaken using an ROV to visually inspect the seabed in the vicinity of the well locations. The survey will confirm seabed condition, identify any dropped objects, and assess the extent of any drill cuttings deposition associated with drilling activities.

Where appropriate, the post-drilling survey may include targeted environmental assessment, such as visual review of drill cuttings accumulation and/or limited sediment sampling, to support evaluation of potential environmental impacts. The requirement for any sampling will be determined based on the outcomes of the visual survey, drilling fluid types used, ROV capability, and the presence or absence of sensitive seabed receptors identified through environmental baseline surveys. Any sampling would be undertaken in accordance with the EBS SOW and subsequent drilling EMPs to allow for appropriate comparison with the data samples collected during the EBS.

Where impacts are consistent with predictions and confined to non-sensitive soft-sediment environments, further sampling may not be required. If unexpected conditions or potential environmental impacts are identified, additional assessment will be undertaken in accordance with the Environmental Management Framework and relevant Environmental Management Plans.

Plug and Abandonment

The KTJ wells will be completed for long term production to the FPSO. They will only be plugged and abandoned at some time in the future after Cessation of Production.

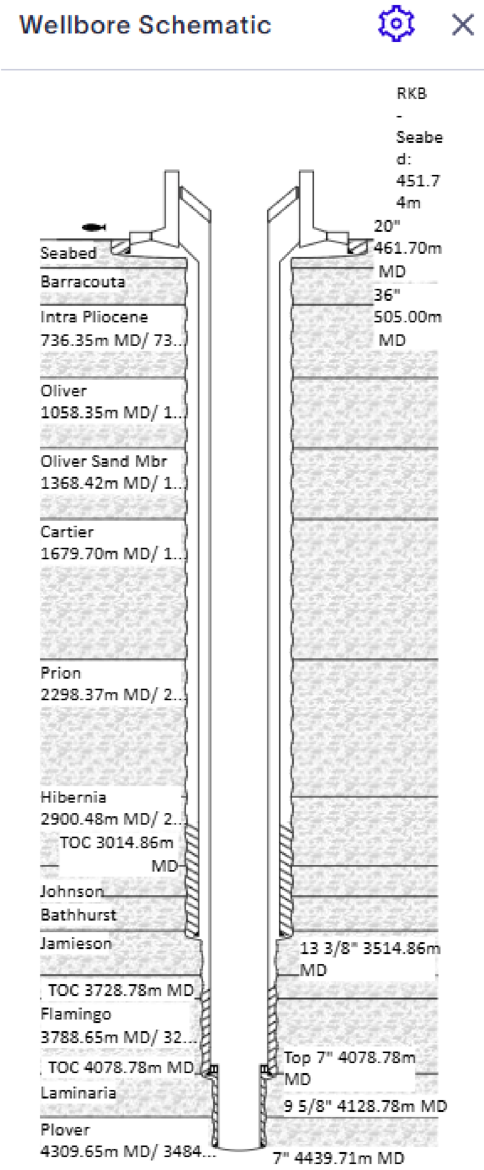


Figure 4-4: Wellbore schematic

4.3.4 Installation

The two Kuda Tasi wells are located within a drill centre arrangement and spaced approximately 50-100m apart and connected to a common seabed Electric Submersible Pump (ESP) skid via ~150m long 6” flexible flowlines. The 6” flexible flowline from the ESP skid towards the FPSO is ~2km, followed by ~700m of production riser. The control umbilical from the FPSO to the Umbilical Termination Assembly (UTA) proximal to the subsea Christmas trees (SSXTs) has a similar length to the flowline. Flying leads from the UTA to each of the SSXTs and the ESP skid provide power and control.

The Jahal field will comprise one subsea well connected to a seabed ESP skid via ~150m long 6” flexible flowline. The 6” flexible flowline from the ESP skid towards the FPSO is ~5.6km, followed by ~700m of production riser. The control umbilical from the FPSO to the UTA proximal to the SSXT has a similar length to the flowline. Flying leads from the UTA to the SSXT and to the ESP skid provide power and control. A summary of the proposed field layouts is provided in Figure 4-5.

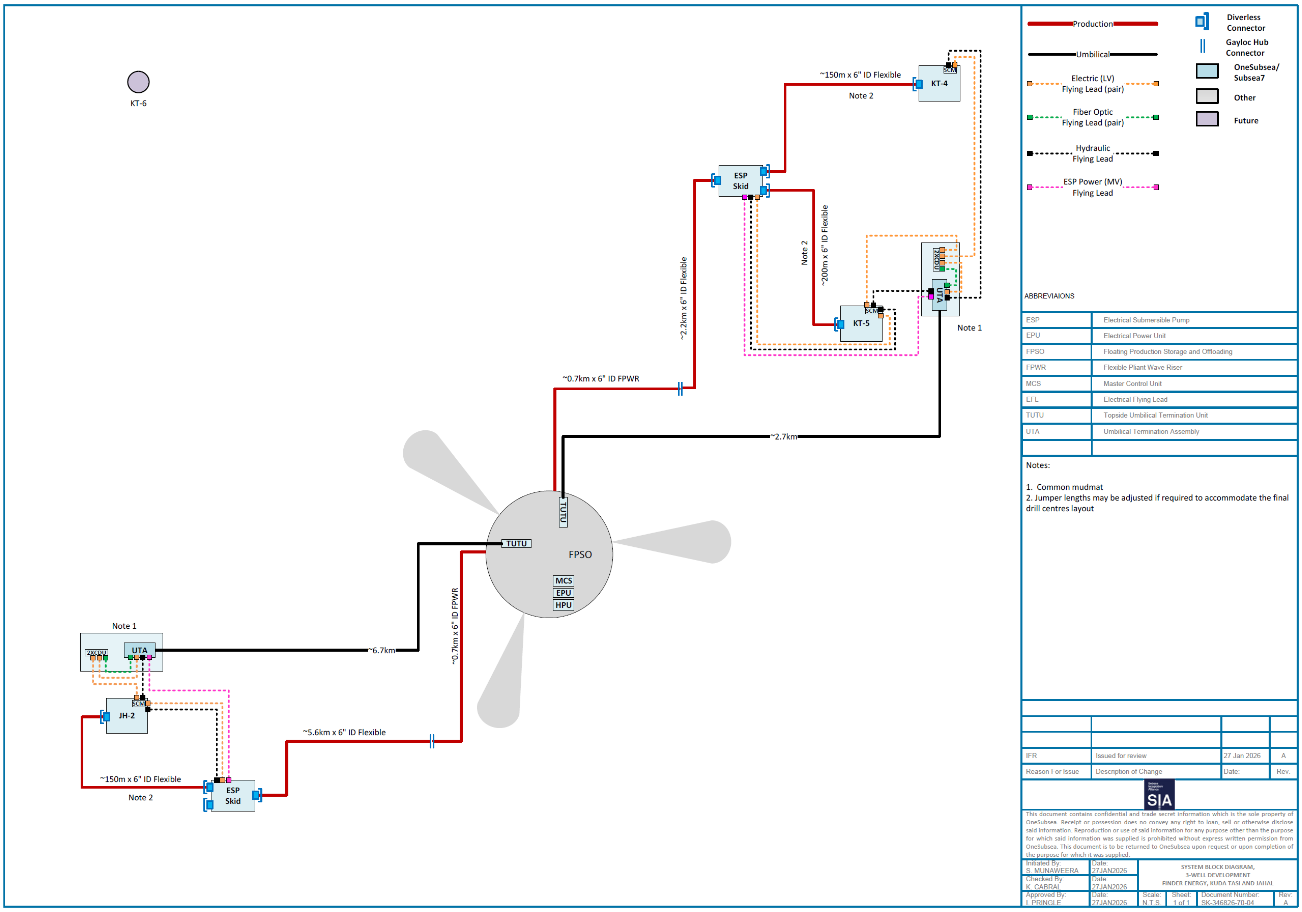


Figure 4-5: Proposed KTJ Field layout (January 2026)

Installation will be undertaken using construction support vessels equipped with ROVs for subsea positioning, metrology, and connection of flowlines, umbilicals, jumpers and flying leads. Subsea structures – including ESP skids, UTAs, and riser bases – will be lowered to the seabed and guided into position using ROVs. Flowlines and umbilicals will be laid along pre-surveyed routes informed by the GPGT survey results, and all connections will be function-tested prior to commissioning.

Installation and commissioning activities will include pre-lay preparation works, laying of flowline systems, umbilical systems (including Subsea Umbilical Distribution Unit (SUDU)/UTA integration), installation of subsea structures, and post-lay works such as tie-ins, connection of jumpers/spools, and addition of stabilisation measures where required.

Wells will be connected to subsea tie-in points such as manifolds, In-Line Tees (ILTs) or equivalent connection points via flexible jumpers or rigid/flexible spools. These components facilitate integration between flowlines, manifolds and subsea infrastructure, and may incorporate valve assemblies (including double block and bleed configurations) that are operable by ROV.

To transition from construction to operations, the system will undergo commissioning activities to confirm that all installed components are correctly installed, tested and function as designed. Commissioning will include system integrity testing, leak testing, pressure testing, control system verification, and preservation activities prior to hydrocarbon introduction. Following successful commissioning, start-up activities will progressively introduce hydrocarbons into the system and bring facilities into steady-state production.

Installation and commissioning activities will be undertaken within the development area, with seabed interaction limited to the installation footprint of subsea infrastructure. In the event of delays or adverse weather, temporary storage of equipment on the seabed may occur, resulting in a short-term and localised additional disturbance footprint.

Post-installation survey

Following installation, an ROV will conduct a post-installation seabed survey along the flowlines, risers, ESP skids, UTAs and FPSO mooring system to confirm correct placement and ensure no dropped objects remain on the seabed. The survey will document the footprint of physical disturbance on the seabed, including evidence of trenching, anchoring, seabed contact points and any temporary or permanent displacement of sediments resulting from installation activities.

Observations from the survey will be used to confirm that seabed disturbance is consistent with predictions made in the EIS and confined to the approved development footprint. Where required, survey outcomes will inform the need for any further monitoring or management measures, which will be detailed in the Field Installation EMP and subsequent environmental monitoring and reporting.

Future EMPs will provide additional detail on any monitoring program if required. Video transects are downloaded to a separate storage device and made available for use in post project environmental monitoring if required and/or used in environmental monitoring reporting.

4.3.5 Operations

The principal activity during the operational phase of the Project will be the flow and transportation of hydrocarbons from the wells to the risers and flowlines with each riser connected to the FPSO.

- Activities associated with operations under the scope of the development include:
- hydrocarbon extraction and transport
- inspection (external and internal)
- maintenance and repair
- well intervention

FPSO Production Operations

Day-to-day operations of the FPSO and the KTJ subsea production system will be managed under the KTJ Field Safety Case and Environment Plan. The Petrojarl I FPSO will be permanently moored between the Kuda Tasi and Jahal fields using an 8-line mooring system, providing a stable production hub for the field. The FPSO will receive produced fluids from the three development wells, separating oil, gas and water through onboard processing systems. Produced water will be treated to meet regulatory oil-in-water limits prior to overboard discharge.

The FPSO has an oil storage capacity of approximately 180,000 bbl, with stabilized crude exported via offtake tankers at regular intervals. The produced oil has a low GOR (gas oil ratio) of 200-250 scf/stb and the gas produced associated with the oil is intended to be used as fuel gas for power generation. During the initial year or two when production of oil is high, any gas not used as fuel gas for the generators will be flared by the onboard ground-flare system. This is in line with the existing fields in Timor-Leste such as the Kitan, Buffalo and Elang-Kakatua fields. Full details of the produced oil and gas volumes will be provided in the field development plan for review by the regulator and approval.

Fuel consumption of the FPSO for power generation will utilise produced gas when sufficient gas is available and will use crude and diesel oil for the shortfall when associated gas production falls off in later field life. The FPSO has 6 diesel oil storage tanks totalling 3,900m3.   Further analysis of the power generation estimates and emissions will be provided in the Field Development Plan (FDP) and the EIS to allow an estimate of emissions to be calculated. This will include flaring and venting (where applicable) as well as other emissions sources.

Produced formation water management will be addressed as part of the production phase of the KTJ Project. At the current stage of project definition, produced water volumes, treatment performance and final handling arrangements (including reinjection and/or discharge) are not yet confirmed. Accordingly, the EIS includes a high level assessment based on conservative assumptions. Detailed produced water modelling and impact assessment will be undertaken once final production forecasts and facility design parameters are confirmed and will be documented in the relevant Operations EMP prior to production commencement.

A summary of the FPSO specifications of the FPSO are provided in Table 4-3. The level of detail provided in the EIS and FDP for the FPSO and its operational components is commensurate with the current maturity of the project design and sufficient to support a robust EIA.

Further refinement of design-specific details, operational parameters and management measures will be provided in the KTJ FDP and phase-specific EMPs following completion of detailed design and engineering. This will include the following;

- General specifications and dimensions of the FPSO
- FPSO processing and utility systems
- Facility power generation
- Produced water treatment and discharge
- Subsea system operations
- Mooring and offloading arrangements
- Emissions and discharges associated with the FPSO operation
- Waste management
- Ballast water management
- Vessel and aircraft support
- Supply base
- Chemical storage

Figure 4-6: Petrojarl I FPSO (Photo: QGEP)

Table 4-3: Summary of FPSO Specifications

Item	Capacity
Dimensions	215m long 32m side 18m deep with 12m draught
Hull	Double bottom and box keel is provided in way of engine room and cargo oil tanks.
Oil Production	Up to 30,000 bopd
Gas Handling	Up to 8 mmscf/d
Water Production	Up to 20,000 bwpd
Oil Storage	180,000 bbls
Riser Slots	Up to 9
Accommodation	Up to 70 persons
Mooring	Turret mooring (permanently anchored)
Power	Up to 25MW across several dual fuel turbines

Subsea operations

The operation, monitoring and control of wells will be conducted remotely from the FPSO via the Subsea Production Control System (SPCS). All well functions will be monitored and controlled from the FPSO through a Master Control Station (MCS) via Subsea Control Modules (SCM) integrated into the subsea tree at each well. All subsea control systems are likely to be electro-hydraulic.

Inspection, maintenance and repair (IMR)

Subsea inspections proactively identify maintenance or repairs required with the aim of maintaining the assets as close to their design condition as possible. Inspection generally involves an IMR vessel travelling along the route of the subsea system with an ROV (and in some cases, divers). Inspections will be undertaken with a frequency determined based on risk and informed by monitoring and previous inspection results. Typically, vessels will be on site for ~2-4 weeks every few years to undertake inspection and/or maintenance works. This frequency is adjusted according to asset integrity risk which is informed both by offshore inspections and ongoing monitoring of asset integrity management measures.

Subsea inspections typically include:

- Cathodic protection measurement – completed using ROVs or AUVs and conductivity probes or by making visual assessments of anode wastage
- General visual inspections – involves ROVs or AUVs deployed from a vessel; may also involve divers and a dive support vessel
- Marine acoustic surveys – includes the use of side-scan sonar (SSS) and multibeam echo sounders (MBES), and typically completed using towed acoustic instruments, ROVs, or AUVs
- Non-destructive testing – includes ultrasonic testing and electrical resistance testing, which are typically undertaken using an ROV or AUV deployed from a vessel. This type of testing may be performed to validate the results of other inspection techniques.
- Wall thickness/fatigue monitoring/inspection—where required, fatigue monitoring equipment will be installed, inspected, and/or retrieved by an ROV deployed from a vessel.
- It is not planned for new production systems to be designed to accommodate inline inspections due to the short design life of the fields and the variation in diameters of the new system compared to the existing system, though is confirmed as part of detailed design.

Inspections typically take approximately 2 weeks at sea for an entire inspection program including mobilisation and demobilisation.

Maintenance and repair activities may need to occur during the operational life of the field to:

- Prevent deterioration and/or failure of infrastructure
- Maintain reliability and performance of infrastructure.

Maintenance and repair activities are typically conducted in response to inspection findings, engineering analyses, and/or external events. The activities are typically performed by ROV from a vessel or by divers from a dive support vessel. Activities may include:

- cathodic protection system maintenance
- leak testing
- excavation (e.g. where pipeline has become buried by shifting sands)
- marine growth and hard deposit removal
- removal of debris (e.g. fishing equipment)
- rectification of electrical or hydraulic fault
- flowline repair
- pipeline gauging
- flowline jumper replacement
- service line/hydraulic capping plate removal and reinstallation
- subsea control unit change out

- replacement of equipment on the seafloor
- stabilisation deployment
- servicing of SSTs, flowlines, well maintenance, flanges and mechanical connections.

Well intervention

Well intervention is the action of re-entering a well for purposes other than drilling; usually to:

- evaluate a well's condition or performance
- remove obstructions
- stimulate the well
- repair well casing / tubing.

Well intervention generally occurs within the wellbore and involves specific types of tools that can be delivered down the inside the well itself. It includes activities such as:

- slickline / wireline / coil-tubing operations
- well testing and flowback
- well workovers (mechanical or hydraulic).

The frequency of well intervention activities depends on well performance which is measured through monitoring of production and via integrity tests involving the operation of well tree valves, typically completed by the control room operators within the onshore gas plant.

4.3.6 Decommissioning

The project will be decommissioned after the end of its operating life once cessation of production has occurred and the reservoirs are no longer commercially viable. The overarching objective of decommissioning is to permanently abandon the reservoirs and decommission infrastructure in a safe and environmentally sensitive manner. Finder will ensure that the activities do not cause unacceptable environmental impacts and will reflect the appropriate legislation, lessons learned, industry best practice at the time of decommissioning in approximately 10 years. Given the length of time until decommissioning, it is premature to define details of the strategy, but broad social, environmental and economic impacts have been considered.

Prior to Cessation of Production (COP), decommissioning activities will be further assessed. At that time the scope of decommissioning will be fully understood based on the operations in the field to that date. An EMP will be prepared at that future time, addressing the decommissioning scope of work.

Currently the identified decommissioning and associated activities are expected to include:

- Plug and abandonment (P&A) of wells including Methods and standards, using good oilfield practice
- Management of waste and equipment and potential environmental impacts associated with P&A
- Flushing of subsea infrastructure to acceptable standards
- Removal of subsea infrastructure, and comparative assessment for items that may be considered in situ abandonment. The comparative assessment would include environmental, technical and safety considerations
- FPSO disconnection and sail away
- Seabed survey and remediation if required
- Monitoring and verification procedures post decommissioning

An ALARP assessment of the decommissioning options at the time of the preparation of the EMP will provide transparency in the decision-making process and align with Finders' risk assessment methodology (described in Section 9.2).

4.4 Project Size

The development concept for the KTJ Project is catered around redeployment of a Floating Production, Storage and Offloading (FPSO) to process the oil and then store it safely until it can be offloaded to shuttle tankers. Redeploying an FPSO reduces environmental impact by reusing existing offshore infrastructure, avoiding the significant embodied carbon associated with new vessel construction, reducing raw material consumption, extending asset life, and shortening development schedules. This circular-economy approach lowers lifecycle emissions while enabling more capital-efficient field developments. Three production wells (1 at Jahal, 2 at Kuda Tasi) will be tied to subsea production equipment and flowlines and the FPSO.

The Project Development Area covers 88 km^2 and the Access Authority covers 3.4 km^2. The northern boundary of the Project Development Area is located approximately 160 km south of the southern coastline of Timor-Leste.

The field layout including the three production wells, FPSO and moorings and subsea production infrastructure is shown in Figure 4-5. Comprehensive programmes for drilling, completions, installation and operations will be developed, outlining each stage of the operation based on engineered designs.

4.5 Project Location

The KTJ Development will be located within the approved Development Area (refer ANP Approval P/ANP/S/26/179). An additional Access Authority area for installation of some of the FPSO moorings has also been granted (P/ANP/S/26/209). The water depth ranges from 400-450m.

Program activities will occur within the KTJ Project Development Area (Figure 4-2). The Development Area within which activities will mostly apply has been defined as:

- 1.5km around proposed FPSO location - to include anchor spread
- 1km around proposed well head locations; and
- 250m each side of subsea infrastructure.

4.6 Workforce and Logistics

During the initial phase of drilling, installation and commissioning, key resources will be required as summarised in Table 4-4. Helicopters and vessels will be required to provide support and supplies at various stages of the development, with a floating MODU required for any drilling and the FPSO on location during operations.

To date, Finder has secured the FPSO (Petrojarl-1) and potential MODU (Hakyuru-5), other vessels will contracted as required for each phase of the development.

Table 4-4 : Summary of Key Resources

Phase	Resources
Environmental Baseline Surveys	1-2 Survey vessels
Geophysical and Geotechnical surveys	1-2 survey vessels
Drilling	Floating MODU Helicopters for crew change Supply and support vessels
Installation and Commissioning	Subsea operations and construction vessel Helicopters Support/supply vessels
Operations	FPSO (Petrojarl-1) Support/supply vessels

	Helicopters Inspection, Monitoring, Maintenance, and Repair (IMMR) Vessels
Decommissioning: Plug and abandonment drilling	Floating MODU Helicopters for crew change Supply and support vessels
Decommissioning: Infrastructure removal	Vessels to support approved decommissioning activities Support and supply vessels Helicopters

The project logistics plan has not been finalised at this time. Finder is considering options for mobilising equipment and personnel via Timor-Leste, and / or Darwin, Australia. Once the project logistical arrangements have been determined, suitable advice will be provided. Offshore supply vessels will be sourced through competitive tender. Helicopters required for personnel transfer and Medivac will be sourced from existing aviation contractors licenced to operate in Timor-Leste airspace.

The specific resources deployed will be determined on a phase-by-phase basis and finalised in the relevant EMPs. Further detail, including vessel selection, specifications and detailed operational arrangements, will be provided in subsequent phase-specific EMPs as designs are finalised

4.7 Vessels

4.7.1 Geophysical & Geotechnical and EBS Survey Vessels

Several types of survey vessels may be required to complete the activities associated with the GPGT and EBS Surveys. A multi-purpose survey vessel is generally used to conduct geophysical surveys, including ROV and AUV survey operations, and light geotechnical operations. EBS data will also be collected on this type of vessel. Other vessels will be used to undertake geotechnical surveys and deployment of geotechnical equipment.

The ROV/AUV survey tracks will transect the areas of planned facilities as shown in Figure 4-3—ensuring subsea conditions are assessed prior to installation. However, there will be several lots of data collected during the development – each informing future surveys (for example GP data will form basis for geotechnical (GT) surveys).

A conservative approach has been employed to select vessel parameters to assess the risks and impacts. Uncrewed surface vessels are controlled from a remote operations centre and may replace conventional vessels for numerous survey tasks over the life of the activity. The uncrewed surface vessels are typically significantly smaller than a crewed vessel of equivalent capability offering a reduced environmental impact.

An offshore support vessel that could be used for EBS has been selected as an example for this EIS. The Outer Limit is a 35m offshore support catamaran capable of transporting 125 tonnes of deadweight, including up to 50 personnel. The vessel can transit at speeds of up to 20 knots over distances ranging up to 1800 nautical miles.

The accommodation, located over three decks contains sleeping and service facilities for crew/personnel of up to 32 persons in 15 cabins.

The aft deck of the 35m Offshore Support Catamaran with a clear work area of over 160 square metres, is arranged for multiple uses and includes a moonpool for survey operations and the capacity to carry up to 4 x 20ft containers. A hydraulic remote deck crane capable of lifting 12 tonne @ 3 metres, and 2.1tonne at 13m. Deck structure to suit a removable luffing A-frame with a safe working load of 20 tonnes.

Powered by twin Caterpillar C32 Acert engines each producing 1,655hp, the vessel has a service speed of approx 19 knots. With a fuel capacity of 35,000 litres.

The geophysical survey will be undertaken using a vessel approximately 65 m in length, with a maximum of 40 personnel onboard. The vessel will operate on marine diesel fuel and will have the largest fuel tank capacity of about 150 m^3.

The geotechnical survey vessels are generally larger of approximately 100 m in length, accommodating up to 60 personnel. This vessel will also be powered by marine diesel and will have a maximum fuel tank size of around 150 m^3.

It is feasible, although unlikely, that two vessels will perform surveys in the DA at any one time.

Geotechnical vessels may hold station in the DA using dynamic positioning (DP). No anchoring is planned within the DA.

Vessels will mobilise and demobilise from international waters (Darwin) or domestic ports from within Timor-Leste. Port calls may occur for crew changes or equipment reconfiguration (e.g., between geophysical and geotechnical surveys). No at-sea bunkering will be required due to the duration of the activities, any refueling will occur during port calls.

ANP will be informed of vessels selected prior to mobilization and the proposed activities.

Autonomous underwater vehicles

An autonomous underwater vehicle (AUV) is a self-propelled submersible that follows a pre-programmed course without being tethered to the survey vessel. The AUV typically returns to the vessel for battery replacement, data download, and reprogramming for the next deployment. During operation, the vessel's USBL system is generally used to track the AUV and communicate with it via acoustic telemetry. AUVs can also be equipped with a range of additional payloads, including synthetic aperture sonar, forward-looking sonar, turbidity sensors, Doppler velocity logs, and digital cameras.

Remotely operated vehicles

A remotely operated vehicle (ROV) is a tethered underwater vehicle equipped with cameras for still and video imaging. ROVs can be fitted with additional sensors, including altimeter, Doppler velocity log, laser scanners, manipulator for collecting sediment or water samples, and pipe trackers for locating buried cables or pipelines.

4.7.2 Drilling - Mobile Offshore Drilling Unit

Drilling activities will be undertaken using a floating MODU. The Hakuryu-5 is one of the MODUs under consideration, and a unit with equivalent capabilities will be selected prior to mobilisation.

The MODU will be mobilised from the previous operator's location to the DA using a single primary tow vessel and a second vessel providing support. At location the eight to twelve (rig dependent) anchors will be either pre-laid on location or run via the rig to secure the MODU on location.

The MODU is expected to accommodate up to 150 workers and will be equipped with marine–standard catering and ablution facilities. The MODU fuel oil capacity is expected to be up to 906 m^3 (5700 bbls) and will use approximately 15 m^3 (94 bbls) of diesel per day during the drilling campaign.

4.7.3 Construction, installation, & commissioning

During the construction, installation, and commissioning phases, subsea operations and construction vessels will be used alongside support and supply vessels to undertake offshore installation activities. Vessels may include anchor handling tugs, heavy construction vessels, heavy lift vessels and support vessels to install moorings and infrastructure and hook up to the FPSO.

4.7.4 Operations

During operations, support and supply vessels will be used alongside IMMR vessels to assist with routine offshore activities and integrity monitoring. The FPSO and typical offshore support vessels are all described in earlier sections 4.3.5 and 4.7.

4.7.5 Decommissioning

During the decommissioning phase, vessels for subsea infrastructure removal will be utilised alongside support and supply vessels to complete offshore dismantling activities. Typical offshore support vessels are all described in earlier sections 4.3.5 and 4.7.

4.8 Schedule

The KTJ Project is a phased development project, with timing and progression dependent on the outcomes of technical studies, regulatory approvals, and internal investment decision gates.

The development of the Kuda Tasi and Jahal fields is going through a fast track development project delivery process, in accordance with the Finder Project Delivery Process Manual (PDPM).

A suitable FPSO has been purchased by Finder, and FPSO Front-End Engineering and Design (FEED) studies have commenced to enable modifications and life extension works to be executed in 2027. Finder and the Joint Venture are targeting the end of June 2026 for Final Investment Decision on the development of Kuda Tasi and Jahal, with first oil production forecast for December 2027.

A detailed Level 2 schedule named the ‘Integrated Master Plan’ (IMP) has been developed around the Work Breakdown Structure (WBS) to ensure that all the necessary activities will be executed for the successful completion of the project. The IMP contains the agreed baseline against which the progress of the project will be measured and variance will be monitored. The key milestones of the project are the following:

Table 4-5: Key Milestones for the development

Milestone	Name	Baseline
A4300	FPSO Purchase	01-Dec-25
A4310	FPSO FEED Complete	01-Jun-26
A4840	KTJ FID	30-Jun-26
A4330	FPSO Long Lead Items (LLIs)	28-Sep-26
A4340	FPSO Shipyard Commence	11-Jan-27
A4350	FPSO Tow to Timor Leste	01-Oct-27
A3630	Wells LLI commenced	16-Feb-26
A3640	Spud Well (Drilling start)	1-Jul-27
FO	First Oil	31-Dec-27

A summary of the Integrated Master Plan which shows the main critical path and milestones has been included in Figure 4-7.

Figure 4-7: Fast-track Development Schedule

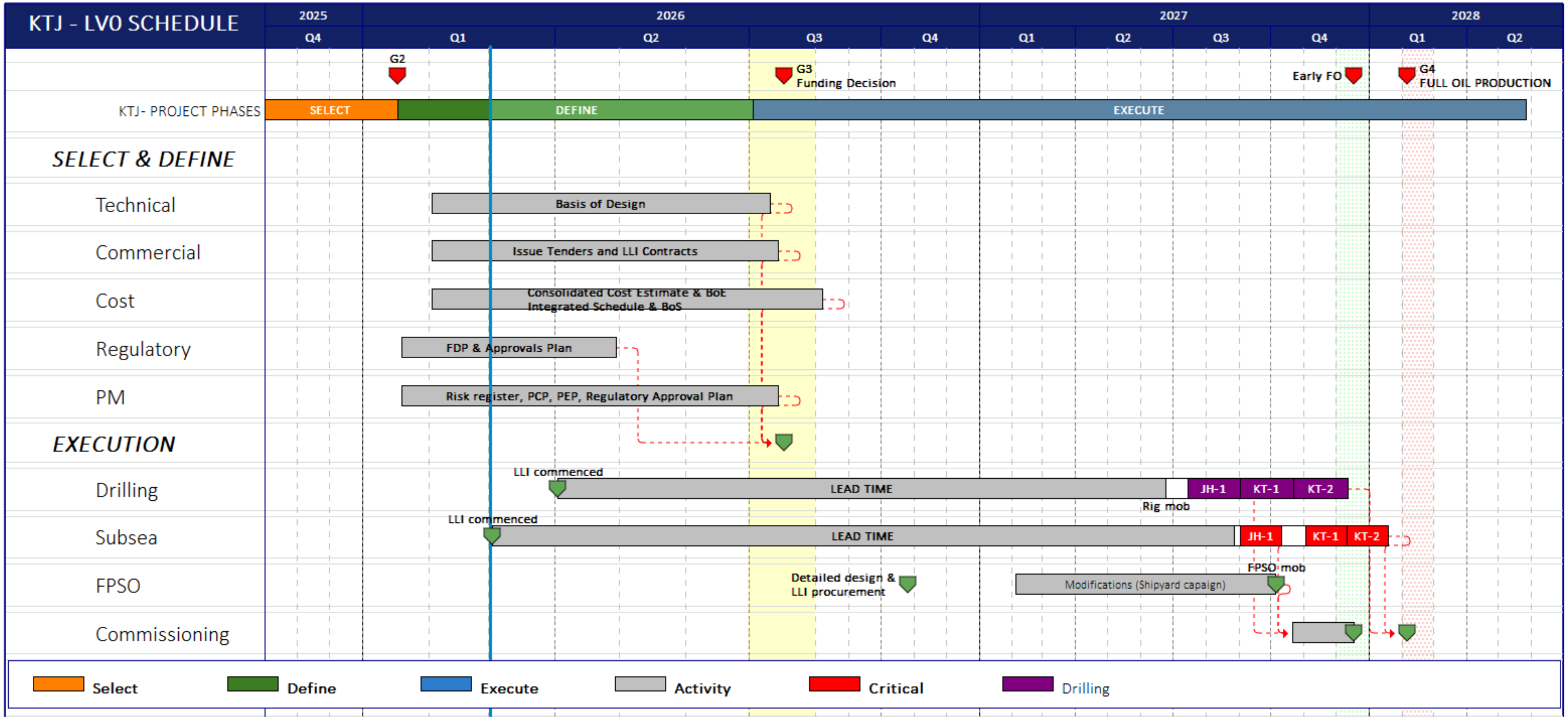


Table 4-6: Project milestones and schedule of Environmental Approvals and Surveys

Phased Project Milestones	Environmental Approvals	Approximate Timing
KTJ Project Scoping	**Project Preparation**	
Explore GPGT/EBS Vessels	Literature review and gap analysis	Q4 2025 - Q2 2026
	Preparation KTJ Environmental approvals supporting documents (TOR, EIS, GPGT EMP, PCP)	
	Submission of Environmental Baseline Survey (EBS) Scope of Work	Q4 2025 – Q1 2026
	Submission of Project Survey (GPGT) EMP	
	Submission of TOR	Q1 2026
	Public and Stakeholder Consultation	Q1-Q2 2026
FDP Submission/Approvals		Q2 2026
	Submission of EIS	Q2 2026
Project Sanction - FID		Q2 2026
Pre-Activity Surveys	Complete EBS Scope of Works	Q3-Q4 2026
	Environmental Management framework – validation (EBS scope)	
	Acquire geophys/geotech data as per GPGT EMP, to inform Drilling/Infrastructure requirements	
	Drilling EMP and monitoring plan	Q3-Q4 2026
Drilling – Drill & Complete (3 Wells)		Q1-Q3 2027
Technical surveys	Post-drilling /pre-subsea infrastructure baseline monitoring	Q1-Q3 2027
As left survey		
	Subsea infrastructure EMP and monitoring plan	Q4 2026 – Q2 2027
Subsea Infrastructure Construction		Q3-Q4 2027
FPSO Mooring & Hookup	Post subsea and pre-operational baseline monitoring	Q4 2026 – Q2 2027
Infrastructure As built survey	Apply environmental management framework	
	Operations EMP and monitoring plan	
Field Commissioning		Q4 2027
	Ongoing operational and environmental monitoring	
Operations		Q4 2027 – 2035+
	Ongoing operational and environmental monitoring	
	Decommissioning EIA/EIS	
Decommissioning		~ 2035+ TBD

4.9 Other key procedures, systems and plans

Further detail on these plans are provided in the FDP or in subsequent EMPs.

4.9.1 Safety and Risk Management Procedures

Comprehensive safety protocols including design standards and equipment specification, peer review of designs and plans, formal risk assessment and HAZOP/HAZID conducted to identify and mitigate risks associated with offshore drilling and oil and gas production activities, including emergency response plans. Well control procedures, Tropical rotating storm planning, personnel training and equipment maintenance schedules. Strategies to mitigate risk and ensure the safety and success of the operation in an environmentally responsible manner.

4.9.2 Emergency Shutdown System (ESD)

The ESD system receives input from the fire and gas detection systems, as well as electrical and manual inputs from the process systems. The proper action for each defined input is given in the ESD cause/effect matrix and is executed automatically.

4.9.3 Process shutdown System (PSD)

The PSD system receives input from the fire and gas detection systems, the ESD system as well as electrical and manual inputs from the process systems. The proper action for each defined input is given in the PSD cause/effect matrix and is executed automatically. The PSD System is independent of the ESD and Process Control systems and has only two levels – PSD1 and PSD2. PSD1 has only one section – PSD1.0 – Total process shutdown. A shutdown at this level gives a full production shutdown, stop of gas – and water injection, fuel change-over from gas to diesel for power turbines and - engines and stop of production support systems. PSD2 is split into different sections.

The FPSO will be permanently moored and will stay on location in all weather conditions.

4.9.4 Logistics and Supply Chain Management

Plans for the procurement and transportation of equipment, materials, and personnel to and from the offshore site are in planning and are not finalised. Finder will plan to ensure efficient operations, and utilise suitably qualified local resources.

4.9.5 Weather monitoring and contingency plans

Monitoring systems to track weather conditions and develop contingency plans for adverse weather events, such as Cyclones or tropical lows to ensure the safety of personnel and equipment. Finder will contract with an appropriate weather forecasting company to provide metocean data for the project. Contingency planning for weather events will be in accordance with MODU and FPSO procedures.

4.9.6 Quality Assurance and Quality Control

Procedures to maintain the quality and integrity of drilling operations, installation activities and ongoing operations including regular inspections, testing, and monitoring of equipment and processes.

4.9.7 Waste Management, emissions and discharges

The MODU, installation and supply vessels and the FPSO will conform to MARPOL and other international standards for waste segregation and management. The project EMPs will provide details of the waste management processes to be implemented.

This EIS includes detailed information on the types, quantities, and management measures for domestic discharges, seawater discharges and other discharges.

Additionally, the EIS provides estimates of GHG emissions from all relevant sources during the drilling, installation/commissioning, operation and decommissioning phases of the KTJ Project.

4.9.8 Chemical Management

All chemicals selected for discharge to the marine environment throughout the development activity are assessed through Finders' Environmental Chemical Risk Assessment Procedure (FDR-RSK-PRC-0007). This document details the environmental risk assessment process by which chemical substances used during exploration and production activities undertaken by Finder Energy will be considered as environmentally acceptable for use. This includes chemicals selected for drilling fluids and for discharge within the produced water stream.

The objective is to promote the selection of chemicals with the lowest possible toxicity levels for use in operational activities and to minimise the potential environmental impact of a discharge or unplanned release. Finder maintains preference for chemicals with low toxicity that meet the technical needs of the chemical application without compromising the safety of personnel. The procedure adopts the internationally recognised chemical ranking system utilised by the Centre for Environment, Fisheries and Aquaculture Science (Cefas), on behalf of the UK government. Cefas assigns product ratings for the petroleum industry based on the Offshore Chemical Notification Scheme (OCNS). These ratings are based on the physical, chemical and ecotoxicological properties of products. Cefas publishes a list of ranked products and their hazard classifications. The assigned hazard groups vary from category A (most hazardous) through to E (least hazardous), and hazard quotient colour bands from purple (most hazardous), orange, blue, white, and silver to gold (least hazardous).

Additionally, The PLONOR List, agreed upon by the OSPAR Convention (Convention for the Protection of the Marine Environment of the North-East Atlantic), contains a list of substances that will pose little or no risk to the environment in offshore waters.

Chemicals with a low environmental impact are selected wherever feasible, this includes chemicals rated on the OCNS list as Gold, Silver, D, E or PLONOR to ensure potential environmental impacts from chemical discharge are acceptable. All chemicals planned for discharge to the marine environment will be managed as per the Chemical Register and approved by ANP prior to use.

4.10 Justification and Need of the Project

The Timor-Leste Strategic Development Plan (SDP) 2011–2030 is the country's overarching long-term blueprint for national development after independence. It sets out a 20-year vision to transform Timor-Leste into a prosperous, upper-middle-income country by 2030. The plan is built on three core pillars—social capital, infrastructure, and economic development—focusing on improving health and education, delivering critical infrastructure such as roads, ports and power, and fostering a diversified private sector beyond oil and gas. While petroleum remains the primary economic driver in the near to medium term, the plan emphasises using these revenues to build sustainable industries, particularly in agriculture and tourism, strengthen institutions, and create jobs, with the ultimate goal of achieving broad-based economic resilience and improved living standards by 2030.

The KTJ Project, with approximately 25 MMbbl of recoverable oil, directly supports Timor-Leste's Strategic Development Plan by converting near-term petroleum resources into tangible national value through revenue generation, infrastructure development, and local capacity building. As a capital-efficient development, KTJ can deliver early cash flow to the state, contributing to the Petroleum Fund and enabling continued government investment in priority social and infrastructure programs (such as the Tasi Mane Project), while also creating local employment and supply-chain opportunities aligned with the SDP's focus on economic diversification and private sector growth. Importantly, with Bayu-Undan now depleted, KTJ Project and its accelerated development will mean it's the next offshore field into production. This provides a continuation of petroleum production and sector and fills the gap prior to the development of the large Sunrise Project.

In addition, the government of Timor-Leste's Petroleum and Mineral Resources program (SDP Section 4.3) prioritises sustaining upstream production, maximising value from existing resources, and ensuring timely and efficient field development to maintain revenue continuity. The KTJ Project aligns directly with these priorities through its accelerated development approach and utilization of existing FPSO infrastructure to enable early production while minimizing the project's CAPEX.

Lastly, the KTJ Project is a scalable and pragmatic development which could become the enabler project for the upside potential in PSC 19-11, such as Krill, Squilla or the low-risk exploration prospects. The KTJ Project leverages the redeployed infrastructure in the FPSO and aligns with the government's objective of maximising value from existing resources while managing capital intensity, thereby reinforcing energy sector sustainability and supporting the broader transition from resource dependence toward a more resilient, diversified economy.

4.11 The Proponent's Endorsement of EIS

Finder confirms that this Environmental Impact Statement (EIS) has been prepared on its behalf and, to the best of its knowledge, presents an accurate and comprehensive assessment of the proposed activity, the existing environment, and the potential environmental and social impacts associated with the Project.

Finder endorses the findings and commitments contained within this EIS and commits to implementing the proposed mitigation, management, monitoring, and reporting measures described herein, subject to applicable regulatory approvals and conditions.

Finder further acknowledges its responsibility to undertake the Project in accordance with relevant legislative requirements, approval conditions, and recognised industry standards and practices.

4.12 Structure of the EIS

Finder have applied a systematic EIA process to identify, evaluate, and manage the potential impacts of the KTJ project. The process is described below.

- Define Activity.
- Scoping: Identify key issues, potential impacts, study boundaries, and assessment requirements.
- Terms of Reference (ToR) development: Establish the scope, methodology, and technical requirements for the assessment.
- Baseline data collection: Gather information on existing environmental and social receptors within the study area, for example environmental baseline surveys or desktop gap analysis.
- Impact identification: Identify potential direct, indirect, and cumulative impacts across all project phases.
- Impact analysis and significance evaluation: Assess the likelihood and consequence of potential impacts in an Environmental Identification (ENVID) workshop.
- Mitigation development: Define control measures to avoid or manage impacts.
- Environmental management plan: Develop monitoring, reporting, and compliance measures to manage impacts.
- Stakeholder consultation: Engage relevant stakeholders and incorporate feedback into the assessment.
- Reporting and submission: Compile the assessment findings into a formal report (this EIS) for regulatory review and decision-making.

A comprehensive program of environmental baseline surveys (EBS), geotechnical and geophysical surveys (GPGT), and risk assessments will build on the information within the EIS, and will inform the subsequent development of project phased activities (drilling, construction, operations) Environment Management Plans (EMPs), and associated monitoring to avoid, mitigate, or offset potential environmental impacts identified during the EIA process.

4.13 EIS Validation

As the KTJ Project is a phased development, it was agreed with ANP in the meeting on 9 December 2025 and subsequent correspondence, that Regulatory Approvals documents would also be submitted in a phased manner (reference to letter ANP/HSE/S/26/071).

Initially, a desktop literature review and gap analysis has been undertaken to understand existing environmental conditions (baseline) within the Study Area and to inform the EIS[2]. Representative regional information on species presence, benthic characteristics, and metocean conditions has been used to establish a preliminary baseline for impact assessment.

The datasets reviewed as part of the desktop literature review and gap analysis were obtained from scientific studies as well as regional operators, including Eni at the Kitan Field, which is less than 10 km from the KTJ Development Area. Additional datasets were also sourced from the recent EIA conducted by Sunda Energy for the Chuditch gas field, the Santos' Bayu-Undan development and the 2019 Eni drilled Kanase-1 well. The Sunda Energy EBS for the Chuditch field was carried out in 2025 and provides relevant temporal baseline information to support the KTJ Project EIA.

Knowledge gaps remain for certain site-specific parameters—including sediment quality, seabed features, and water quality—which will be addressed through the Environmental Baseline Survey (EBS) – phased survey approach[3].

To ensure Best Practice environmental outcomes, this phased approach will be guided by an Adaptive Management Approach for baseline data collection. This Adaptive Management Approach (Figure 4-8) provides a structured approach to applying targeted surveys, clear decision criteria, and risk-based adaptive responses to ensure environmental risks remain ALARP throughout the project lifecycle.

[2] [2] As per Item 2 in ANP/HSE/S/26/071 letter of approval for a phased environmental approval strategy
[3] [3] As per Item 3 in ANP/HSE/S/26/071 letter of approval for a phased environmental approval strategy

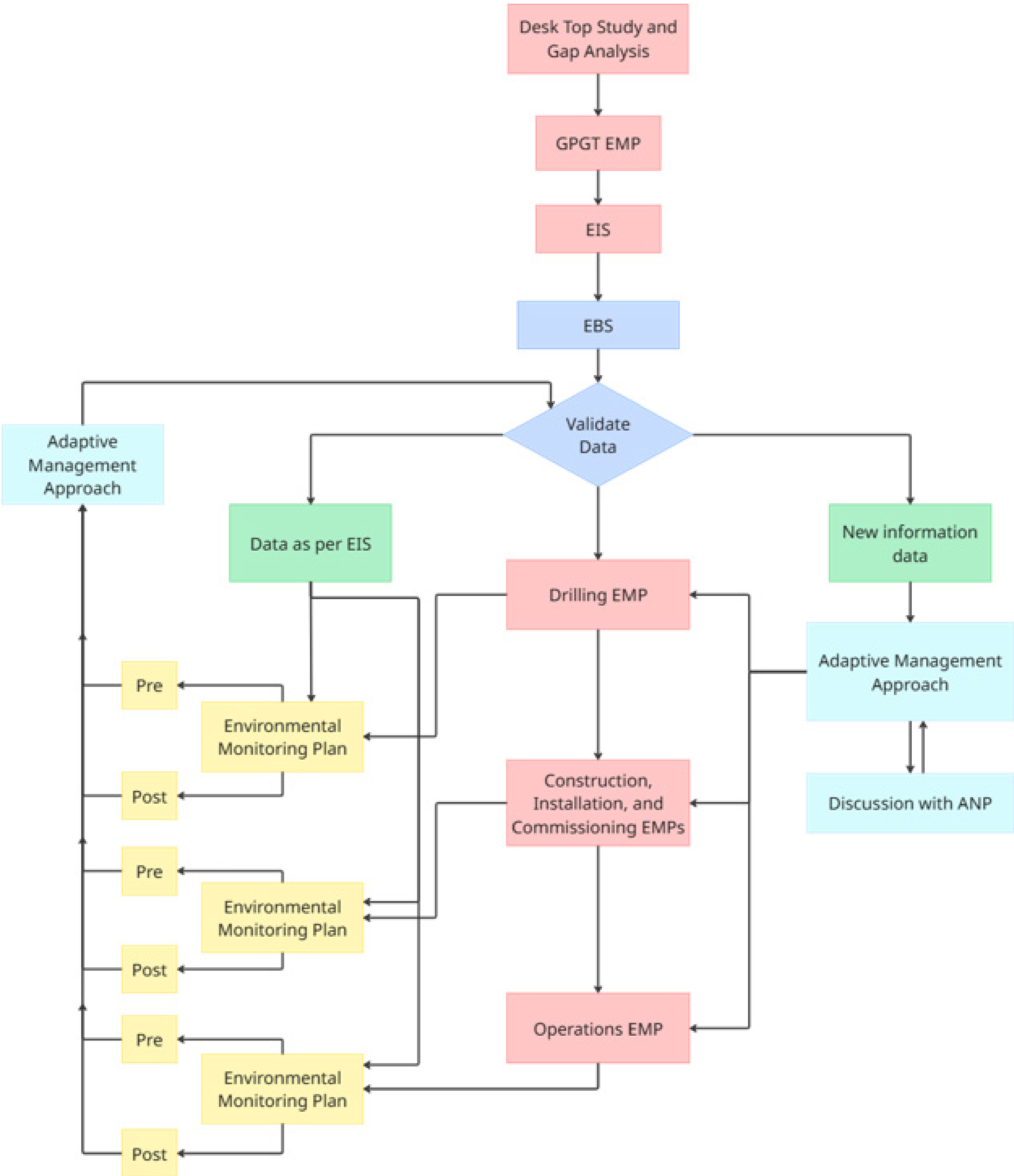


Figure 4-8: Adaptive Management Approach for baseline data collection

The EBS has been designed to adequately sample and broadly characterise the marine environment within the area in which ecologically relevant changes may potentially occur in response to the construction (including drilling), installation/commissioning, operation and decommissioning of the KTJ Project. Allowance is made for some small modifications to the locations of Project infrastructure (including the wellheads and FPSO) during final design. This adaptive, risk-based approach aligns with international best practice and maintains full environmental integrity while enabling the project to proceed on schedule.

The proposed approvals and data collection schedule will allow numerous opportunities to review existing information and ensure that any impact assessment is accurate, and that management is also considered appropriate. Should the EBS identify any material differences from information used to undertake impact assessment in the initial EIA, Finder commits to updating the EIA and the Environmental Monitoring and Management Plans accordingly, ensuring all mitigation and monitoring measures reflect validated baseline conditions and maintain impacts and risks at ALARP.

Table 4-7 outlines the parameters that will be sampled during the EBS (primary data), versus the desktop data that has been used to inform the description of existing environment in the EIS (secondary data).

Table 4-7: Primary vs. secondary data sources

Data	Data source		Comments
	Primary (EBS)	Secondary (Desktop)	
Physical environment			
Climate, metocean		✓	
Bathymetry		✓	Primarily GPGT survey
Current and tides		✓	
Water quality	✓		
Sediment quality	✓		
Biological environment			
Planktonic assemblages	✓	✓	
Benthic habitats & communities	✓	✓	Epibenthic macrofauna during EBS Benthic infauna via eDNA
Coral reefs		✓	
Breeding & spawning grounds		✓	
Sensitive habitats		✓	
Fishes		✓	
Marine mammals Marine turtles Sea snakes Whale sharks Seabirds	✓	✓	Opportunistic observations during EBS
Socio-economic environment			
Fisheries		✓	
Marine traffic and navigation		✓	
Other subsea infrastructure, fibre optic cable		✓	
Cultural heritage			Not applicable
Community use of marine areas		✓	

5. POLICY, LEGAL, AND INSTITUTIONAL FRAMEWORK

5.1 Background

Petroleum Activities in PSC 19-11 fall under Decree Law 2019/25 "Transition of Petroleum Titles and Regulation of Petroleum Activities from the Joint Petroleum Development Area" and the associated Interim Administrative Guidelines for the JPDA – Guideline # 5 "Guideline for the preparation of Environmental Impact Assessments of petroleum activities". A summary of the clauses from this Decree Law and guidelines relevant to the activity are provided in Table 5-1.

A summary of the high level Timor-Leste legislation and regulations that meet the general principles of environmental protection has been provided in Table 5-2, and international legislation and best practice in Table 5-3.

5.2 Decree Law 2019/25 and the Interim JPDA

Table 5-1: Applicable legal requirements under Decree Law 2019/25 and the Interim JPDA

Title	Relevant Clause or description	Relevance to the activity	Relevant Section of EIS
Decree Law 25-2019	Article 33, clause (a) (Environmental protection)	This clause requires operators to protect the environment and ensure activities cause minimum ecological damage.	Sections 10 and 11 (impact assessment) address potential impacts from the activities and include planned and unplanned events. Section 9.4 lists control measures that will be in place to protect the environment from the impacts from planned and unplanned events.
	Article 33 (b) (Safety of Persons)	This clause ensures the health and safety of personnel involved in offshore activities, which includes safe deployment of equipment, vessel operations, and emergency response procedures.	Sections 10 and 11 (impact assessment) address potential impacts from unplanned events that could occur during activities (such as spills) and also the control measures to ensure the safety of vessels and personnel. Section 15 also addresses emergency preparedness.
	Article 33 (c) (Safe condition of equipment)	This clause requires all equipment used in operations to be maintained in safe and good condition, ROVs, acoustic systems, and vessel machinery that could fail and cause environmental harm.	Section 9.4 lists control measures that will be in place to protect the environment from the impacts of equipment and vessels (such as light and noise emissions, benthic habitat disturbance, interactions with fauna).
	Article 33, clause (d) (Avoiding interference with other users)	This clause requires operators to avoid unnecessary interference with other marine users, which applies to survey vessel routing, safety zones, and communication with fisheries or shipping.	Section 9.4 lists control measures that will be in place to protect the environment from the impacts of interactions with other marine users (such as commercial vessels, support vessels, and fishing vessels).
	Article 33 (e) (Clean-up)	This clause requires operators to remove equipment, clean up the area, and leave the environment safe.	Section 9.4 lists control measures that will be in place to protect the environment such as the removal of equipment from the seabed, the collection of dropped objects

Title	Relevant Clause or description	Relevance to the activity	Relevant Section of EIS
			overboard, ensuring crew are trained, and ensuring lift plans are in place for recovering equipment.
	Article 32 (Conducting Good Oil Field Practice)	This clause requires all operations to follow Good Oil Field Practice, which includes environmental protection, safe operations, and minimising impacts.	Good Oil Field Practice is reflected throughout with Section 9.4 detailing controls to ensure activities are conducted safely and with impacts to the marine environment reduced as far as reasonably practicable.
	Article 36 (a-c) (Data, records, and reporting)	This clause requires operators to keep and provide data and reports, which applies to environmental monitoring records, marine fauna observations, incident reports, and survey logs.	Section 16 addresses the requirements for record keeping of reportable incidents, environmental harm, or pollution. Each individual EMP will also address this in further detail with incident reporting, annual reports other environmental reports to ANP.
	Article 65.2 (l) (Environmental Impact Assessments)	This clause explains the requirement for environmental impact assessments for proposed activities.	Sections 10 and 11 (impact assessment) address potential impacts from the activities and include planned and unplanned events. Section 9.4 lists control measures that will be in place to protect the environment from the impacts from planned and unplanned events.
	Article 65.2 (f) (Control of the flow of discharge, drilling fluid, water)	This clause authorises the Ministry to issue regulations governing well control, drilling fluid management, produced water handling, and prevention of any unplanned discharge of petroleum, water, drilling mud, or chemical mixtures during drilling operations.	Section 9.4 lists control measures that will be in place to protect the environment from the impacts of unplanned discharge of petroleum, water, drilling mud, or chemical mixtures during drilling operations.
	Article 2 (o) (I,ii,iii) (Good Oil Field Practice)	These clauses outline operational safety and environmental protection under "Good Oil Field Practice"	Good Oil Field Practice is reflected throughout, with Section 9.4 detailing controls to ensure activities are conducted safely and with impacts to the marine environment reduced as far as reasonably practicable.
	Clause 7(a) – (Description of Environment) (Attachment A Section 1)	Requires a description of the physical and biological environment in the development/development area (including location, geology, climate, oceanography, marine life in the area).	Section 6 describes the existing environment within the study area.
JPDA Guidelines No 5 (Guideline for the preparation of Environmental Impact	Clause 7(b) (Statement of potential environmental impact) (Attachment A Section 2)	Requires assessment of potential environmental impacts, including information on the primary, secondary, short term and long term effects.	Sections 10 and 11 (impact assessment) address potential impacts from the activities and include planned and unplanned events.

Title	Relevant Clause or description	Relevance to the activity	Relevant Section of EIS
Assessments of petroleum activities)	Clause 7 (c) (Standards adopted)	Requires a description of the safeguards and standards in place to protect the environment.	Section 9.4 lists control measures that will be in place to protect the environment from the impacts from planned and unplanned events.
	Clause 14 (Procedures and Equipment)	Requires the operator to outline procedures and equipment that will be used to reduce or prevent possible harmful effects throughout the activity.	Section 9.4 lists control measures that will be in place to protect the environment from the impacts from planned and unplanned events.
	Clause 15 (Contingency plans and emergency response)	Requires contingency planning for environmental emergencies, including response organisation and pollutant disposal.	Section 9.4 lists control measures that will be in place to protect the environment from the impacts from planned and unplanned events, and includes emergency response procedures such as the Shipboard Oil Pollution Emergency Plan (SOPEP). Section 15 (Emergency Preparedness) outlines the most potential emergencies during activities and an emergency response framework.
	Clause 5 (Drilling impact on environment)	Requires identifying and evaluating risks associated with drilling operations, including impacts from drilling fluids, cuttings, produced formation water, vessel activity, and potential spills.	Section 9.4 lists control measures that will be in place to protect the environment from the impacts from drilling
	Clause 6 (Description of existing environment, impacts, controls)	Applies directly to drilling fluid containment, spill prevention, well control, blowout prevention, and emergency preparedness — all critical for preventing the escape or discharge of petroleum, water, or drilling fluids.	Section 6 describes the existing environment within the study area. Section 9.4.2 lists control measures that will be in place to protect the environment from the impacts from drilling
JPDA Guidelines No 7 (Administrative guideline on tendering and reporting on drilling operations in the Joint Petroleum Development Area)	Section B, item 1 (Provide an environmental assessment)	Requires the Contract Operator to submit an environmental assessment prior to drilling, in accordance with Administrative Guideline No. 5 and Clause 501 of the Regulations, to demonstrate that environmental impacts of the proposed drilling activity have been identified and assessed.	Sections 10 and 11 (impact assessment) address potential impacts from the activities and include planned and unplanned events for drilling. Section 9.4 lists control measures that will be in place to protect the environment from the impacts.
Interim Regulations issued under Article 37 of the Interim Petroleum Mining Code	Clause 226 - Housekeeping	Requires work areas, equipment and facilities to be maintained in a clean, orderly and safe condition. This supports safe offshore operations and reduces the risk of debris, hazards or materials entering the marine environment.	Section 9.4 lists control measures that will be in place to ensure safe and orderly operations, including waste management, deck housekeeping, and procedures to prevent debris or materials entering the marine environment.

Title	Relevant Clause or description	Relevance to the activity	Relevant Section of EIS
(Former JPDA Interim Regulations)	Clause 255 – Chemicals	Sets requirements for the safe handling, storage and use of chemicals. This ensures that chemical substances used during petroleum activities are managed in a way that prevents spills, contamination and risks to personnel and the environment.	Sections 10 and 11 (impact assessment) address potential impacts associated with the use and handling of chemicals during activities, and Section 9.4 outlines control measures for chemical storage, transfer, spill prevention and crew training. Section 15 outlines emergency preparedness measures for chemical spills.
	Clause 285 – Reporting Escape or Ignition of Petroleum and Other Material	Mandates immediate reporting of any escape, discharge or ignition of petroleum or other materials. This enables rapid response, incident control and regulatory oversight in the event of an unplanned release.	Section 16 addresses the requirements for record-keeping and reporting of incidents, including unplanned releases, environmental harm, or pollution. Section 15 (Emergency Preparedness) outlines the response framework for unplanned events such as spills, leaks or ignitions.
	Clause 615 – Approval to Flare or Vent	Requires operators to obtain approval before flaring or venting petroleum. This ensures that flaring and venting are controlled, justified and undertaken in accordance with regulatory expectations for emissions management.	Section 9.4 lists control measures to minimise emissions and ensure compliance with regulatory approval requirements.
	Clause 616 - Pollution	Prohibits pollution and requires operators to take all necessary measures to prevent the release of harmful substances into the environment. This establishes a clear duty to avoid environmental harm and implement appropriate prevention and control measures.	Sections 10 and 11 (impact assessment) address potential impacts from planned and unplanned events, including pollution risks. Section 9.4 lists control measures to prevent pollution, manage waste, and avoid the release of harmful substances into the marine environment. Section 15 outlines emergency preparedness measures for pollution events such as spills.
	Clause 224 – Oil Spills	Requires operators to take immediate action in the event of an oil spill. This ensures that any unplanned release of hydrocarbons during GPGT surveys, drilling or production is rapidly contained and controlled to minimise environmental harm to the marine environment.	Sections 10 and 11 (impact assessment) address potential impacts from planned and unplanned events, including oil spill pollution risks. Section 9.4 lists control measures to prevent pollution, manage waste, and avoid the release of harmful substances into the marine environment.

Title	Relevant Clause or description	Relevance to the activity	Relevant Section of EIS
			Section 15 outlines emergency preparedness measures for pollution events such as spills.
	Clause 254 – Dangerous and poisonous substances	Sets requirements for the safe storage, handling and use of dangerous or toxic substances. This reduces the risk of accidental releases or contamination during petroleum activities, protecting water quality and preventing exposure of marine fauna to hazardous materials.	Section 9.4 lists control measures to prevent pollution, manage waste, and avoid the release of harmful substances into the marine environment. Section 15 outlines emergency preparedness measures for pollution events such as spills.
	Clause 517 – Disposal of Drilling Fluids	Regulates the disposal of drilling fluids to ensure they are managed in a controlled and environmentally responsible manner. This prevents contamination of the seabed and water column during drilling operations and ensures waste streams are handled in accordance with regulatory expectations.	Section 9.4 lists control measures to prevent pollution, manage waste, and avoid the release of harmful substances including drilling fluids into the marine environment.
	Clause 655 – Records of Petroleum in Discharged Formation Water	Requires operators to maintain records of petroleum content in any discharged formation water. This supports environmental monitoring and ensures discharges remain within acceptable limits, enabling oversight of potential hydrocarbon contamination during production activities.	Section 16 addresses the requirements for record keeping of reportable incidents, environmental harm, or pollution. Each individual EMP will also address this in further detail with incident reporting, annual reports other environmental reports to ANP.
	Clause 506 – Blow-out Prevention Control	Requires the installation and maintenance of blow-out prevention equipment to control well pressures. This is critical for preventing uncontrolled releases of hydrocarbons during drilling, thereby reducing the risk of major environmental incidents such as blowouts or seabed pollution.	Section 15 outlines emergency preparedness measures for pollution events such as uncontrolled releases of hydrocarbons during drilling.

5.3 Timor-Leste Legislation and Regulations

Table 5-2: Applicable legal requirements under the Timor-Leste Legislation and Regulations

Title	Relevant Clause or description	Relevance to the activity	EIS Response to Legislative Requirement
Constitutions of the Republic Democratic of Timor-Leste	Article 61 (Environment)	The article specifies provisions for state including the proponent shall undertake to defend, and safeguard the environment recognizes the right of all citizens to a humane, health and ecologically balances environment while also specifying the duty of	Sections 10 and 11 (impact assessment) address potential impacts from the activities and includes planned and unplanned events. Section 9.4 lists control measures that will be in place to protect the

		everyone to preserve and protect the environment for the benefit of future generation. Provides the basis for environmental protection and safeguarding in the Country.	environment from the impacts from planned and unplanned events.
Decree-Law No. 26/2012	Article 5 – Environmental Principles	Activities must be conducted in accordance with preventive, precautionary, polluter-pays and sustainable development principles and the proponent must avoid, minimise and mitigate environmental impacts arising from activities	Section 4 outlines the activity, with controls outlined in Section 9.4 and emergency preparedness outlined in Section 15.
	Article 7 – Duty to Protect the Environment		
	Article 12 – Environmental Responsibility		
Decree Law No. 5/2016	National System of Protected Areas (Appendix 1 List of Timor-Leste)	Defines for the protection of the terrestrial and marine protected areas.	Section 6.3.6 outlines the national parks and reserves in Timor-Leste, Indonesian, and Australian waters and their proximity to the KTJ Development Area.
Decree-Law No. 6/2020 – Biodiversity Protection and Conservation	Article 6 – Protection of Biodiversity	Activities must avoid unnecessary disturbance to biodiversity and habitats. Requires avoidance and mitigation of impacts to marine fauna.	Section 9.4 lists control measures that will be in place to protect the environment including those to avoid unnecessary disturbance to biodiversity and habitats. Section 15 outlines the most likely emergencies during and an emergency response framework.
	Article 15 – Protection of Marine Species		
Interim Petroleum Mining Code	Article 24 (a) (Protect the environment)	Specifies protection of the environment in and about the contract area	Sections 10 and 11 (impact assessment) address potential impacts from the activities and include planned and unplanned events. Section 9.4 lists control measures that will be in place to protect the environment from the impacts from planned and unplanned events.
	Article 27 (1-2) (Removal of property and clean up)	Requires removal of all property and compliance with pollution containment and clean-up directions.	Section 9.4 lists control measures that will be in place to protect the environment such as the removal of equipment from the seabed, the collection of dropped objects overboard, ensuring crew are trained, and ensuring lift plans are in place for recovering equipment.
	Article 28 (2)(f) (Environmental protection)	Confirms that environmental protection and pollution cleanup obligations cannot be exempted or varied under the Petroleum Mining Code	Sections 10 and 11 (impact assessment) address potential impacts from the activities and includes planned and unplanned events. Section 9.4 lists control measures that will be in place to protect the environment from the impacts from planned and unplanned events.

	Article 37(k)(Environmental Protection)	Operators must implement all reasonable and practicable measures to prevent, reduce and manage environmental impacts to ALARP, including impacts to water quality, seabed habitats, marine fauna and ecosystems.	Sections 10 and 11 (impact assessment) address potential impacts from the activities and include planned and unplanned events. Section 9.4 lists control measures that will be in place to protect the environment from the impacts from planned and unplanned events.
	Article 37 (l) (Environmental Impact Assessment & Approval)	Environmental impact assessments must be prepared and approved prior to undertaking offshore petroleum activities, demonstrating environmental risks and proposed controls.	Sections 10 and 11 (impact assessment) address potential impacts from the activities and includes planned and unplanned events. Section 9.4 lists control measures that will be in place to protect the environment from the impacts from planned and unplanned events.
	Article 42 (Security of Structures), Item 1	Operators of vessels, drilling rigs, and offshore structures in the JPDA to control access to their facilities, maintain adequate surveillance of safety zones, and ensure effective communication with relevant authorities in the event of any accident, incident, or threat to life or security.	Section 9.4 lists control measures that will be in place to manage interaction with other users.

5.4 International standards and good oilfield practices

Table 5-3: Applicable international standards and good oilfield practices relevant to this project

Title	Relevant Clause	Relevance to the activity
Navigation Act 2012	The Navigation Act 2012 is legislation which covers international ship and seafarer safety, protect the marine environment where it relates to shipping and the actions of seafarers in Australian waters	It is adopted for vessels undertaking activities in PSC 19-11 as it is recognised as industry best practice and gives effect to other relevant international conventions for maritime issues.
1948 Convention on the international Maritime Organization	The IMO Convention is an international agreement that establishes a framework for cooperation between governments to develop and maintain global standards, covering maritime safety, navigation efficiency, and the prevention of marine pollution from ships	The vessels are required to comply with the provisions of the IMO Convention.
London Convention on the Prevention of Marine Pollution by dumping of wastes and other matter, 1972 (London Convention).	The convention is an agreement to control pollution of the sea by intentional disposal at sea of potentially harmful materials	Any chemical inventories onboard vessels/MODU/FPOS will be adequately transported and stored in suitable containers to prevent accidental discharge to the sea. There will be vessel movement during the activity subject to SOLAS
SOLAS 1974 – International Convention for the Safety Life of Sea	The main objective of the SOLAS Convention is to specify minimum standards for the construction, equipment, and operation of ships, compatible with their safety. Flag	

Title	Relevant Clause	Relevance to the activity
	States are responsible for ensuring that ships under their flag comply with its requirements, and a number of certificates are prescribed in the Convention as proof that this has been done.	
MARPOL 73/78 – The international Convention for the Prevention of Pollution from Ships.	The international convention is the main convention covering prevention of pollution of the marine environment by ships/vessels from operation or accidental causes. The objective of this convention is to reduce the volumes of the harmful material entering marine environment. Annex I – Regulations for the Prevention of Pollution from Oil Annex IV – Regulations for the Prevention of Pollution by Sewage from Ships Annex V – Regulations for the Prevention of Pollution by Garbage from Ships Annex VI – Regulations for the Prevention of Air Pollution from Ships	Vessels/MODU/FPSO are required to comply with the provisions of MARPOL.
AMSA – Marine Order 30– Prevention of Collision 2016.	This order gives effect to the Prevention of Collision Convention, which sets out, for the prevention of collisions, internationally agreed measure for the navigation, management and working of a vessel, and the lights and signals to be provided and used on a vessel.	Vessels. MODU and FPSO are required to comply with this order.
International Convention on Standards of Training, Certification and Watchkeeping for Seafarers 1978 (STCW)	This convention provides a standardized approach to the qualifications and competencies of masters, officers and watch personnel and is essential to navigation of vessel and safety crew.	The vessels and crews are required to comply with STCW.
International Regulations for Collisions at Sea 1972 (COLREGS)	These regulations provide internationally agreed rules for the navigation of vessels, which are intended to reduce the likelihood of vessel collisions.	Vessels/MODU/FPSO are required to comply with COLREGS.

6. DESCRIPTION OF THE ENVIRONMENT

6.1 Introduction

It is important to understand the existing environment in the vicinity of the proposed development as the conditions have several implications for marine survey operations, vessel station-keeping, equipment deployment and personnel safety. These were considered when undertaking the ENVID for the activity to ensure appropriate controls were adopted. This description of the environment draws on regional datasets, scientific literature and any available site specific information[4].

6.1.1 Area Definition

The existing environment described below encompasses a number of areas to inform the impact assessment and includes the geographical boundary within which all planned, routine, and non-routine activities described in the EIS will occur:

- **KTJ Project Development Area** is located in the northern part of PSC 19-11 and covers the area of the discovered and fully appraised Kuda Tasi and Jahal Oil Fields.
- The **access authority area** is an additional Access Authority area for installation of some of the FPSO moorings has also been granted (P/ANP/S/26/209).
- The **environment that may be affected (EMBA)** is a larger area surrounding and extending beyond the project development area and is defined as the maximum geographical area that could potentially experience direct or indirect environmental impacts resulting from the largest credible hydrocarbon spill scenarios which are further detailed in Section 11.6. The EMBA boundaries have been defined by modelling of worst-case spill scenarios, and environmental receptors located within this area are described below.
- The **Operational Area** is the area in the immediate vicinity of the activities, such as the 500 m petroleum safety zone (PSZ) around the Mobile Offshore Drilling Unit (MODU), the area covered by FPSO anchoring moorings, the footprint of subsea infrastructure, and all associated activities, including vessel movements, helicopter operations, and subsea installation works.

The planned and unplanned impacts from the activity will be contained within the areas above.

The EMBA includes all physical, biological, cultural, social, and economic values that could be affected by a worst case hydrocarbon spill.

6.1.2 Weather considerations for the project

Oceanic currents associated with the Indonesian Throughflow and monsoonal wind regimes may influence vessel manoeuvrability and station-keeping performance, particularly during the southeast monsoon when current velocities are highest. Elevated current speeds during this period may increase fuel consumption and place additional loads on dynamic positioning (DP) systems, towed equipment and moorings. Survey planning will account for seasonal current peaks, scheduling higher-energy operations during lower-current periods where practicable.

Persistent drift in the upper layers and wind-driven currents can reduce full tidal reversals and cause net movement in one direction. This affects equipment layback, positioning (e.g. streamers), and the behaviour of suspended or drifting objects, and should be considered during longer deployments.

[4] As per Item 1 and 2 in ANP/HSE/S/26/071 letter of approval for a phased environmental approval strategy

While typical wave heights are low, episodic events (monsoons, cyclones, or remote swell) may limit deck work, lifting operations, and small-craft use. Accurate forecasting and clear operational limits are therefore important for safety and scheduling.

Water temperature stratification and thermocline may affect acoustic performance, including positioning and sub-surface sensors. Calibration and quality control should account for seasonal changes in sound velocity. Generally, no seasonal constraints are anticipated for the proposed activities; however, this is dependent on the vessels selected. Accordingly, environmental conditions are assessed by the vessel provider during survey planning, taking into account vessel size, type, and survey objectives, and ensuring compliance with relevant legislative requirements (e.g. the IMO Convention) relating to vessel safety at sea, including the consideration of appropriate weather windows and cyclone season (for example).

A description of the physical, ecological and social components are provided below. Once EBS data is collected this information will be revised and updated as required.

6.1.3 Data Currency

The existing environmental datasets used to characterise the physical and ecological marine environment within the Timor Sea include information collected over a range of years, with some datasets exceeding five years in age[5]. Notwithstanding this, the datasets are considered suitable and representative for the purposes of the impact assessment. This conclusion is based on the generally stable nature of the offshore deep-water environment and the broad temporal consistency of key environmental characteristics within the region.

The Timor Sea offshore environment is characterised by relatively stable oceanographic, climatic and seabed conditions over decadal timescales. Regional weather and climate patterns are strongly governed by large-scale seasonal and oceanographic processes, including monsoonal influences and established current systems, which are well understood and have not materially changed since the collection of the referenced datasets. Similarly, deep-water seabed environments are typically subject to very low rates of natural physical change, particularly in areas beyond the influence of coastal sediment transport and shallow-water dynamic processes.

For ecological receptors, including pelagic fish, marine turtles, cetaceans and migratory species, the available data primarily describe species presence, regional distribution, migratory pathways and habitat utilisation patterns derived from long-term scientific studies, regional databases and established literature sources. These ecological characteristics are inherently broad-scale and temporally persistent in nature. While annual or seasonal variability in species abundance and occurrence may occur, there is no evidence of any substantial shift in regional species assemblages, migration corridors, critical habitat use, or ecological function that would materially alter the environmental impact assessment conclusions since the data were collected.

In addition, the assessment has adopted a precautionary approach by integrating multiple data sources, including regional studies, publicly available databases, contemporary literature and analogous offshore environments where appropriate. Collectively, the information provides a robust and scientifically defensible characterisation of the existing environment sufficient to support the EIS and associated impact assessment processes.

Once EBS data is collected this information will be revised and updated as required.

[5] As per Item 4 in ANP/HSE/S/26/071 letter of approval for a phased environmental approval strategy

6.2 Physical Component

6.2.1 Climate

The Bonaparte Basin and Timor Sea region experience a tropical climate characterised by two distinct seasons: a summer monsoonal wet season from October to March, and a cooler winter dry season from April to September. Rapid seasonal transitions typically occur in April and September – October (Longitude, 2025), driven by two major atmospheric pressure systems — the subtropical ridge of high-pressure cells and the broad tropical low-pressure system, also known as the Monsoon Trough. This seasonal pattern is primarily influenced by the north–south movement of the Inter Tropical Convergence Zone (ITCZ), which governs the shift between the northwest monsoon and the southeast monsoon (Finder Energy, 2025).

During winter, the subtropical highs migrate eastward across the southern Indian Ocean, moving further south in summer. These highs, often separated by low-pressure troughs or cold fronts, generate the southeast trade winds that dominate the Timor Sea during the dry season. Along northern Australia's coastline, this period aligns with the warm, dry season typical of the region, particularly across the semi-arid areas of northern Western Australia and the wet–dry monsoonal zones of the Northern Territory (Finder Energy, 2025).

The Monsoon trough or Inter-Tropical Convergence Zone (ITCZ) develops across the tropics during the summer months. It is an area of low atmospheric pressure that runs East-West. As the ITCZ shifts southward during the northwest monsoon, moist air from the north and northwest flows into the region, driving the hot, humid conditions characteristic of the wet season.

During the wet season, south-westerly winds bring thunderstorms, high rainfall, and occasional tropical cyclones. Tropical cyclones are most frequent during this summer monsoon period. The dry season, influenced by easterly winds, is typically marked by warm, dry conditions and minimal rainfall (RPS, 2024).

6.2.2 Rainfall

During the dry season (April to September), rainfall across the northern region is generally low to negligible, although light coastal showers may occur, particularly in the southern waters of the Timor Sea.

In the wet season, weather conditions along the south coast of Timor-Leste are strongly influenced by the position and activity of the monsoon trough, which alternates between active and inactive phases. The active phase is typically associated with extensive cloud cover, widespread rainfall, and moderate to fresh north-westerly winds north of the trough. When the trough lies near or over land, heavy rainfall is common. The active phase occurs when the trough weakens or retreats northward, bringing light winds, isolated showers, and occasional thunderstorms with gusty squalls.

High rainfall is generally linked to the Northwest Monsoon, while the Southeast Monsoon brings low rainfall conditions. Tropical cyclones and thunderstorm activity can also produce periods of higher rainfall. Almost all rainfall occurs between November and April, the greatest falls being in January and February. The mean annual rainfall for the Timor Sea region is approximately 1,770 mm (Heyward et al., 1997). Mean air temperatures recorded at the Jabiru Floating Production, Storage and Offloading (FPSO) facility, located about 180 nautical miles south of Timor-Leste, range from 24.9°C in July to 29.6°C in December (URS, 2002).

6.2.3 Oceanography

The main forces influencing surface water movement in the vicinity of PSC-19-11 are general oceanic circulation, astronomical tides, and wind stress. The Pacific–Indian throughflow carries warm, relatively low-salinity water southward through the Indonesian Archipelago into the eastern Indian Ocean. As PSC-19-11 lies close to the Bayu Undan Area, similar oceanographic conditions apply. The throughflow may contribute a westerly component to the local current regime. Current speeds vary seasonally — lowest in April at the end of the northwest monsoon, when winds blow toward the Pacific, and highest in September during the southeast monsoon (Wijffels et al., 1996). The Indonesian Seas region plays a crucial role in global ocean circulation, with the warm waters of the Arafura and Timor Seas acting as a “heat engine” that influences large-scale ocean–atmosphere interactions, including ENSO (Finder Energy, 2025).

Tides in the Timor Sea are mixed and predominantly semi-diurnal, with a well-developed spring to neap tidal variation. Persistent drift in the upper layers often inhibits the diurnal reversal of the currents. The tidal range in the Bayu-Undan Field is typically 4 m for spring tides and 1.8 m for neap tides (Sinclair Knight Merz (SKM), 2001).

The major surface currents in the region flow polewards, away from the equator. Their waters are warm, have low salinity and are oligotrophic (low in nutrients). The major surface currents influencing the region include the Indonesian Throughflow, the Leeuwin Current, the South Equatorial Current and the Eastern Gyral Current. Regional currents in the Timor Sea are thought to be weak and variable in the summer months (October – March). These have a south-westward tendency, which tend to be easily reversed during periods of strong monsoonal westerlies. Ebb and flow of the tidal currents orientate along a north-west/south-east axis (Lavering, 1993; SKM, 2001). The tidal currents are influenced by wind driven currents (Longitude, 2025). The Indonesian Throughflow (ITF) is a defining oceanographic feature of the region, driven by the pressure gradient built up in the western Pacific by the easterly trade winds. It enters primarily through the Makassar Strait, with major outflows through the Lombok Strait, Ombai Strait and Timor Passage, transporting warm, low-salinity Pacific waters into the Indian Ocean (Finder Energy, 2025).

A pronounced seasonal cycle of drift currents is superimposed on the predominating tidal currents. This seasonal cycle is linked to the changing wind fields of the monsoons. The drift current flow during the southeast trade winds period is to the southwest into the Indian Ocean. Drift current speeds vary between 0.1 and 0.3 m/s (0.4–1.1 km/h) with a mean yearly current of less than 0.05 m/s (0.2 km/h) tending to the south-west (SKM, 2001). Wind-induced currents result from local wind forcing at the surface and are most pronounced during cyclones. The wind induced currents lead to the development of transient oscillations called inertial currents following the passage of cyclones. Wind driven surface currents and their direction are generated by prevailing seasonal winds from the west in summer and from the east and southeast during winter. As Pacific waters transit through the Indonesian Seas, they undergo strong modification due to intense air–sea interactions, monsoon-driven upwelling, and powerful tidal mixing, producing distinct temperature and salinity layers within the ITF (Finder Energy, 2025).

In the broader Timor Sea and northern Australian waters, water movement is predominantly poleward, transporting warm, low-nutrient waters (DEWHA, 2008). Seasonal variation in surface currents is closely linked to the trade wind regime in the equatorial Pacific Ocean which drives the Indonesian through-flow (ITF).

Finder Energy commissioned a metocean study in 2025 (Finder Energy, 2025) to characterise the environmental and oceanographic conditions of the Kuda Tasi and Jahal Development Field in the central Timor Sea. Findings from this study indicate a shoaling and intensification of the ITF, with the thermocline velocity maximum in the Makassar Strait shifting from ~140 m to ~70 m depth and increasing in speed from ~70 cm/s to ~90 cm/s, suggesting a sustained strengthening of the throughflow (Finder Energy, 2025).

Tidal ranges are large — approximately 0.8 m during neap tides and up to 7 m during spring tides (RPS, 2018), and strongly influence regional currents. Tidal amplitudes persist over long distances offshore, initially travelling in a northeasterly direction through deeper waters in the region (RPS, 2018).

The tidal current component is imposed on the broader synoptic scale flow. Locally generated wind-driven currents add further variability to water movement within the area. These appear to be more variable and are superimposed over large-scale flows.

The water temperatures of the Timor Sea are largely influenced by the Indonesian Throughflow and a highly pronounced thermocline. Seawater temperature in the region ranges from 25ºC to 31ºC at the surface and ~10ºC at the seafloor in ~ 400m of water in the KTJ Development Area (Finder Energy, 2025).

Wave height within the Bayu-Undan Field is most commonly between 0.6m-0.8m and waves predominately from the west in summer and from the east in winter (URS, 2010). The influences on waves in the region are:

- Locally generated wind waves: generally, from the west during wet season and from the east during the dry season; and
- Remotely generated swells: south to south westerly swells persist from storms in the southern Indian Ocean and occasional, low amplitude waves (1 m) originate from earthquakes in the Sunda Trench, between Australia and Indonesia.

6.2.4 Winds

The dry season (April to September) is characterised by steady northeast to southeast winds ranging from 5 to 12 m/s, driven by the southeast trade winds over the Timor Sea. The wet season (October to March) is dominated by northwest to southwest winds averaging around 5 m/s for periods of 5 to 10 days, with occasional surges reaching 8 to 12 m/s lasting 1 to 3 days.

During the transition season (September to October), low-pressure systems moving west to east across the Australian mainland cause surface winds over the Timor Sea to develop a westerly component, typically remaining light (<5 m/s). In the April transition period, winds are initially southeasterly before shifting back to north-westerly airflow (RPS, 2024). Satellite-derived wind data averaged over a 0.25° radius and three-hour window show good agreement with ECMWF-ERA5 (European Centre for Medium range Weather Forecasting) winds (Finder Energy, 2025). Operational wind conditions derived from ERA5 indicate that the dominant wind directions are from the east to southeast (90°–135°), accounting for approximately 54% of annual wind events, with secondary contributions from the southwest to west (225°–270°), comprising around 27% (Finder Energy, 2025). Wind speeds exceeding 10 m/s occur only 3.74% of the time annually (equivalent to roughly 14 days per year), with exceedance most frequent in January and February (Finder Energy, 2025). Monthly mean wind speeds range from 3.2 m/s in November to 6.4 m/s in June, while maximum observed winds reach 18.4 m/s in January and December (Finder Energy, 2025). Winds above 6 m/s occur approximately 31.56% of the time annually, while winds above 12 m/s occur less than 1% of the time (Finder Energy, 2025).

Extreme wind conditions have been assessed using annual maxima and fitted with a Gumbel distribution to characterise return-period winds (1-, 10-, 50- and 100-year events) (Finder Energy, 2025). Directional and omnidirectional extreme wind values have been estimated at a standard 10 m reference height, with results provided for multiple averaging periods. For example, the 100-year return-period 3-second gust reaches 26.4 m/s in January, while the 1-minute mean wind peaks at 23.7 m/s (Finder Energy, 2025).

These wind patterns contribute significantly to surface current variability, wave generation, and operational planning across the Timor Sea.

6.2.5 Cyclonic Weather Systems

The Bonaparte Basin is prone to tropical cyclones during the wet season, when atmospheric and oceanic conditions are most favourable for their development. Under extreme cyclonic conditions, 10-minute sustained wind speeds can exceed 205 km/h, with gusts reaching up to 408 km/h (Cyclone Olivia, Bureau of Meteorology (BoM), 1996).

Tropical cyclones commonly develop in the Timor Sea during the northern wet season, typically forming within an active monsoon trough. Tropical lows and cyclones may also originate in the Coral Sea, moving through the Torres Strait as tropical lows or low range cyclones, occasionally strengthening over the Gulf of Carpentaria or in the Timor Sea (Bureau of Meteorology (BoM), 2024). These systems can bring heavy rainfall and strong, sometimes destructive winds extending several hundred kilometres from the cyclone centre.

Most tropical lows and cyclonic systems track west or southwest before turning southwards. Fully mature cyclones range in diameter from 100 km to 1,500 km (e.g., Cyclone Justin, 3rd March 1997; Bureau of Meteorology (BoM)). They typically persist for 4 to 7 days, although some weaker Category 1 systems may only briefly reach gale force, while others can re-intensify or degrade to tropical lows over several weeks.

Cyclone activity in the Timor Sea and Bonaparte Basin is most frequent between December and April, when sea surface temperatures exceed 26.7°C (SKM, 2001). Approximately 75% of cyclones in this region are not fully mature, with estimated wind speeds below 80 km/h, while severe cyclones (wind speeds exceeding 100 km/h) occur on average once every 2.6 years (Heyward et al., 1997).

6.2.6 Geology

PSC 19-11 is located within the prolific oil province of the Laminaria High in the Bonaparte Basin. The Laminaria High is a major intra-basinal high flanked by lows; the Sahul Syncline and Nancar Trough to the south-west and south and the Flamingo Syncline to the east (Figure 6-1). The major Timor Trough flanks the northern boundary of the Laminaria High. The primary hydrocarbon play for the area is the excellent quality Middle Jurassic Laminaria and Plover shallow marine fluvio-deltaic reservoir sandstones sealed by Late Jurassic marine shales of the Frigate and Flamingo Formations. Hydrocarbon charge is from the Early-Middle Jurassic Plover formation carbonaceous shales and coals.

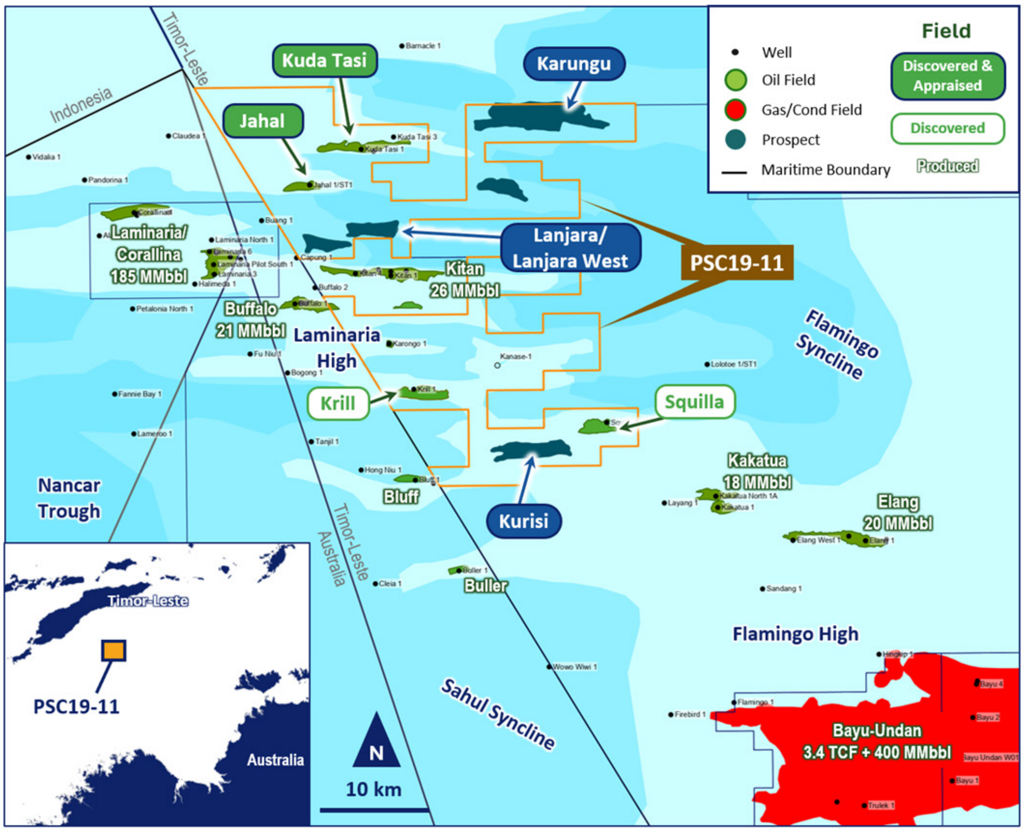


Figure 6-1 Laminaria High location map and PSC 19-11 oil field and prospects

Jahal and Kuda Tasi oil fields are discovered and appraised oil fields located in the northern part of PSC 19-11. Jahal-1 was drilled by BHP in 1996 and discovered a 10m gross oil column within an east-west orientated tilted fault block structure. Formation pressure testing and sampling indicated an Oil-Water Contact (OWC) at 3,285 mSS, and the top 15m of reservoir was perforated for a well production test which recovered a light oil (57 API, GOR 140 scf/bbl) at 1,350 Barrels of Oil Per Day (BOPD). Production rates have been interpreted to be on the lower end of predictions due to reservoir damage reducing near wellbore permeability.

Kuda Tasi was discovered in 2001 by Woodside when Kuda Tasi-1 intersected a 17m gross oil column within a tilted horst block with a E-W trending normal fault and dip closure to the west, east and north. It was located approximately 6km northeast of Jahal. Appraisal wells Kuda Tasi-2 (2003) and Kuda Tasi-3 (2006) confirmed an OWC at approximately 3,425mSS. In Kuda Tasi-2, a DST conducted over the upper reservoir section flowed 55deg API oil at a maximum rate of 5,200 bopd and constrained by a 36/64” choke.

6.2.7 Air

Air quality in offshore areas is generally good, although localised emissions from shipping, drilling, and other offshore activities can contribute to temporary air pollution.

Secondary data indicate minimal air temperature variation throughout the year. The mean maximum summer and winter air temperatures recorded at Point Fawcett on Melville Island — the nearest meteorological station to the Development Area, range between 33–34°C in November/December, with an annual minimum temperature of 27°C in June (RPS, 2024). The average tropical cyclone frequency for the Timor and Arafura Seas region is one cyclone per year, most commonly occurring between December and April (RPS, 2024). Regional climate patterns along northern Australia show a strongly seasonal regime, with a hot, humid wet season from November to March driven by moist north-westerly inflow, and a warm, dry season from May to October dominated by southeast trade winds (Finder Energy, 2025). Air temperatures across the broader Timor and Arafura Seas remain consistently high, with monthly mean values typically between 26–29 °C and minimum temperatures rarely falling below 22–23 °C, reflecting the stable tropical maritime environment (Finder Energy, 2025).

The MODU and support vessels will operate diesel-driven power generators, while helicopter operations servicing the area will use gas turbine engines. These sources emit small quantities of sulphur dioxide (SO_2), nitrogen oxides (NO_x), and carbon monoxide (CO), which may be released through exhaust stacks designed to discharge emissions at height.

The drilling location lies beyond the territorial waters of both Timor-Leste and Australia, further minimising any potential onshore impacts. The diesel generators used offshore are maintained in accordance with manufacturer specifications, ensuring efficient operation and compliance with relevant standards.

6.2.8 Marine Waters

Marine water quality sampling for the Chuditch-2 Environmental Baseline Survey was undertaken in March/April 2025, by O2 Marine. The study found stable offshore conditions with little spatial variation across the site. Temperature, salinity, turbidity and pH were consistent throughout the water column, with only a slight thermocline at 22–25 m depth. Dissolved oxygen levels were high (~95%) with a minor decrease below 25 m, and turbidity was low, indicating limited sediment resuspension. Heavy metals, hydrocarbons, and oil and grease were below detection limits, confirming low contaminant levels and baseline marine water quality. It is expected that similar marine water quality parameters will occur within the KTJ Development Area, reflecting comparable offshore environmental conditions and baseline water column characteristics.

Marine water quality sampling is planned to be undertaken by Finder for the Kuda Tasi Jahal Environmental Baseline Survey (EBS).

6.2.9 Sediment

Sediments in the Timor Sea are predominantly composed of fine sand, silt, and clay. Assessing sediment quality is essential for understanding the potential impacts of offshore activities, including sediment resuspension and possible contamination from wastes. Sediment quality monitoring provides valuable information to identify potential impacts caused by activities, particularly the release or formation of contaminated sediments that could affect marine ecosystems (Trefry et al., 2013; Reuscher et al., 2020).

Finder plan to undertake Environmental Baseline Surveys to understand site specific information in the Development Area. Earlier surveys that have been undertaken in the region, such as those for the Chuditch, Northern Endeavour, BayuUndan and Kitan projects (Figure 6-1) may be comparable to that of the KTJ Development.

In summary, the seabed environments across Chuditch, Kitan, Northern Endeavour, and Bayu-Undan are broadly similar in being flat, sediment-dominated offshore systems with contaminant levels generally consistent with natural background conditions and low ecological risk.

Across all locations, contaminant concentrations were low and generally consistent with natural background conditions. Metal concentrations were below relevant guideline thresholds, including the Australian and New Zealand Governments and Australian state and territory governments (ANZG, 2018) and apparent effects thresholds published by the National Oceanic and Atmospheric Administration, indicating low ecological risk. Hydrocarbons (including BTEXN, PAHs and TPH/TRH) were mostly below laboratory detection limits. While minor TRH detections and two isolated oil and grease elevations were recorded at Chuditch, concentrations remained below applicable guideline values. Kitan and Bayu-Undan showed no evidence of anthropogenic hydrocarbon contamination or impacts from prior drilling activities.

6.2.10 Bathymetry and Seabed Features

The Timor Sea includes both the Sahul Shelf and the Timor Trough and is characterised by varied bathymetry. The Sahul Shelf is a broad, shallow platform extending roughly 300 km from the northern Australian coastline, featuring a variety of rises, depressions, banks, terraces, and channels shaped by Pleistocene sea-level changes. At its centre lies the Bonaparte Basin, which contains numerous pinnacles up to 50 m high and 50–100 km long, along with submerged shoals and banks. The shelf edges are defined by the Van Diemen Rise to the northeast and the Londonderry Rise to the northwest, with additional shoals and banks along the northern outer margin. The Sahul Shelf is separated from Timor by the Timor Trough, where depths exceed 2,000 m.

Sediments in the Timor Sea are predominantly composed of fine sand, silt, and clay. Earlier surveys in the region, such as those for the Northern Endeavour, Bayu Undan and Kitan projects, documented largely flat and uniform seabed conditions with occasional rocky outcrops. Three dimensional seismic survey data over the KTJ Development Area shows that the it is located on the gently sloping outer shelf and upper continental slope at depths of 400-450m, with similar flat uniform seabeds.

6.3 Ecological Components

6.3.1 Benthic Habitat and Communities

At the regional scale, the Timor Sea is characterised by raised geomorphic features, including shoals, banks and terraces, which promote biodiversity through enhanced light penetration in shallower areas and nutrient enrichment from ocean currents (Przeslawski et al., 2011; Nichol et al., 2013; Radke et al., 2015). Benthic communities vary with bathymetry, substrate type, geochemistry, exposure, and current regimes, which shape the structure, distribution and abundance of organisms over time. Much of the region is influenced by persistent, low-energy processes, and the upper slope is generally stable, supporting persistent benthic assemblages in deeper soft sediments (Nichol et al., 2013; Pinceratto & Oliver, 1996).

The KTJ Development Area is located in open waters of the Timor Sea at depths of approximately 400–450 m. It is not situated within, or immediately adjacent to, any sensitive shoal or bank features. The nearest mapped carbonate banks are Echo and Big Bank Shoals, located to the southwest of the Development Area. Other regional shoals, including Dillon, Karmt and Jabiru, occur at greater distances. Based on their location, these features are not expected to be directly affected by development activities, but they fall within the environment that may be affected (EMBA), although the likelihood of interaction is considered low.

Big Bank Shoals, located ~15-20 km from the KTJ Project rise from 200–300 m to 20–30 m below the surface and are mostly flat with unconsolidated gravel and rubble substrates (Heap et al., 2009; AIMS, 2012). They support macroalgae (*Halimeda* spp.), sponges, soft corals, and some hard corals on consolidated edges (Heyward et al., 1997; GeoOceans, 2018). The central areas are sparsely populated and dominated by macroalgae. Benthic communities are depth-stratified, with shallow algal habitats and deeper filter-feeding assemblages, and high interannual variability reflects natural disturbances such as cyclones and wave energy. These shoals provide greater habitat complexity and biodiversity compared with surrounding soft sediments (Heap et al., 2009).

Similarly, Echo Shoals are isolated carbonate build-ups supporting depth-stratified benthic assemblages (Heap et al., 2009; AIMS, 2012). Shallow areas support macroalgae and coral where substrate and light permit, while deeper flanks host filter-feeding invertebrates such as sponges and gorgonians. As with Big Bank Shoals, these features provide enhanced habitat complexity and biodiversity relative to surrounding unconsolidated shelf sediments.

Benthic habitats around the KTJ Development Area are likely typical of the wider Timor Sea and may include:

- Unconsolidated sediments dominated by carbonate sands and soft muds, supporting diverse invertebrates, predominantly polychaete worms and crustaceans, with patchy distributions across small to large scales (Przeslawski et al., 2011, 2019; Picard et al., 2018; Sandulli & Pinckney, 1999; Rogers et al., 2008; Zajac, 2008; Kraan et al., 2009; Ramey et al., 2009; Meadows et al., 2012; Somerfield et al., 2019; Stark et al., 2024).
- Carbonate terraces, banks and shoals beyond the Development Area, supporting barrel sponges (*Xestospongia testudinaria*), fan sponges (*Ianthella* spp.), sea fans (*Mopsella* spp.), and sea whips (*Junceella fragilis*) (Heyward et al., 1997, 2017; Przeslawski et al., 2011). These features are unlikely to be affected by development.

Surveys from Bayu-Undan, Northern Endeavour, and Kitan indicate that regional deep-sea and slope habitats are dominated by soft sediments with varying bioturbation, low abundance and diversity of infauna, and isolated hard substrates supporting low-to-medium cover of filter feeders and soft corals. Infauna are typically dominated by Annelida, Sipunculida, Arthropoda, and Mollusca, with temporal variability driven by episodic organic input rather than long-term environmental change (Larkin et al., 2009; Glover et al., 2010).

Planned geophysical, geotechnical and EBS surveys of the PSC19-11 area will provide more site-specific information on benthic habitat, infauna, and sediment characteristics.

6.3.2 Corals

In the broader region (EMBA), coral reefs are widespread and categorised into: fringing reefs that occur around coastal islands; and large platform reefs, banks and shelf-edge atolls offshore. There are no coral reefs found within PSC 19-11.

Fringing reefs are the dominant coral formations in Timor-Leste, commonly found in areas influenced by strong currents and near river mouths, where they contribute to the accumulation of coral fragments along the upper reef slope (Kim et al., 2022). Shallow reefs along the northern coast cover approximately 3,000 hectares, while potential deeper-water coral habitats may extend over more than 60,000 hectares. Reef-building corals are generally confined to depths shallower than 46 m, although coral species have been recorded at depths of up to 6,000 m (Kim et al., 2022).

The southern coastline of Timor-Leste lies within a region of exceptionally high coral diversity, with 367 species of reef-building corals documented (Erdmann and Mohan, 2013). Coral reefs are a defining feature of Nino Konis Santana Marine Park in the northeast, where they constitute over half of inshore habitats (Edyvane et al., 2009). Reefs along the southern coast are characterized by diverse assemblages including sponges, hydroids, Halimeda algae, ascidians, and Montipora corals (Asian Development Bank, 2014).

Along the Indonesian coastline, coral reefs cover an estimated 75,000 km^2, with fringing reefs being the most widespread type and scleractinian corals the most dominant (Hutomo and Moosa, 2005). Savu Island is characterized by fringing reefs and sandy beaches, while Flores Island hosts some of the world's oldest coral reefs, many of which remain largely pristine (Asia Dive Site, 2016). Reef development along the southern coast of Flores and adjacent southern Indonesian shores is constrained by active volcanism, leading to reef-less areas interspersed with scattered nearshore coral patches. Despite these limitations, surveys of Indonesian waters reveal exceptionally high coral diversity, including 452 species of hermatypic scleractinian corals (Tomascik et al., 1997) and up to 590 species of scleractinian corals overall (Suharsono, 2004).

Within Australian Waters the closest important coral reef systems to the Development Area include Ashmore and Hibernia Reef and Cartier Island, and corals are likely present on the shoals within the region.

6.3.3 Seagrass

Seagrasses rely on sufficient sunlight for photosynthesis and are therefore generally restricted to shallow, well-lit coastal waters, such as reef flats, lagoons, and sheltered bays. In Timor-Leste, this means seagrass meadows are primarily found along the northern coast and around islands like Atauro, where water clarity and light penetration support their growth.

In the Timor Sea, 7 genera of seagrass are commonly found (ATSEA, 2023). These are *Halodule, Halophila, Enhaslus, Cymodocea, Syringodium, Thalassia,* and *Thalassodendron*. Recent assessments estimated Timor-Leste's seagrass cover to be 13.95km^2 (Blue Ventures & Project Seagrass, 2023). These seagrass meadows perform carbon sequestration and storage functions (NOAA, 2022). The seagrass meadows of Timor-Leste provide food and critical habitat for green sea turtle (*Chelonia mydas*) and dugong (*Dugong dugon*), while also serving as nurseries and feeding grounds for pelagic fish, shrimp, and crab.

Within Australian waters the closest important seagrass to the Development Area include Ashmore and Hibernia Reef and Cartier Island. Ashmore Reef has a high coverage of seagrass that supports a small dugong population (Guinea and Whiting, 2005).

Seagrasses are not expected to occur broader EMBA given the distance that the EMBA spreads, but may be in shallower waters around coastlines.

6.3.4 Marine Fauna

The Timor Sea is a biodiversity hotspot in terms of fish, marine mammals and marine reptiles. This section outlines the marine fauna that may be present in and around the Development Area.

Table 6-1: Species of Conservation Value That May Occur in the Development Area

Sensitive Receptor	Protection Status	Sensitive Periods
Cetaceans		
Pygmy blue whale	Endangered, Migratory (EPBC Act, Bonn Convention)	June - September
Bryde's whale	Migratory (EPBC Act, Bonn)	Year round
Humpback whales	Migratory (EPBC Act, Bonn)	Austral winter (July - October
Omura's whale	Migratory (EPBC Act, Bonn)	Year round
Spotted bottlenose dolphins	Migratory (EPBC Act, Bonn)	Year round
Marine Reptiles		
Green turtle	Least Concern (IUCN Red List)	Year round
Hawksbill turtle	Critically Endangered (IUCN Red List)	Year round
Loggerhead turtle	Vulnerable (IUCN Red List)	Year round
Olive ridley turtle	Vulnerable (IUCN Red List)	Year round
Leatherback turtle	Critically Endangered (IUCN Red List)	Year round
Sharks		
Whale shark	Endangered (IUCN red List)	August-September
Great white shark	Vulnerable, Migratory (EPBC Act, Bonn)	Year round

Marine Mammals

The Timor Sea supports a wide array of whales, dolphins, and porpoises, several of which are considered endangered or vulnerable, largely due to their extensive migratory routes. While species like humpback, and fin whales may occasionally appear in the Development Area their presence is transitory. Opportunistic marine megafauna, such as cetaceans, were observed and recorded by RPS field team members and vessel crew in 2025 during environmental baseline surveys in the Chuditch-2 area, close to PSC 19-11.

Blue whales are widely distributed throughout the world's oceans. There are two subspecies in the Southern Hemisphere: the southern blue whale (*Balaenoptera musculus intermedia*) and the pygmy blue whale (*Balaenoptera musculus brevicauda*) (DAWE, 2019). They are native to Australia, Indonesia and Timor-Leste (Reilly et al., 2008a). Antarctic blue whales occur mainly in relatively high latitudes and pygmy blue whales are typically distributed in latitudes further north (north of 55°S) (McCauley et al., 2004; Reilly et al., 2008a). It is therefore likely that only the pygmy blue whale subspecies is found in the Timor Sea.

Pygmy blue whales are present in Indonesian waters, with the waters around Sawu Island acting as nurseries and feeding grounds. On their northern migration pygmy blue whales were recorded by satellite tags to travel along the shelf break approximately 40 to 100 km offshore up to North West Cape of Western Australia (WA), after which they continued north approximately 240 to 250 km offshore to Indonesia (Double et al., 2012, 2014). The southern migration from Indonesia may occur from September and finish by December in the subtropical frontal zone after which the animals may make their way slowly northwards towards the Perth Canyon by March/April (DCCEEW, 2025). A Pygmy Blue Whale migration BIA (defined in Australian legislation as an area that may be important for whale migration) that overlaps the Development Area.

The Bryde's whale occurs in tropical and temperate waters (Bannister et al. 1996a). They may occur through a broad area of the continental shelf in the region. A noise monitoring study detected Bryde's whales in the Timor Sea almost year-round (January to October) (McPherson et al. 2016). Bryde's whale may be encountered within the Development Area year-round in low numbers, particularly in oceanic and continental slope waters.

The Humpback whale occurs worldwide and undertakes long seasonal migrations between Antarctic feeding grounds and tropical breeding and calving areas (IUCN, 2023; Reilly et al., 2008b). These migrations typically follow continental coastlines and island chains. Humpback whales are present in waters around Australia, Indonesia, and Timor-Leste, with recorded sightings in the Ombai-Wetar Strait and along Timor-Leste's north coast (Dethmers et al., 2009; Jefferson et al., 2015). Humpback whales' migration, calving, and resting areas are over 440 km southwest from the Development area.

The Indo-Pacific spotted bottlenose dolphins occur in coastal and continental shelf waters of the Indian and western Pacific Oceans, including northern Australia and adjacent Southeast Asian waters. In the Arafura and Timor Sea regions, this species is generally associated with shallow shelf habitats, typically in waters up to ~100 m deep, including coastal embayments, reef systems, and nearshore islands, rather than the deeper continental slope or oceanic waters (Bannister et al., 1996b; Jefferson et al., 2015). Spotted bottlenose dolphins tend to occur in open coastal waters of less than 200 m depth, consistent with the shallow shelf preference observed in the region (Mann et al., 2000; Möller & Harcourt, 1998; Ross, 2006). Surveys and records indicate the species is present year-round along the continental shelf, including areas adjacent to Timor-Leste, where shelf width, shallow banks, and reef-associated habitats provide suitable foraging grounds (Department of Climate Change, Energy, the Environment and Water (DCCEEW, 2023a).

The Omura's whale is a recently described baleen whale distributed throughout tropical and warm-temperate Indo-Pacific waters (Wada et al., 2003; Cerchio et al., 2015). In Australian waters, it has been recorded mainly in northern tropical regions, including offshore Western Australia and the Timor Sea (DCCEEW, 2023b). In the Timor Sea, the species has been detected year-round, with more frequent sightings between April and September (Stacey et al., 2015). Although considered occasional and likely under-recorded due to identification challenges at sea, records and strandings indicate it occurs in offshore and shelf waters of northern Australia and overlaps with tropical Indonesian waters to the north, consistent with its broader Indo-Pacific distribution (Cerchio et al., 2015; DCCEEW, 2023b).

Dugongs occur in tropical and subtropical coastal and inland waters and have a specific diet of seagrass. They are native to Australia, Indonesia and Timor-Leste. Dugongs are known to frequent Ashmore Reef, with estimates of between 10 to 60 individuals (Guinea and Whiting, 2005). Regular dugong sightings occur along the north coast of Timor-Leste, specifically around Metinaro, Hera, Cristo Rei Cove, Dili, Atauro Island and Manatuto. Dugongs are not expected to occur within the Development Area due to the lack of suitable foraging habitat in open ocean environments. However, individuals could potentially occur within the broader regional area of influence if a hydrocarbon spill were to occur.

Marine Reptiles

<u>Marine Turtles</u>

The Arafura and Timor Sea region is home to six species of sea turtle including green turtle (*Chelonia mydas*); hawksbill (*Eretmochelys imbricata*); loggerhead (*Caretta caretta*); leatherback (*Dermochelys coriacea*); olive ridley (Lepidochelys olivacea); and flatback turtle (Natator depressus). Under the IUCN Red list, hawksbill turtles are listed as Critically Endangered. Loggerhead, olive ridley and leatherback turtle are listed as Vulnerable and green turtles are listed as Least Concern.

The flatback turtle (Natator depressus) is reproductively endemic to northern Australia (continental and nearshore island beaches) and ventures into the nearby waters of Papua New Guinea and Indonesia. However, it is the only sea turtle species that does not undergo an oceanic phase, staying in coastal and shelf waters for its entire lifecycle, therefor this species is not likely to be found in the Development Area due to the depth and distance from coastline (SWOT 2025).

Jaco Island and Tutuala Beach in Timor-Leste are known nesting sites (Nunes, 2001), and other potential breeding sites may exist along the South coast of Timor-Leste, Indonesia or in the Northern Territories of Australia.

The Development Area’s open-ocean environment does not support marine turtle feeding or nesting, and only low numbers are expected to pass through during migration.

In the broader region, potential foraging habitats, such as reefs, banks and shoals (e.g. the Sahul Shoals) may occur. Major turtle nesting sites, including Ashmore Reef and Cartier Island are distant from the Development Area (more than 370km).

Sea Snakes

Most species of sea snake occur in the warm, shallow seas of the Indo-Malaysian Archipelago, northern Australia and Oceania. Three groups in the Hydrophiidae family (*Hydrophus* spp., *Aipysurus* spp. and *Pelamis platurus*) are commonly found on the northern Australian continental shelf. Some of these species, such as the leaf-scaled sea snake, are only found on the reefs of the Sahul Shelf in WA. Considering the species habitat preference and the water depths in the area (approximately 400-450m), they are unlikely to occur in the PSC19-11 Development Area.

Fish, Sharks and Rays

Several fish, shark and ray species of conservation significance listed under the IUCN Red List may occur in the PSC19-11 Field. The whale shark, great white shark, and manta ray are listed as vulnerable under the IUCN Red List. The scalloped hammerhead, green sawfish, narrow sawfish and largetooth sawfish are listed as critically endangered under the IUCN Red List.

The whale shark, Rhincodon typus, is a long-lived migratory species inhabiting tropical and warm-temperate waters worldwide (Stevens 2007). Timor-Leste is identified as providing a suitable habitat for whale sharks, with over a third of all known whale sharks recorded in the area (Edyvane et al., 2009).

The whale shark is prevalent in Timor-Leste waters and is considered threatened (Fish Base, 2006). Bajo and Rotinese fishermen of Eastern Indonesia commonly sight whale sharks in various locations in the Timor Sea, including in Timor Leste waters. Sightings are most common during the months of August to December (Stacey et al 2012). Due to their widespread distribution and highly migratory nature, whale sharks are likely to pass through the Development Area, albeit in very low numbers.

The Great White Shark (*Carcharodon carcharias*) may transit the region and is considered vulnerable (Environment Australia, 2002). At least 49 species of sharks, including whalers, are identified within the Timor Sea region (Last & Stevens, 1994). The great white shark and giant manta ray may also move through the Development Area but are not expected to be common. The narrow, green and largetooth sawfish are predominantly associated with shallow, nearshore environments and are therefore likely to only occasionally occur in and around the Development Area.

Birds

A variety of seabird and coastal bird species occur within the Timor Sea and broader Timor-Leste marine region. While seabirds may occasionally pass through the area, the deep offshore environment and significant distance from land mean the Development Area is unlikely to provide suitable or significant bird habitat. There are no nearby seabird breeding islands, and no exposed land within PSC19-11 that could offer nesting or resting sites. Therefore, bird presence in the area is expected to be limited to transient or foraging pelagic seabirds.

Common marine species recorded in the Timor Sea include terns, frigatebirds, boobies and shearwaters, which regularly forage across pelagic waters influenced by regional upwelling (BirdLife International, 2020; Coates et al., 2006). These species are widespread across tropical northern Australia and Southeast Asia and may traverse the Timor Sea during long-distance foraging trips (BirdLife International, 2020; Norman et al., 2017).

PSC 19-11 occurs within the East Asian-Australian flyway which is a major flyway through which migratory waterbirds traverse annually, including 34 globally threatened species and 25 near threatened species (Mundkur & Langendoen, 2022). Many migratory birds that use the East Asian-Australian flyway are the subject of international migratory bird protection agreements such as the Bonn Convention on the Conservation of Migratory Species of Wild Animals (1979) (Convention on Migratory Species, 2020).

6.3.5 Fisheries

The Development Area is located approximately 150km from the nearest coastline of Timor-Leste and while there is no official commercial fisheries operating in the area, there is potential for three types of tuna fisheries to occur. Figure 6-2, Figure 6-3 and Figure 6-4 illustrate the following Australian fisheries, however they do not operate in TL waters:

- Western Tuna and Billfish Fishery
- Western Skipjack Tuna Fishery
- Southern Bluefin Tuna Fishery

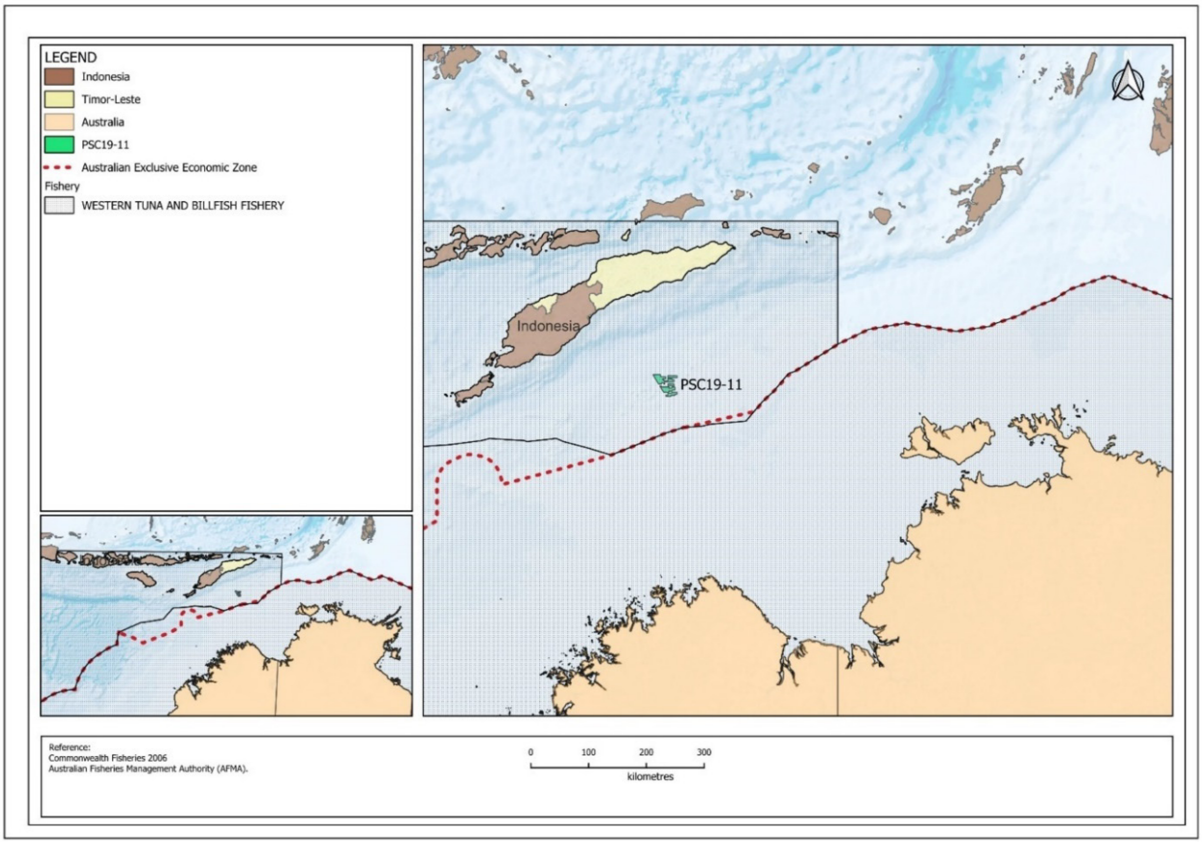


Figure 6-2 Western Tuna and Billfish Fishery

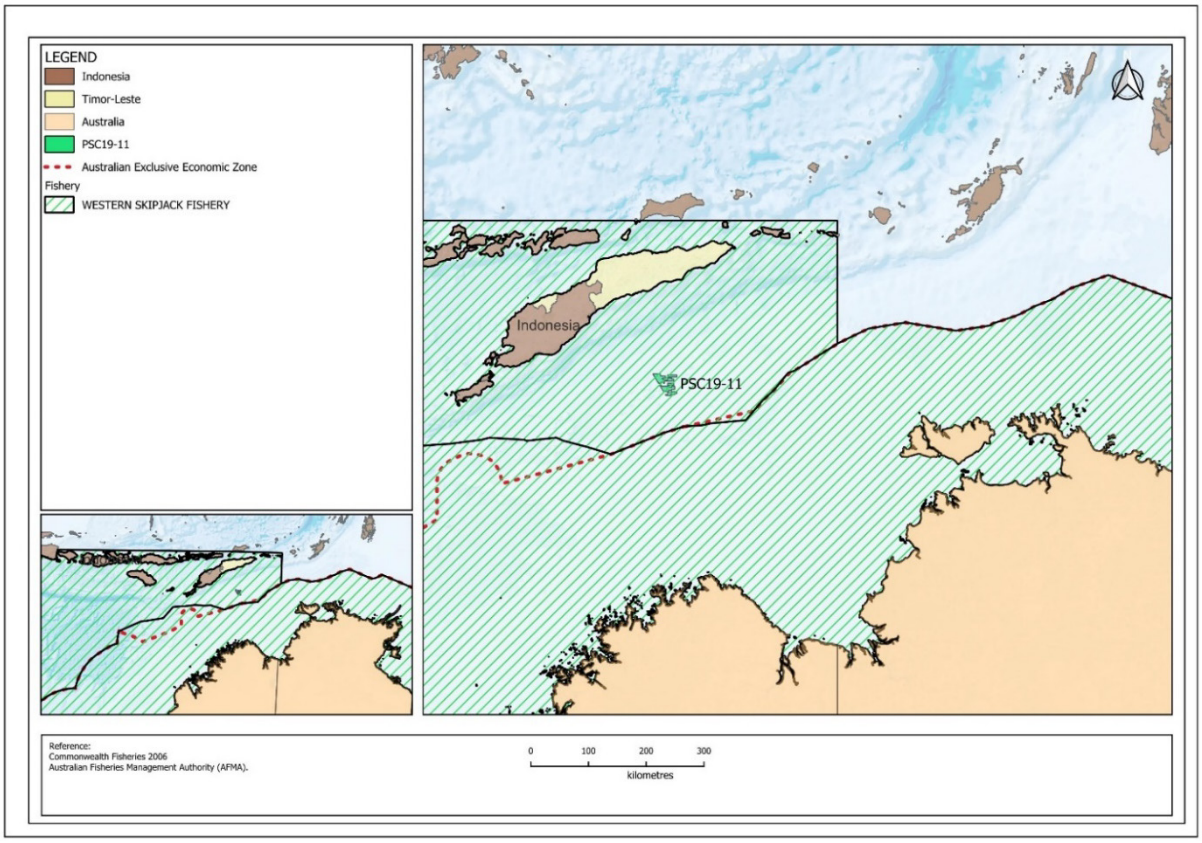


Figure 6-3 Western Skipjack Fishery

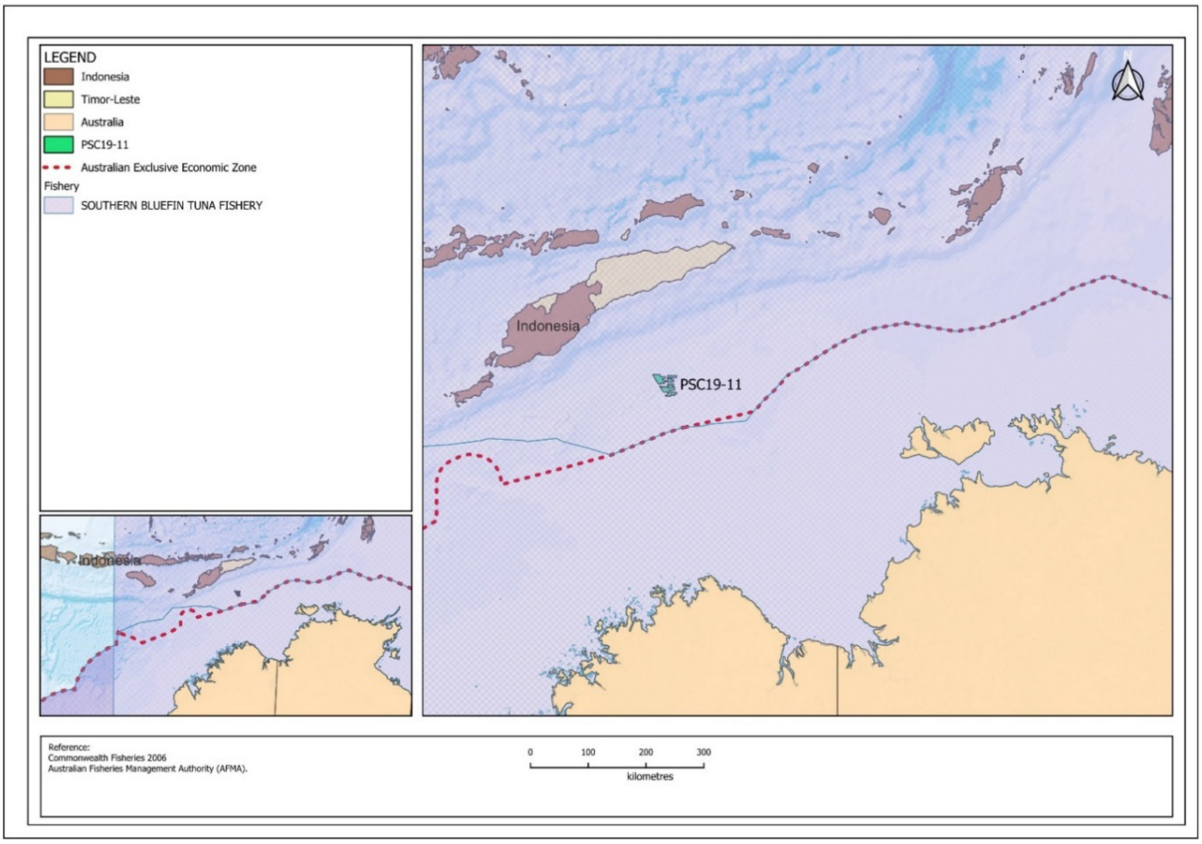


Figure 6-4 Southern Bluefin Tuna Fishery

Illegal, unreported, and unregulated (IUU) fishing activities and the deployment of fish aggregating devices (FADs) frequently occur in the Timor Sea and may also occur in the Development Area.

FADS are typically deployed in nearshore waters, most commonly within approximately 3 km of the mainland (Tilley et al., 2019) and only rarely beyond 5 km offshore. The PSC19-11 Development Area is located approximately 147km offshore from the Timor-Leste coastline and therefore the use of fish aggregating devices is not anticipated within the Development Area. Coastal communities along the 600km of Timor-Leste's coastline rely on a wide range of fish, including the large tuna species, flying fish, coral reef fish and deep-water snappers for their livelihoods. The Peskas database Fishing Activity Heatmap (Figure 6-5) shows the highest density of fishing is around the coastal strip of East Timor and north of Dili and Liquica (PESKAS 2025).

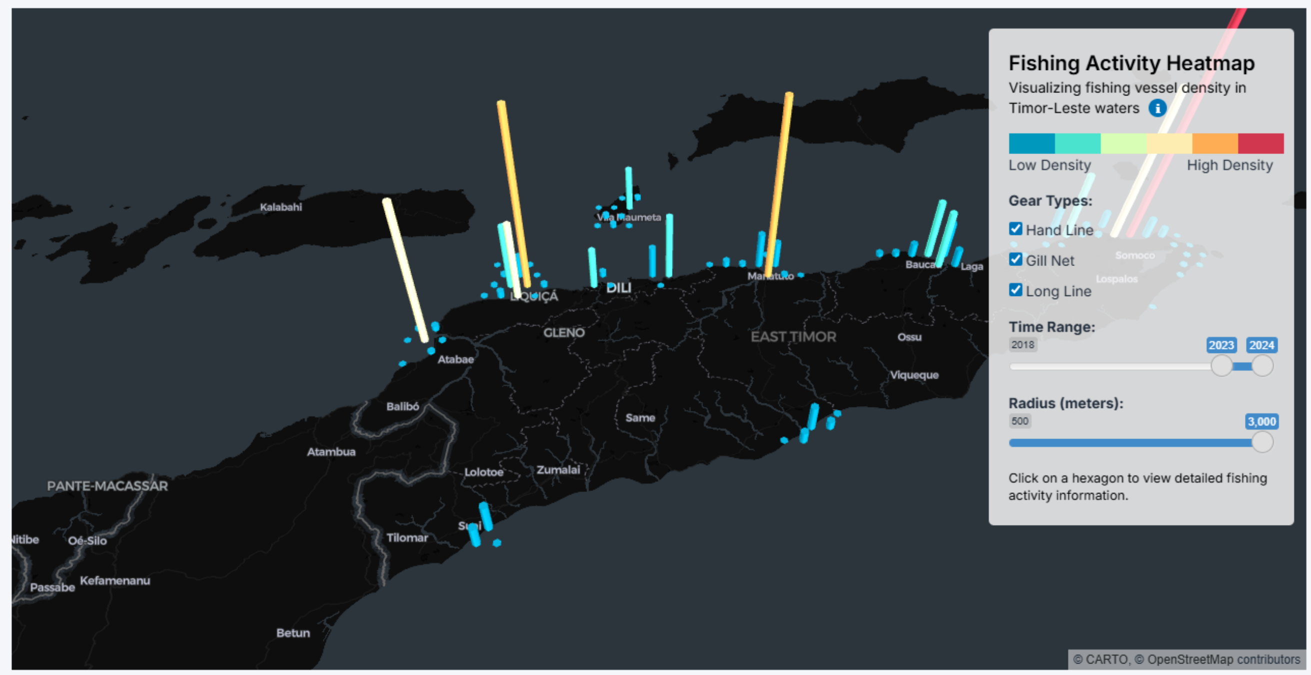


Figure 6-5 PESKAS Fishing Heat Map around East Timor (PESKAS 2025)

6.3.6 Protected Areas and National Parks

There are no World Heritage Properties, Ramsar wetlands, Marine Protected Areas or National Parks within the PSC19-11 field. A number of marine parks and reserves occur regionally. A summary of the relevant marine parks and reserves in Timor-Leste, Indonesian and Australian waters is provided in Table 6-2.

Table 6-2: Protected Areas and their proximity to PSC19-11

Country	Name of Park/ Reserve	Distance/ Relation to PSC19-11	Area of Park/ Reserve	Key Features
Timor-Leste	Nino Konis Santana National Park	243 km north-north-east	566 km2 of marine habitats	Important area for marine turtles. Bird species. A diverse coral reef. Declared Timor-Leste's first National Park in 2008.
	Jaku (Jaco) Island Marine Park	250 km north-north-east	Unknown	Important area for marine turtles, sharks and rays. Coral reefs. Within the Nino Konis Santana National Park.
Indonesia	Komodo National Park	708 km north-west	1,733 km2	Coral reefs. Nesting areas for marine turtles. Key cetacean habitat. Located between the islands of Sumbawa and Flores and includes three larger islands: Komodo, Padar and Rinca, and 26 smaller ones.
	Teluk Kupang Marine Park (northern side of island)	257 km north-north-west	500 km2	Diverse coral reef, mudflats and mangrove forest. Important area for dugongs. Important feeding site for migratory shorebirds.
Australia	Oceanic Shoals Australian Marine Park (AMP)	59 km south-south-east	71,744 km2	Important resting, internesting and foraging area for loggerhead, flatback and olive ridley turtles. Key ecological features include a carbonate bank and the terrace system of the Van Diemen Rise; carbonate banks of the Joseph Bonaparte Gulf; pinnacles of the Bonaparte Basin; and the shelf break and slope of the Arafura Shelf.
	Ashmore Reef AMP	356 km south-west	583 km2	Important areas for sea snakes. Critical nesting and internesting habitats for green turtles. Important area for seabird rookeries. Staging/feeding area for migratory seabirds. Includes two extensive lagoons, shifting sand flats and cays and a large reef flat covering an area of 239 km2.
	Cartier Island AMP	342 km south-west	167 km^2	Important areas for sea snakes, marine turtles, seabird rookeries. An important staging/feeding area for migratory seabirds. Cartier Island is an unvegetated sand island surrounded by a variety of habitats including a mature reef flat, a small submerged pinnacle, known as Wave Governor Bank and two shallow pools.

6.4 Economic Components

The economy of Timor-Leste is highly dependent on petroleum revenues and public expenditure, with a large proportion of the population relying on subsistence agriculture. Timor-Leste's economy is strongly shaped by subsistence agriculture (e.g., corn, rice, cassava, millet, sweet potato) and key cash/ritual products such as coffee, palm, and betel nut; livestock (buffalo, cattle, pigs, chickens) is important in rural communities. Coastal livelihoods include small- scale/artisanal fisheries, which contribute to food security and income for coastal communities.

The primary source of petroleum revenues for Timor-Leste originates from the development and production of offshore oil and natural gas deposits in the Timor Sea. Notably, Bayu-Undan, the primary revenue-generating oil field, ceased production on June 4th, 2025. To ensure the nation's future economic prosperity, it is imperative to foster the development and production of oil and gas deposits both offshore and onshore. Furthermore, there is significant potential for the development and production of mineral deposits onshore of Timor-Leste.

As of April 2026, the Asian Development Bank (ADB) forecasted Timor-Leste's economy to grow at 3.8% in 2026 and 4.1% in 2027. However, this prediction is uncertain due to the ongoing conflict in the Middle East. The International Monetary Fund's (IMF's) report supports this statement, indicating that Timor-Leste's nominal GDP in 2026 will be US$2.17 billion, and Gross Domestic Product (GDP) per capita will be US$1,520. These figures represent an increase of 3.8% GDP per capita from 2025.

The economy's reliance on oil and gas revenues presents challenges due to the finite nature of these resources. As per the World Bank report, the Petroleum Fund holds a balance of US$18.7 billion as of June 2025. While high levels of public expenditure have contributed to the improvement of basic infrastructure, they have not resulted in commensurate increases in private investment. Consequently, Timor-Leste's early-stage private sector faces limited local employment opportunities, and the country heavily relies on imports. The government's objective is to achieve medium-term growth of at least 5% by stimulating private investment in agriculture, tourism, fisheries, livestock, alternative and clean energy, food processing, and manufacturing. However, recent growth has averaged 3.4% between 2021-2023 and is projected to reach 3.7% over 2025-2027, which is below the government's predictions.

Timor-Leste's macroeconomic outlook is shaped by its heavy reliance on petroleum revenues, which have historically funded the majority of government spending. With oil and gas production ceasing in 2025, the country now faces mounting fiscal pressures as large withdrawals from the Petroleum Fund continue to finance persistent budget deficits. While GDP growth has been supported by high public expenditure and a rebound in tourism, the external position has weakened sharply, underscoring the need for a more sustainable fiscal path. Inflation remains low, but employment challenges persist, with only a fraction of the working-age population economically active.

Looking ahead, diversification is the central priority. Agriculture is being strengthened through mechanization and irrigation to improve food security and reduce import dependence, while tourism offers potential for sustainable growth. Private-sector development, however, requires structural reforms in land administration, finance, and regulatory frameworks to encourage investment and job creation. Membership in the World Trade Organization (WTO) and the Association of Southeast Asian Nations (ASEAN) provides new opportunities for trade integration, but fiscal sustainability hinges on aligning expenditure with non-oil revenues to avoid depleting the Petroleum Fund. Timor-Leste's youthful population and regional partnerships offer promise, but decisive reforms are essential to secure long-term stability.

The development and production of the Kuda Tasi and Jahal Fields will significantly contribute to the country's economy, foster national growth and micro- and macroeconomics. The associated royalties, taxes, and production-sharing contracts will make a substantial contribution. Furthermore, this project generates employment opportunities in maritime logistics, engineering, maintenance, and supporting industries such as transportation, catering, and accommodation. Additionally, it will stimulate the economy by increasing demand for local businesses and services, thereby creating a multiplier effect that enhances household incomes and consumer spending. These factors are essential for diversifying and strengthening Timor-Leste's economy and its broader economic resilience.

6.4.1 Employment Sectors

Timor-Leste's livelihoods and employment landscape are characterized by a youthful and expanding labor force, yet formal job opportunities remain scarce. Less than one-third of the working-age population participates in the formal economy, and unemployment, particularly among youth, persists at elevated levels. Underemployment is prevalent, with numerous workers engaged in low-productivity subsistence farming or informal activities that offer inadequate income security. The informal economy predominates, as most households rely on small-scale agriculture, petty trade, and casual labor rather than formal wage employment. Seasonal work, particularly in the agricultural and fishing sectors, generates income fluctuations and exacerbates vulnerability during periods of economic hardship.

Skills development is a critical challenge. Many workers lack vocational training or technical expertise, which limits their ability to transition into higher-value sectors such as tourism, construction, or services. Migration for temporary work abroad, particularly in Australia's seasonal labour schemes, has become an important livelihood strategy, providing remittances but also highlighting domestic job shortages. Expanding skills training, improving access to finance for small enterprises, and fostering private-sector growth are essential to reduce reliance on informal and seasonal work, while creating sustainable employment opportunities for Timor-Leste's youthful population.

The employment sector in Timor-Leste operates within a developing economy characterized by a high reliance on subsistence and informal livelihoods, a relatively small formal employment sector, strong dependence on public sector and government expenditure, and limited private sector and industrial development. In Timor-Leste, the employment sector is predominantly concentrated in sectors such as agriculture, forestry, and livestock, public sector, trade, retail, and informal economy, construction and infrastructure, services, and extractive industry including petroleum.

The Timor-Leste Population and Housing Census 2022 shows that the number of employed individuals aged 15 and above is 874,000, resulting in an overall employment-to-population ratio of 34.9%. The overall employment-to-population ratio closely aligns with the Labor Force Participation Rate (LFPR) which was 35.9 percent. The LFPR is an indicator of the proportion of the working-age population engaged in either employment or unemployment. This statistic serves as a gauge of the labor market structure, the availability of human resources for the production of goods and services and facilitates an understanding of the labor market dynamics among different population groups.

In contrast, the census data indicates that Timor-Leste has approximately 9,000 unemployed individuals. This figure is supported by data from the International Labour Organization (ILO), which shows that the unemployment rate in Timor-Leste was 1.59% of the total labor force in 2025. This rate is slightly higher than the 1.52% unemployment rate recorded in 2024. The unemployment rate has increased in 2025 after the decline in 2016 as shown in Figure 6-7.

According to the International Labour Organization (ILO) (2021), the services sector is the largest employer, comprising 59.1% of the workforce and encompassing sectors such as education, healthcare, public administration, and retail. Conversely, the agriculture sector employs 26.9% of the workforce, primarily engaged in subsistence farming of crops like coffee, maize, and cassava. The industrial sector, comprising construction, manufacturing, and extractive industries, accounts for 13.5% of employment in Timor-Leste. Even though its relatively modest workforce share, it plays a pivotal role in infrastructure development and economic diversification. Despite the oil and gas industry's substantial employment share in Timor-Leste, the percentage of employment remains the lowest among all sectors.

To address the challenges in the employment sector, the government has prioritized strategic economic diversification as outlined in the Strategic Development Plan (2011–2030) and National Employment Strategy (2017-2030). This strategy entails reducing reliance on oil revenues by promoting agriculture, tourism, and manufacturing. These sectors are expected to generate sustainable employment opportunities. Additionally, investments in infrastructure projects, such as road networks and construction, are being prioritized to stimulate economic activity. Human capital development is another key focus, with vocational training and education initiatives being implemented in collaboration with organizations like the International Labour Organization (ILO) to enhance workforce skills and align them with market demands.

Despite these endeavors, persistent challenges such as high levels of informal employment, restricted opportunities for youth, and gender inequality continue to pose obstacles. Addressing these systemic issues remains paramount to realizing sustainable economic growth and enhancing livelihoods in Timor-Leste. The government's emphasis on education, infrastructure development, and economic diversification presents a viable path toward cultivating a more inclusive and resilient labor market.

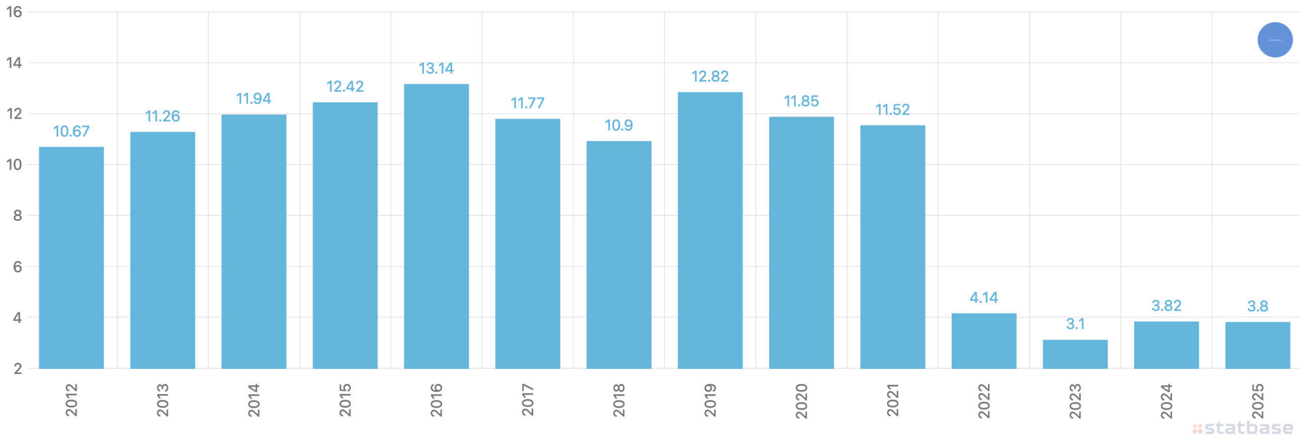


Figure 6-6: Employment percentage in Timor-Leste (Source: ILOSTAT, March 2026).

6.4.2 Fishing

Timor-Leste boasts an abundance of marine resources, primarily due to its extensive coastline spanning approximately 735 kilometers. This is complemented by an Exclusive Economic Zone (EEZ) encompassing approximately 72,000 square kilometers, teeming with marine life. Though, the fisheries sector in Timor-Leste plays a critical role in food security, livelihoods and supplementary household income, nevertheless, several challenges persist along the value chain that necessitate their resolution. These challenges include inadequate infrastructure, inadequate cold chain storage facilities, and stringent regulations to safeguard against overfishing and illegal fishing activities. While fishing holds significant economic and social importance at the local level, its contribution to the national GDP remains modest, currently accounting for approximately 0.4 percent (Iyengar & Swain, 2024).

According to the Timor-Leste Fish Consumption Survey (TL-FCS) of 2024/25, the average annual consumption of fish by Timorese individuals has increased to 8.7 kilograms per person, surpassing the estimated 6.1 kilograms in 2011. The government has set a target to elevate this consumption to 10 kilograms by 2030.

Several species found in Timor-Leste are of significant commercial importance, including the tuna (Thunnus obesus), commonly known as the "Big Tuna," which is listed as a threatened species, mackerels, and snappers. The most common and important fish group and the amount of the live catch data is shown in Figure 6-8.

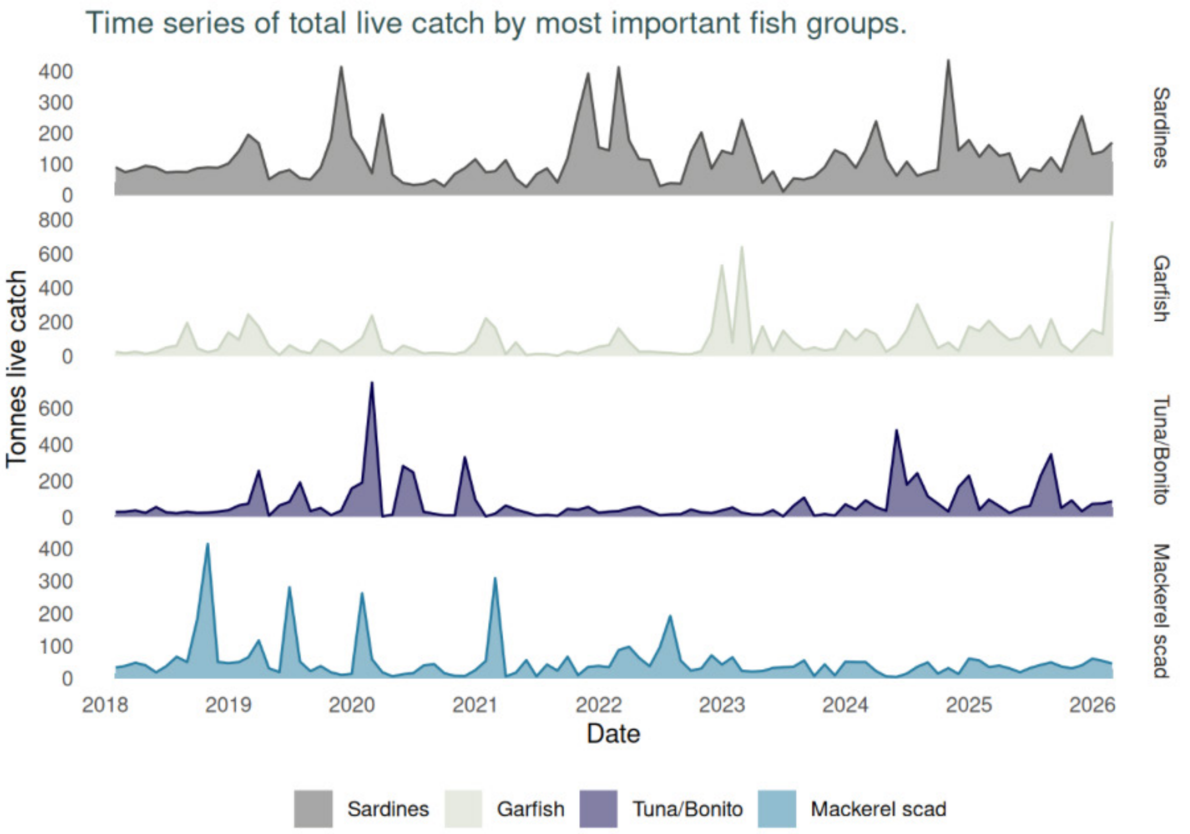


Figure 6-7: The weight of live catch in tonnes for the common and important fish groups. (Source: Peskas, Data compiled April 27, 2026)

The fish densities in the contract area are anticipated to be low, with some pelagic species transiting the region. However, waters characterized by higher fish abundance are likely to be found in the shallow coastal fringe and around reefs and shoals at the edge of the continental shelf (CSIRO 1999a). The broader Timor Sea region supports pelagic fish species that are utilized in both traditional and commercial fisheries in the deeper offshore areas.

Subsistence Fishing

The majority of fishing in Timor-Leste employs artisanal methods, primarily for subsistence or semi-subsistence purposes. This encompasses various small-scale, low-capital fishing practices involving individual fishing families. Artisanal fishing, in its traditional form, significantly contributes to catch patterns in the region, alongside a small commercial fishing sector that targets tuna, mackerel, and other species. These fishermen commonly utilize handlines, gillnets, and traditional traps to target species.

Coastal communities along the 600km of Timor-Leste's coastline rely on a wide range of fish, including the large tunas, flying fish, coral reef fish and deep-water snappers for their livelihoods. Their economic significance, both in terms of local incomes and market contributions, is substantial, making them indispensable in ensuring the livelihoods of communities. The National Directorate of Fisheries and Aquaculture estimated that over half the 20,000 fishermen in Timor-Leste, fishing is the main source of food and income many individual, small-scale operators with small boats catch a range of fish mostly sardines.

Commercial Fisheries

Timor-Leste's underdeveloped commercial fishing sector is exacerbated by the absence of essential infrastructure, a weak cold storage chain, and stringent regulations governing overfishing. Despite the challenges, Timor-Leste presents opportunities for economic diversification through its participation in international trade in fisheries and aquaculture products. These products have experienced significant growth in recent decades, facilitating cross-continental and regional trade. In 2020, global exports of aquatic products, excluding algae, reached $151 billion. The value of traded aquatic products accounted for 11% of total agriculture trade (excluding forestry) and approximately 1% of total merchandise trade.

Timor-Leste possesses the potential to yield substantial annual fish catches, with projections reaching 116,000 tons. However, the actual annual catches, excluding losses attributable to illegal, unreported, and unregulated fishing, are estimated to be less than 10,000 tons (FAO, 2019). This disparity presents a substantial opportunity for the development of the fisheries sector in Timor-Leste, encompassing both domestic consumption and global export.

To ensure sustainable fishing practices, the government has implemented several regulatory measures. Joint Ministerial Order No. 11/GM/2015 establishes minimum sizes and weights for fishing aquatic species, aiming to prevent overfishing of juvenile stocks. Furthermore, Joint Ministerial Order No. 18/MAP/MCIA/II/2017 enumerate protected aquatic species, prohibiting their capture to preserve biodiversity. The implementation of a Satellite System for Monitoring Fishing Vessels (VMS) under Decree-Law No. 21/2008 further enhances the management of fish stocks by enabling effective monitoring, control, and surveillance of fishing activities. Despite these efforts, challenges persist, including illegal, unreported, and unregulated (IUU) fishing, which threatens marine ecosystems and local livelihoods. In response, Timor-Leste has taken steps to strengthen its commitment to combating IUU fishing by approving accession to the Agreement on Port State Measures, as outlined in Government Resolution No. 8/2023.

Despite the government's efforts to combat illegal and overfishing, the government acknowledges the country's resource constraints, particularly the need for patrol vessels to monitor deeper waters. According to Tatoli news, Timor-Leste authorities recently seized an Indonesian-flagged vessel operating illegally within Timor-Leste's exclusive economic zone (EEZ) (Fonseca, 2026). The Ministry of Agriculture reported that Timor-Leste lost over 2,200 tonnes of fish equivalent to US$48.5 million between 2024 and 2026 due to illegal fishing.

Aquaculture

In an effort to develop a fisheries sector and economy diversification strategy, aquaculture presents a substantial potential for augmenting domestic fish supply by 2030. In Timor-Leste, aquaculture has been implemented on a limited scale, primarily focusing on the production of milkfish, tilapia, carp, shrimp, abalone, crabs, and oysters, as well as seaweed harvesting. The development of community-based coastal aquaculture and mariculture activities, which necessitate a transition beyond the subsistence and semi-industrial levels, by fostering the establishment of an appropriate community-led private sector, can provide sustainable employment opportunities to a substantial portion of Timor-Leste's population. This approach will significantly contribute to enhancing the incomes of coastal communities, particularly those most susceptible to poverty, as outlined in Timor-Leste's vulnerability assessment.

According to the Timor-Leste Agriculture Census of 2019, approximately 3.2% of all agricultural households engaged in aquaculture activities. Notably, only 1% of all households in the country relied on aquaculture as their primary source of livelihood.

6.4.3 Tourism

Tourism in Timor-Leste holds significant potential as a driver of economic diversification and sustainable growth. The country's natural beauty—pristine beaches, coral reefs, rugged mountains, and rich biodiversity—offers opportunities for eco-tourism and adventure travel. Recently, the island of Ataúro in Timor-Leste was recognized as one of the world's richest in biodiversity. Furthermore, studies indicate that Timor-Leste's water corridor is pivotal for the economic diversification of the tourism industry and the establishment of a sustainable blue economy zone.

Cultural heritage, including traditional villages, crafts, and historical sites, adds depth to the visitor experience, while the capital Dili serves as a gateway for international arrivals. The rebound in tourism in recent years highlights its capacity to generate foreign exchange, create jobs, and stimulate small business development, particularly in hospitality, transport, and local services.

Although its current contribution to GDP and employment remains modest, it is gradually increasing. While tourism ranks third in the country's economy, it accounts for only 1% of its GDP (Iyengar & Swain, 2024). Tourism activity is still underdeveloped, with limited infrastructure, connectivity, and skilled workforce posing challenges. Seasonal demand and reliance on niche markets, such as diving and trekking, mean that growth requires targeted investment in facilities, marketing, and training. Expanding vocational skills in hospitality and tour operations, improving transport links, and promoting Timor-Leste's image as a safe and unique destination are essential steps. With ASEAN membership and growing regional integration, tourism can become a cornerstone of non-oil diversification, supporting livelihoods and showcasing Timor-Leste's cultural and natural assets to the world.

Tourism is highly susceptible to environmental and social transformations, particularly in coastal and marine regions. Consequently, any project development must meticulously assess its potential effects on tourism assets and guarantee that opportunities for sector improvement are optimally realized.

6.4.4 Infrastructure Facilities

Land Transportation

The nation's road network spans approximately 6,041 kilometers, with approximately 2,600 kilometers paved and the remainder unpaved. The general condition of these roads is inadequate, frequently hindering efficient transportation. Public transportation primarily consists of privately operated minibuses, commonly referred to as microlets, which serve various routes without formal schedules. Recent initiatives, such as the Timor-Leste Branch Roads Project, are intended to enhance road connectivity by connecting key towns and facilitating access to popular destinations like Mount Ramelau.

Additionally, a section of the highway has been completed, and future construction will extend along the southern coast of Timor-Leste as part of the Tasi Mane Project.

Air Transportation

The country operates several airports, with Presidente Nicolau Lobato International Airport in Dili serving as the primary hub for international flights. This airport accommodates flights to destinations such as Darwin, Denpasar, Malaysia, and Singapore. However, operational limitations, including a short runway and the absence of night-time landing capabilities, restrict flights to daylight hours. Other airports, such as those in Oecusse, Baucau, and Suai, primarily handle domestic flights and possess less extensive capabilities for international traffic.

Marine Transportation, Seaport and Shipping

Maritime transportation is vital for both domestic and international trade in Timor-Leste, primarily due to its geographical isolation as an island nation. The country's reliance on imported goods and materials, coupled with its limited domestic manufacturing capacity, underscores the critical role of maritime transport.

Seaports serve as vital conduits for international trade, facilitating the import of fuel and petroleum, construction materials, consumer goods, and passenger transportation. Additionally, they enable inter-island connectivity, ensuring efficient connectivity within the nation's archipelago.

Ports, shipping and logistics (port operations, vessel traffic patterns, supply routes) are relevant to offshore activities, particularly the KTJ Development project. These facilities can be used and create local employment potential across the value chain.

Timor-Leste has two primary ports: the Dili Port and the Tibar Bay Port. As of October 2022, the Dili Port ceased its container ship operations but will continue to serve domestic passenger and cruise ships carrying international tourists. Currently, the Dili Port facilitates connections between Dili and Atauro and Dili and Oecusse providing essential connectivity for both passengers and vehicles.

The Tibar Bay Port commenced operations in November 2022, serving as the primary container and bulk shipping port in Timor-Leste. Located approximately 2 kilometers west of Dili, the Tibar Bay Port represents Timor-Leste's inaugural public-private partnership (PPP) initiative. This port has provided Timor-Leste with a new gateway to the global market, facilitating access to lucrative shipping lanes and fostering opportunities for increased trade, investment, and job creation. The Tibar Bay Port has the capacity to handle up to one million containers annually, connecting Timor-Leste to the Asian region and the global market. This expansion enhances Timor-Leste's trade access to goods in sectors such as agriculture, tourism, fisheries, livestock, and other industries.

Additionally, there are other smaller ports and landing sites located in Atauro, Oecusse, Suai, and Com. These ports handle domestic cargoes, small-scale trade, fishing, local transportation, and inter-island connectivity.

Both Dili and Tibar Bay Ports are situated on the northern coast of Timor-Leste, located on the opposite side of the Kuda Tasi and Jahal Fields. In contrast to the northern coast of Timor-Leste, which has limited marine transportation activities, the southern coast of Timor-Leste boasts major ports, with their traffic transiting through the Timor Sea, in the vicinity of the Development Area as shown in Figure 6-9.

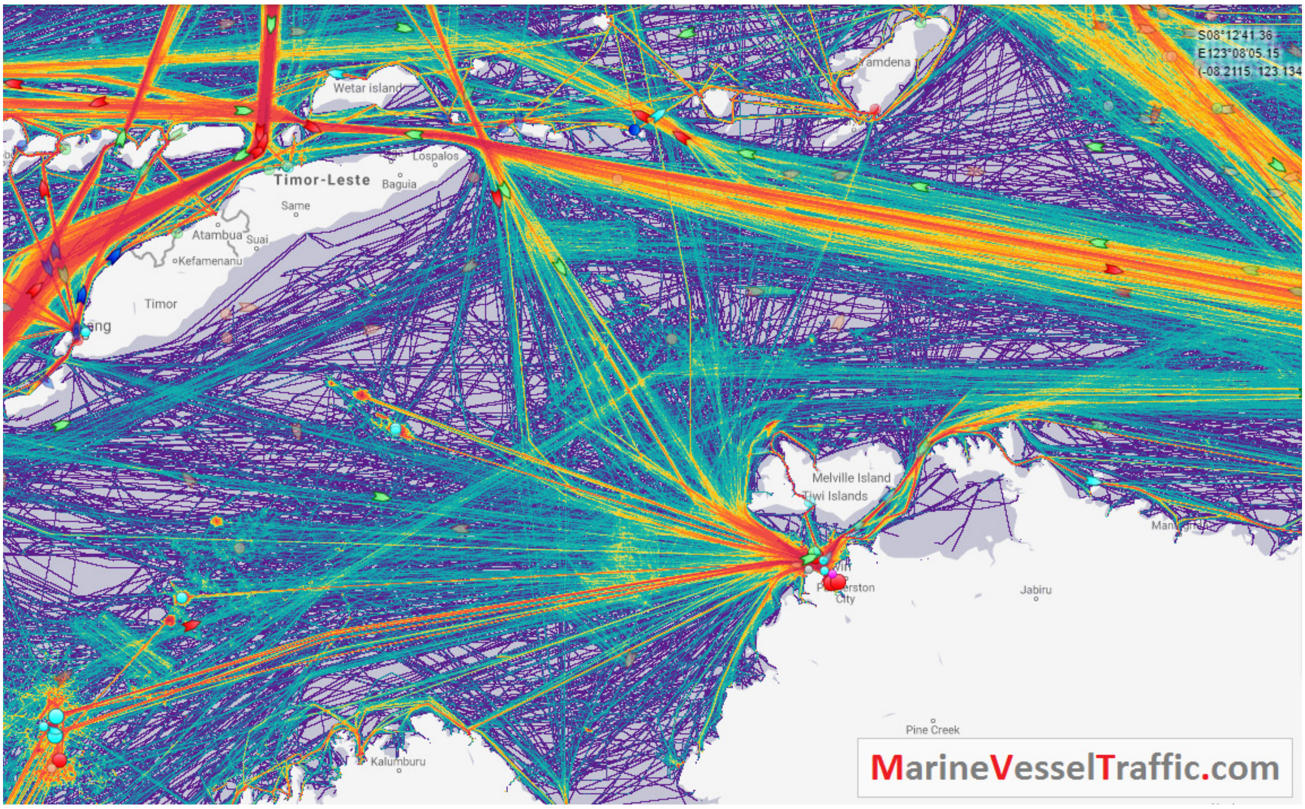


Figure 6-8: Details record of marine traffic in Timor-Sea (Source: Marine Vessel Traffic, 2026)

Darwin serves as the primary deep-water port and logistical hub for Timor Sea operations, functioning as the primary docking point on the northern Australian coast between Cairns and Perth. Notably, key landing sites, particularly for amphibious, commercial, and offshore supply vessels, include East Arm Port, Frances Bay Mooring Basin, and regional locations such as Port Melville (Tiwi Islands) and Gove. Strategically situated in the Timor Sea, Darwin Port serves as Australia's northern maritime gateway to Southeast Asia. Furthermore, this port has historically supported offshore drilling, liquefied natural gas (LNG) processing, marine supply vessels, and subsea infrastructure. The Tibar Bay Port is envisioned to enhance trade connections with northern Australia.

Other Marine Infrastructure: Fiber Optic Cable

Historically, Timor-Leste heavily relied on expensive and relatively slow satellite-based internet connectivity, resulting in high telecommunications costs and limited bandwidth capacity. On June 24th, 2024, the Government of Timor-Leste launched the first installation of the submarine fiber optic cable known as the Timor-Leste South Submarine Cable System (TLSSC). The development of TLSSC systems aims to substantially enhance internet speed, reliability, affordability, and national connectivity. The TLSSC system comprises a 607km subsea cable connecting Dili to the North-West Cable system, as shown in the map below (Figure 6-10). This system includes seven repeaters and a dedicated Greater Sunrise Branch Unit (BU) equipped with high-voltage electricity. These facilities are commissioned and working, and are a boom for Oil companies, private and public sector in Timor-Leste. With fiber optic cable system, increase in speed on data, internet access, mobile phone networks will have domino effects on economy.

Figure 6-9: Timor-Leste South Submarine Cable (TLSSC) (Source: Submarine Cable Networks)

6.4.5 Agriculture and Forestry

The majority of Timorese still engages in traditional and subsistence agriculture, lacking access to modern technology. The most recent data on agriculture, forestry, and livestock originates from the Timor-Leste Agriculture Census of 2019. This census reveals that 72 crops and plants are cultivated, with thirteen major crops collectively accounting for approximately 70% of the total area under cultivation. These crops include corn (18%), rice (7.6%), cassava (7.4%), coffee (6.3%), coconut (5.8%), banana (5.4%), teak (4.2%), mango (3.6%), sweet potatoes (2.8%), papaya (2.4%), candlenut (2.1%), taro (2.0%), and areca nut (1.9%). The remaining 56 crops and plants collectively contribute 30% of the gross cultivated area. Notably, coffee plays a significant role in the trading sector and contributes to the diversification of the economy.

Livestock and poultry constituted the second most significant agricultural activity undertaken by agricultural households, following crop cultivation. Consequently, they played a pivotal role in supporting the livelihoods of and providing income to agricultural households. Approximately 95% of all agricultural households in Timor-Leste engaged in the raising of livestock and/or poultry at the time of the census enumeration. The prevalent livestock and poultry species raised encompass cows, buffaloes, pigs, goats, chickens, ducks, and other poultry birds.

Timor-Leste's tropical soil is conducive to growing bamboo and other high-value hardwood such as teak, mahogany and sandalwood (National Industry Development Policy). Timor-Leste has some of the most valuable bamboo species such as "*Bambusa Lako*" also known as Timor Black Bamboo, due to its aesthetics and its s unique specie to Timor-Leste. The Bamboo and hardwood have potential for small-scale and commercial industry.

The proposed drilling location is far offshore and would not have any significant impact on the agriculture, forestry, and livestock aspects. The development of Oil and Gas subsequently would have significant positive impact in supply chain of fresh fruits, vegetable, cattle, and poultry to Oil and Gas Industry.

6.4.6 Other Industries

Timor-Leste is considered a highly promising country for mineral, natural gas, and oil both onshore and offshore.

Oil and Gas Exploration

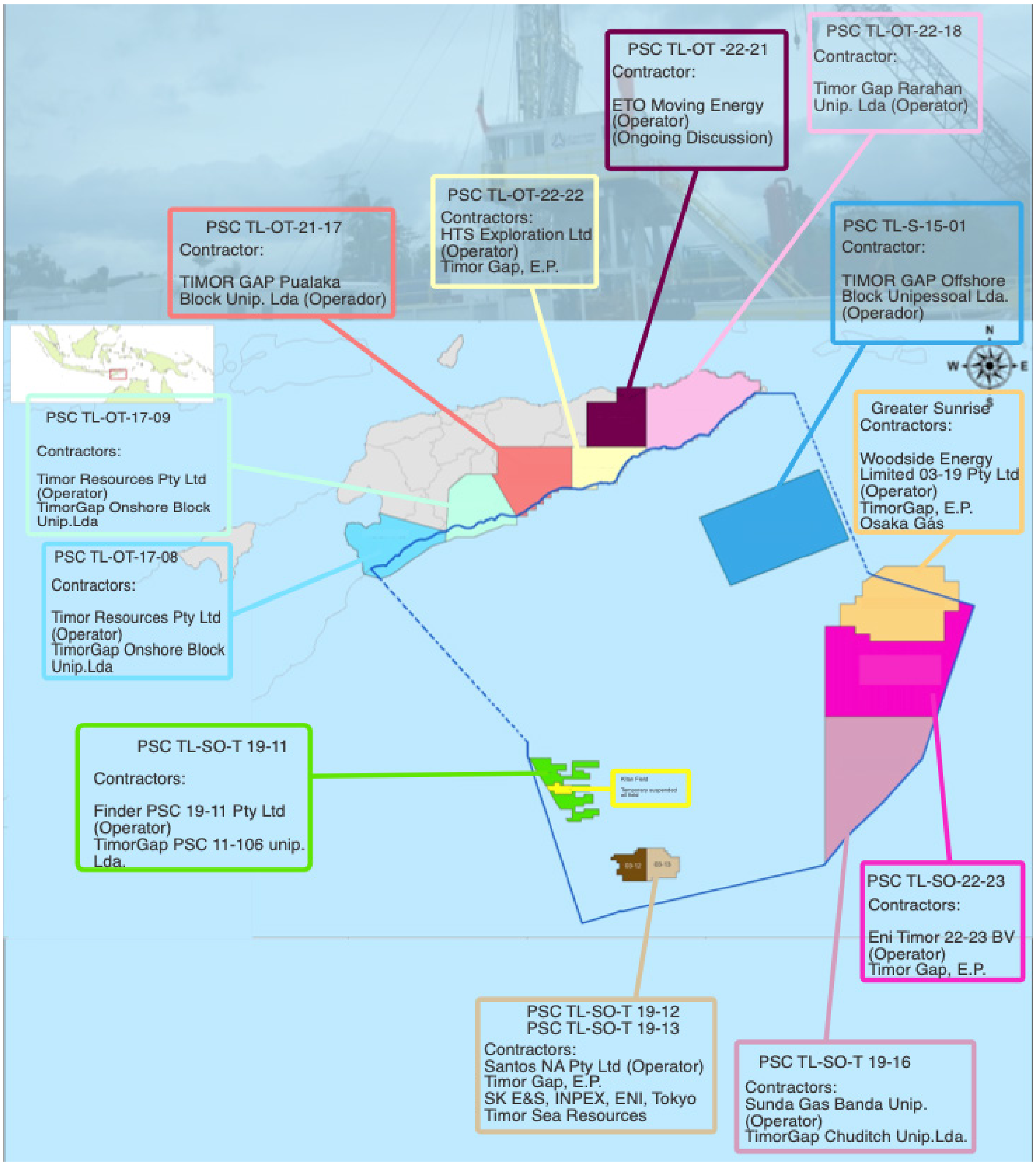


Figure 6-10: Contract areas for oil and gas exploration in Timor-Leste's onshore and offshore. (Source: ANP, 2024)

As shown in Figure 6-11 that there are exploration and production for oil and gas along the south coast of onshore Timor-Leste and offshore in Timor Sea.

In the onshore region of Timor-Leste, Timor Resource and TIMORGAP, a joint venture, are conducting operations and exploration in PSC TL-OT-17-08 (Block A) and PSC TL-OT-17-09 (Block B). To date, Timor Resource has drilled three exploration wells in Block A. Furthermore, TIMORGAP Pualaca Block (TGPB), a subsidiary of TIMORGAP, is managing a seismic survey in the Pualaca Block (PSC TL-OT-21-17).

In the offshore region of Timor-Leste, the production of gas condensate from Bayu-Undan (PSC 03-12 and PSC 03-13) was piped to Darwin for processing into Darwin LNG. However, production at Bayu-Undan ceased in June 2025. Currently, there is a plan in progress to repurpose the infrastructure for the Bayu-Undan Carbon Capture and Storage (CCS) project.

In addition, the PSC-TL-SO-T 19-16 (Chuditch-2) will undergo re-evaluation through appraisal drillings. ANP has obtained the environmental license for these drillings. An active seismic and drilling program is underway for PSC-TL-SO-22-23, commonly referred to as Block P, with Eni as the operator.

Mineral

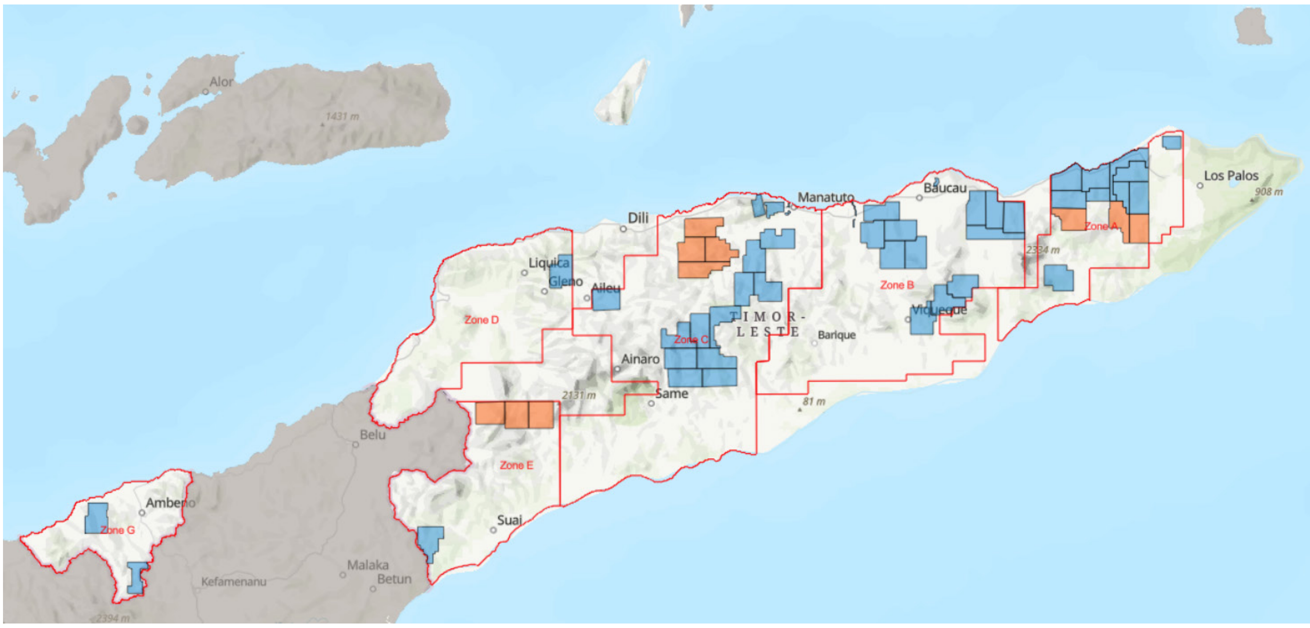


Figure 6-11: Current and Future Mineral Exploration in Timor-Leste Onshore (Source: ANM, 2026)

Figure 6-12 shows onshore map of Timor-Leste which are divided into mineral zones for the purpose of exploration and production. According to the study conducted by the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP), Timor-Leste possesses significant reserves of both metallic and non-metallic minerals. The country's metallic mineral deposits include copper-gold, chromite, gold, and manganese. Notably, the northern edge of Oecusse is recognized as one of the richest copper zones in Timor-Leste, alongside Baucau and the northern central Viqueque Municipality. Additionally, the Atauro and Ossu areas within the Viqueque Municipality have yielded numerous gold and silver occurrences. Furthermore, the eastern and western coastal regions of Timor-Leste are characterized by the presence of limestone and marl formations. Central Baucau Municipality is home to phosphate and bentonite deposits. Furthermore, Manatuto boasts the presence of high-quality marble. It is hypothesized that the belt extending from east Dili to the east coast may contain clay and kaolin deposits.

Onshore development of mining resources would significantly enhance the economic growth of Timor-Leste. Notably, unexplored mineral deposits in Timor-Leste include laterite nickel, platinum, and diamonds.

6.5 Social Components

Timor-Leste has made significant strides in rebuilding its social and economic components since achieving independence in 2002. This section provides an overview of the social components in Timor-Leste, including the status of the population, living standards, health indicators, and societal structures. Furthermore, it evaluates the potential impacts of oil and gas production activities, such as the Kuda Tasi and Jahal project, on livelihood, employment, income levels, and infrastructure development.

6.5.1 Demographics and Population Composition

According to the Timor-Leste Population and Housing Census 2022, the total population of Timor-Leste was 1.34 million. Furthermore, data from the United Nations Population Fund (UNPF) indicates that the total population of Timor-Leste was 1.4 million in 2025 (UNFP, 2025).

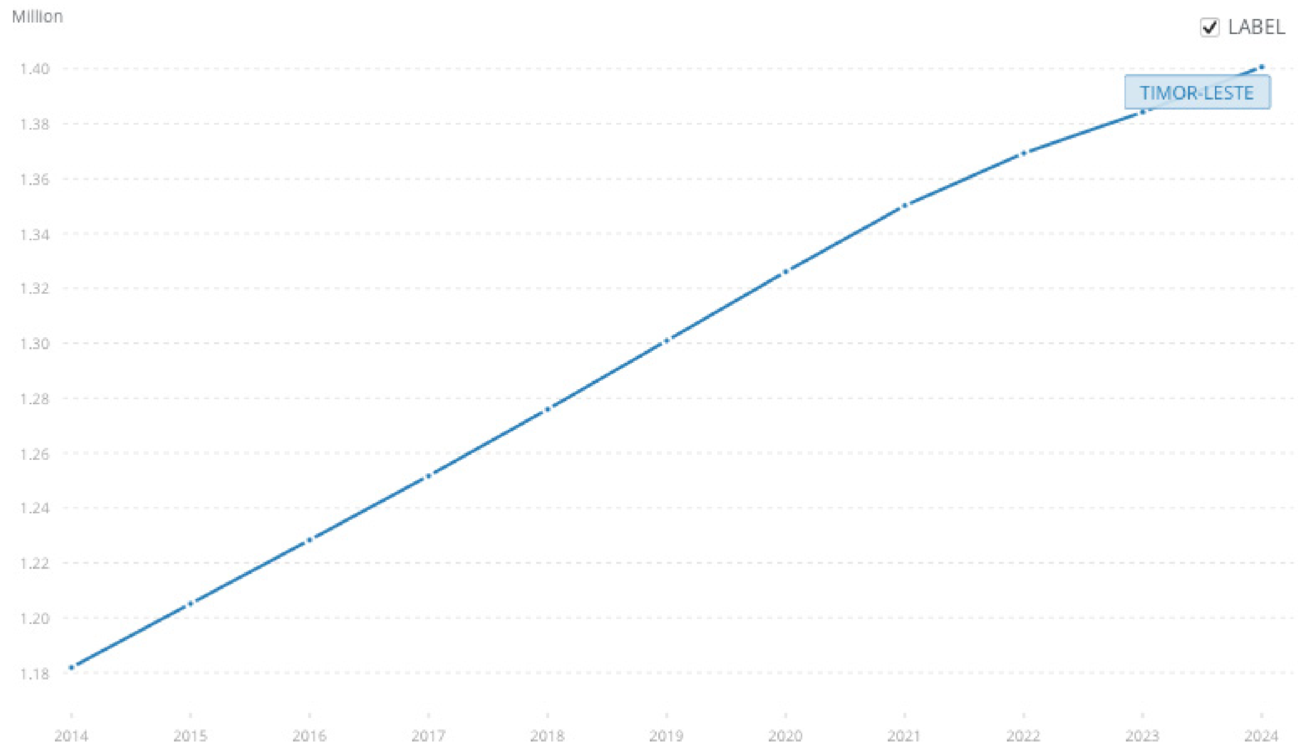


Figure 6-12: Number of Timor-Leste population in million versus years (2014-2024). (Source: World Bank, 2024)

Figure 6-12 shows data obtained from the World Bank and UNPF, the population of Timor-Leste is projected to experience a modest increase from 2024 to 2025. Out of the total population of 1.4 million, approximately 62% are within the working age range of 15 to 64 years, while 33% are between the ages of 0 and 14, and the remaining 5% are above the age of 65 (UNPF, 2025).

Settlement patterns: Approximately 70% of the population resides in rural areas dispersed throughout municipalities, while Dili, the capital city, serves as the primary urban hub. Ethnically, the population exhibits a diverse complexity influenced by Austronesian and Melanesian cultures. Over 30 local languages are spoken, in addition to the official languages of Tetum and Portuguese, and the working language of English and Bahasa Indonesia.

6.5.2 Living Standard

Although Timor-Leste has made strides in elevating its living standards, substantial challenges persist.

Housing

The Timor-Leste Population and Housing 2022 Census (Figure 6-14) revealed that 55.9% of households possess units with concrete or brick walls. Palm trunk (*bebak*) constitutes the second most prevalent wall material. In rural areas, 19.5% of all housing units use palm trunks as wall material, whereas in urban areas this percentage is significantly lower (6.9%). Approximately one in seven Timor-Leste housing units have bamboo walls (14.4%). While this figure is 19.6% in rural areas, only a handful of houses in urban areas use bamboo as a construction material for walls (1.2%).

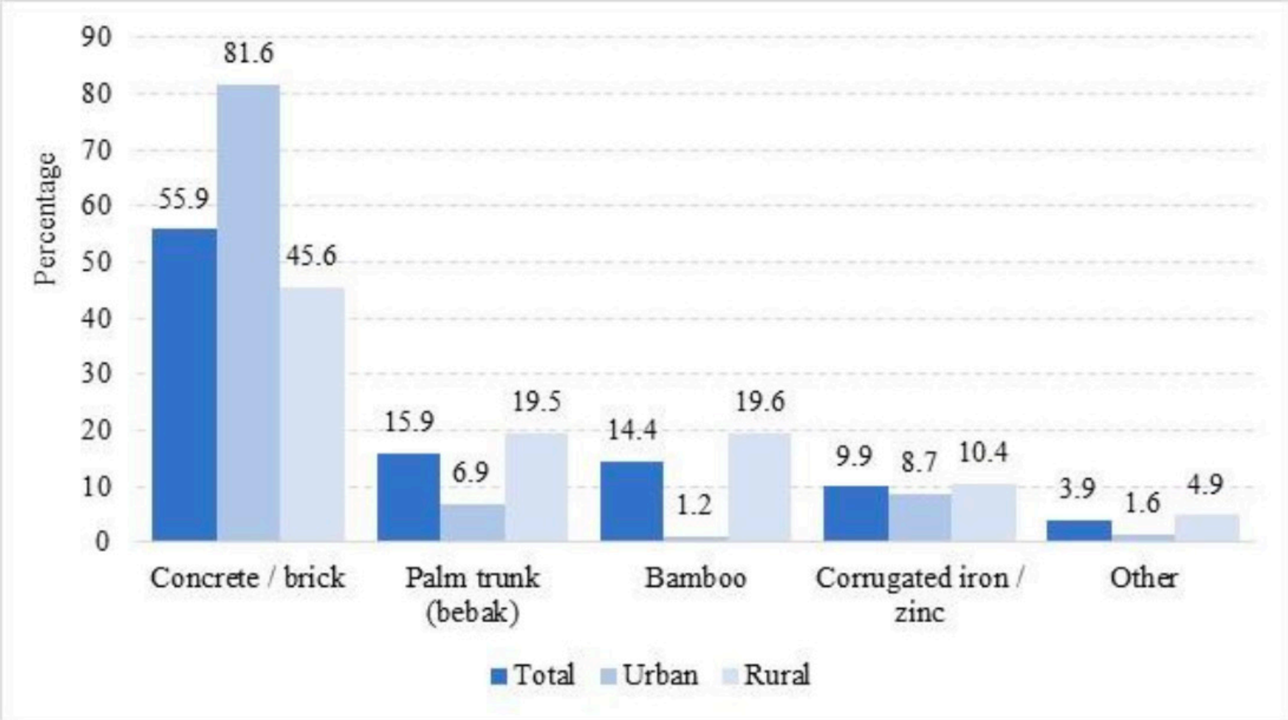


Figure 6-13: Timor-Leste Housing Condition Data from 2022 Census (Source: INETL, I.P., 2023)

Clean Water and Sanitation

Clean water and sanitation – often grouped as WASH (Water, Sanitation, and Hygiene) – is a critical development issue in Timor-Leste. While the country has made progress, major gaps remain, especially in rural areas.

Clean Water

The Ministry of Public Works (MPW) is the primary authority responsible for water supply and sanitation services in Timor-Leste. Its functions encompass policy formulation, infrastructure planning, and service provision. Rural water systems are typically managed by communities, while urban systems are administered by public utilities such as *Bee Timor-Leste, I.P. (BTL, I.P.)*.

The Clean Water and Sanitation Census 2022 categorized drinking water into two distinct groups: 'improved' and 'unimproved' sources. These categories are determined by the accessibility of drinking water on premises, the duration required to collect drinking water, including queuing, the availability of water in times of need, and the absence of contamination.

Piped supplies and non-piped sources, such as boreholes, protected wells, springs, rainwater, and packaged or delivered water (e.g., via tanker trucks), are classified as improved drinking water sources. Conversely, unimproved water sources, including rivers, streams, irrigation channels, and lakes, do not provide protection against bacterial and chemical contamination.

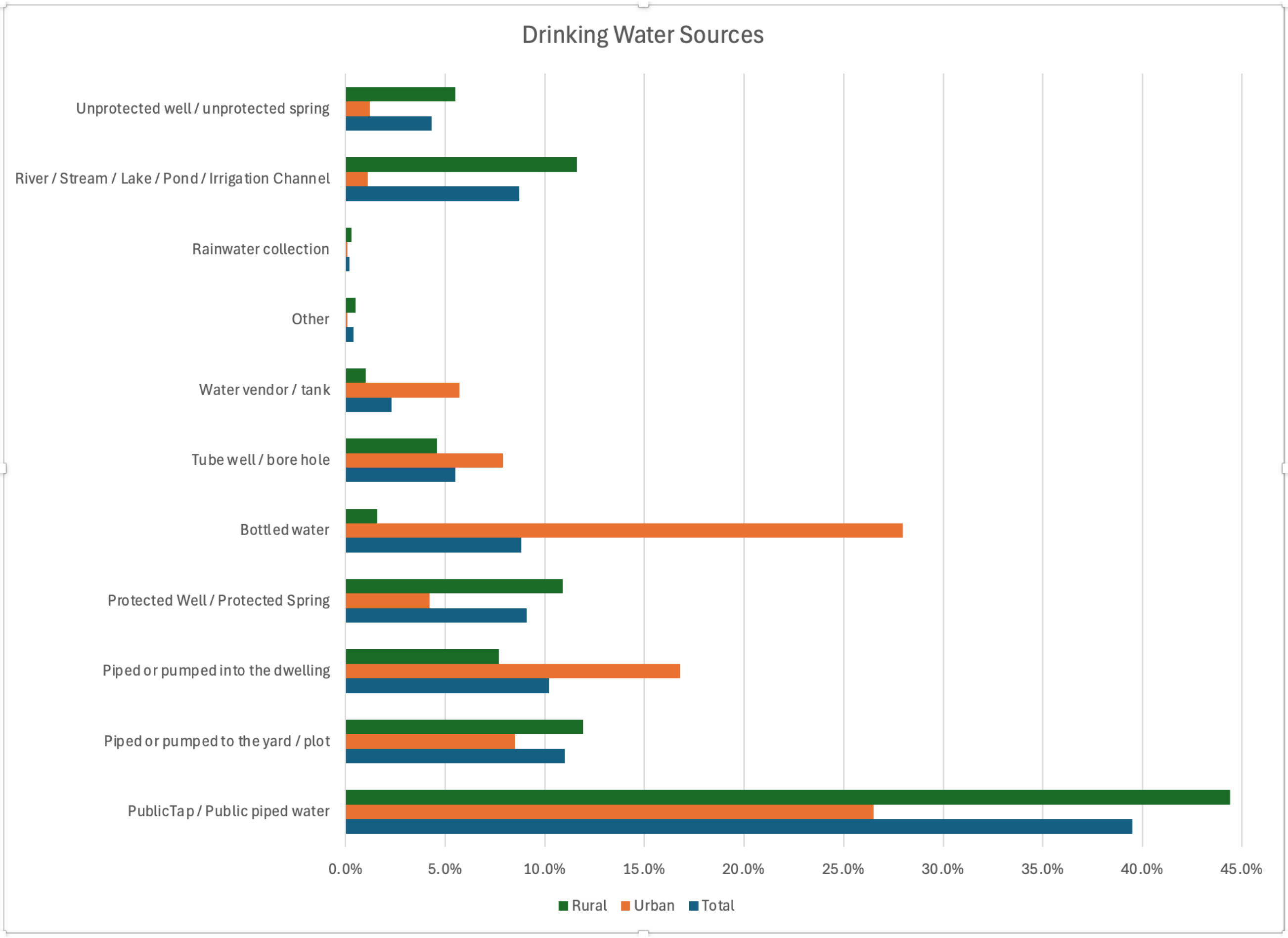


Figure 6-14: Occupied housing units, by type of drinking water source and by urban/rural area (Source: Adapted from INETL, I.P., 2023)

Figure 6-15, which reports on drinking water sources, indicates that the majority of occupied housing units rely on public taps or public piped water (39.5%). Only a minority of 10.2% of all housing units have piped or pumped water in their homes, while 11.0% have a private water source in their yards. Bottled water and water delivered by water vendors account for 8.8% and 2.3% of all housing units, respectively. Additionally, 8.7% of all housing units depend on rivers, streams, lakes, ponds, and irrigation channels for their drinking water, with a higher percentage in rural areas, and 4.3% obtain their drinking water from unprotected wells and unprotected springs. Consequently, unimproved drinking water sources are utilized by 13.0% of all housing units.

As of 2024, households utilizing improved drinking water sources constitute 87% of the population, with 98% residing in urban areas and 82% in rural areas (UNICEF Timor-Leste Annual Report 2024). This data indicates a substantial enhancement in the accessibility of improved drinking water sources for both urban and rural regions in comparison to 2022.

Sanitation

Sanitation coverage in Timor-Leste is comparatively low. Similar to clean water, sanitation is categorized based on identifying sanitation services for improved and unimproved sanitation facilities. Improved facilities are those that separate human excreta from human contact, while unimproved facilities do not separate excreta from human contact. Improved facilities include flush and pour flush toilets connected to sewers, septic tanks, or pit latrines (wet facilities), ventilated improved pit latrines, pit latrines with slabs, and composting toilets (dry facilities).

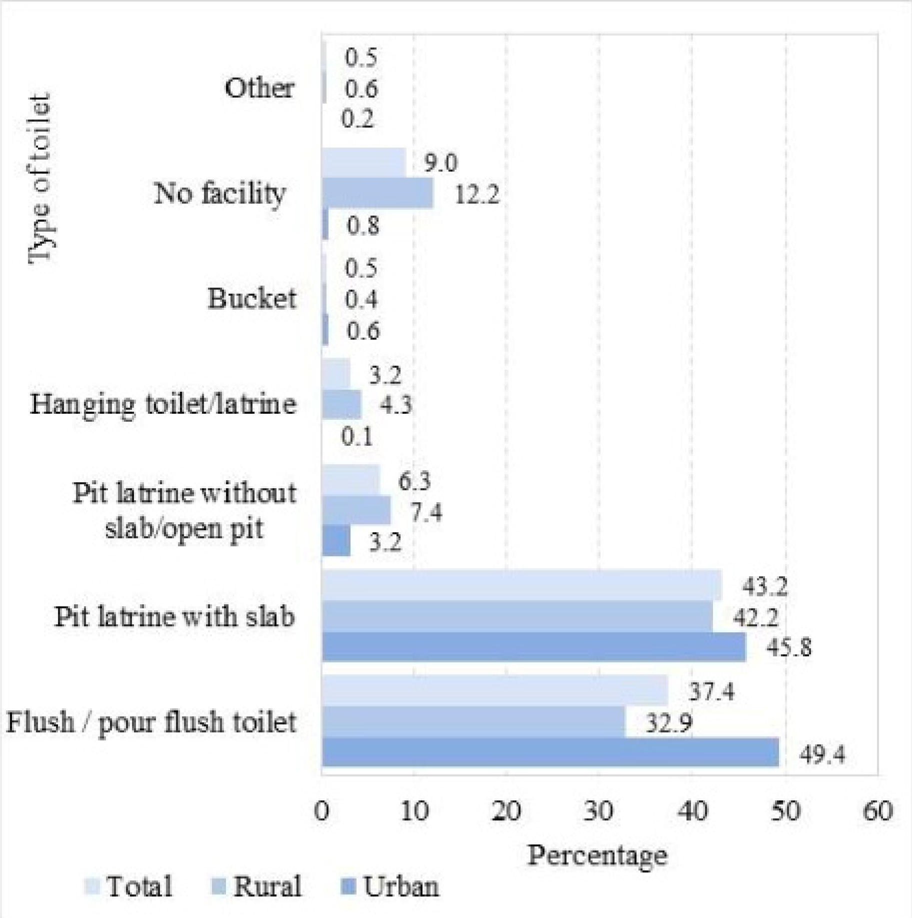


Figure 6-15: Occupied housing units by type of toilet, and by urban/rural location (in percentage). (Source: INETL, I.P., 2023)

Figure 6-15 indicates that the majority of housing units in Timor-Leste either have a pit latrine with slab (43.2%) or a flush or pour flush toilet (37.4%). Notably, nine percent of all housing units lack toilet facilities and resort to open defecation in various locations, including bushlands, fields, shores, oceans, rivers, ponds, and lakes. This practice is more prevalent in rural areas. According to the UNICEF 2024 annual report, there has been a substantial improvement in sanitation, with approximately 58% of households benefiting from improved sanitation facilities, comprising 72% of urban households and 52% of rural households.

Electricity Access

Timor-Leste has achieved a national electrification rate of 100% since 2023, as reported by the World Bank Group (Figure 6-16). This accomplishment underscores the government's substantial efforts to expand electricity access throughout the nation. This achievement aligns with the National Strategic Development Plan (2011–2030), which emphasizes universal access to reliable, 24-hour electricity by 2030. The plan underscores rural electrification as a crucial component of sustainable development, aiming to reduce disparities and foster economic growth throughout Timor-Leste.

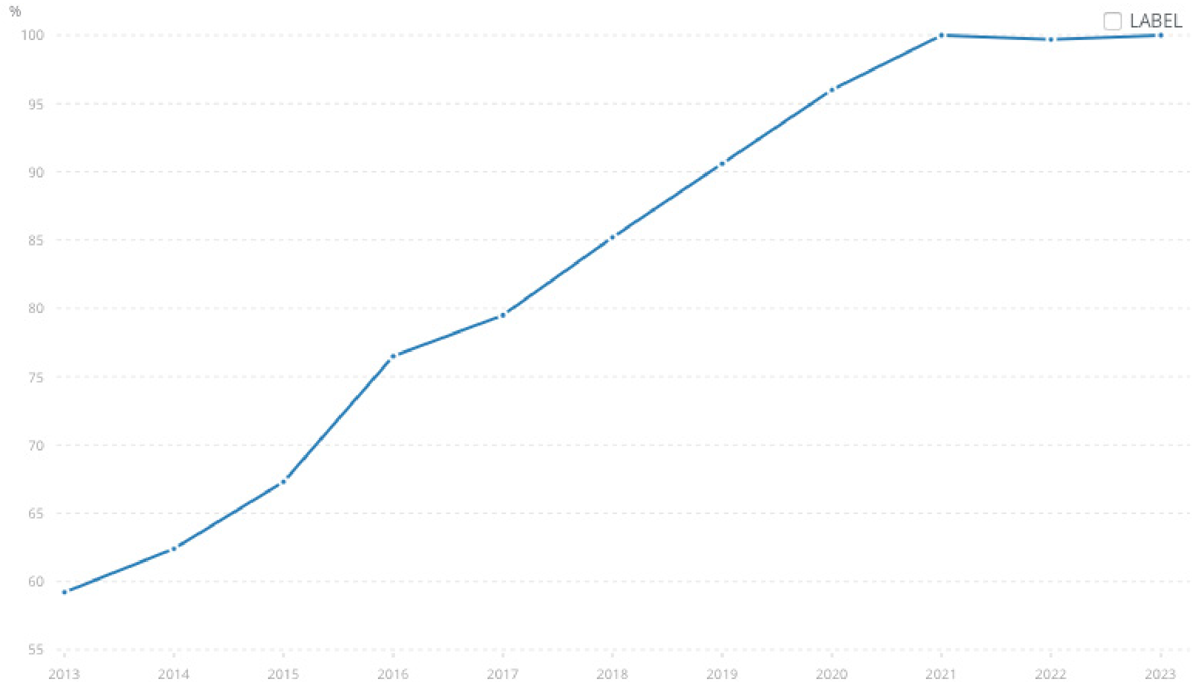


Figure 6-16: Percentage of Timor-Leste's population with access to electricity over the span of 10 years. (Source: World Bank Group, 2021)

Despite these advancements, challenges persist, as nearly all electricity generated from diesel or other fossil fuels. The recent conflict in the Middle East and the scarcity of petroleum products have significantly impacted electricity accessibility. Furthermore, due to limited infrastructure and access to power grids in rural areas, the government and international organizations have implemented targeted initiatives. For instance, the United Nations Development Programme's Accelerating Clean Energy Access to Reduce Inequality (ACCESS) project, funded by the Korea International Cooperation Agency, has been instrumental in improving energy access for vulnerable communities. Between 2020 and 2023, the project concentrated on enhancing sustainable electricity access in 25 villages across the Atauro, Bobonaro, and Manatuto municipalities, with the objective of enhancing livelihoods and reducing energy inequality.

The United Nations Sustainable Development Goals (UNSDGs) Solar-Powered UN House project underscores Timor-Leste's dedication to adopting greener and more sustainable energy solutions. This initiative demonstrates the potential of renewable energy sources, particularly solar power, to mitigate chronic energy challenges and diminish reliance on costly and environmentally detrimental diesel generators (UNSDG Solar-Powered UN House). The government is actively promoting renewable energy technologies, such as micro-hydro, solar panels, and biofuel generators, particularly in underserved regions. Communities are encouraged to adopt these solutions, which provide opportunities to generate surplus energy for sale to the national grid.

Although Timor-Leste has made significant strides in electrification, sustained efforts are imperative to guarantee the reliability, accessibility, and longevity of electricity, particularly in remote regions.

6.5.3 Health Status

Timor-Leste's health status in 2026 is marked by substantial and persistent challenges, including elevated malnutrition rates, high maternal mortality rates, and restricted healthcare accessibility. The Ministry of Health (MoH) administers the healthcare system in Timor-Leste, delivering public healthcare services through a decentralized network of facilities. These facilities include:

- National and referral hospitals
- Municipal health centers

- Community health posts (SISCa - Serviço Integrado de Saúde Comunitária)

International partners such as the World Health Organization and UNICEF support service delivery, disease control programs, and health system strengthening.

Healthcare services are predominantly publicly funded and free at the point of use. However, access remains uneven, particularly in rural and remote areas.

Life Expectancy

Life expectancy in Timor-Leste has experienced substantial improvement, reaching approximately 68 years as of 2021, a notable increase from the 62.9 years recorded in 2000. This progress can be attributed to advancements in healthcare, education, and living conditions within the country. However, despite these gains, life expectancy in Timor-Leste still falls below the global average, which stood at 71.4 years in 2021, as reported by the World Health Organization (WHO).

The observed improvements are attributed to investments in public health infrastructure, vaccination programs, and the subsequent reduction in infant and maternal mortality rates. Nevertheless, certain challenges persist, such as limited access to healthcare in remote areas, nutritional deficiencies, and the substantial burden associated with communicable and non-communicable diseases. Consequently, sustained efforts in addressing these issues are paramount to narrowing the gap with the global average.

Healthcare Access

Timor-Leste grapples with substantial challenges in guaranteeing equitable healthcare access, particularly for rural communities. While healthcare infrastructure is concentrated in urban centers such as Dili, rural and remote areas continue to be underserved. This geographical disparity significantly impacts access to skilled healthcare professionals. Notably, only 40% of births in rural areas are attended by skilled health personnel, in contrast to 85% in urban settings.

Resource and Workforce Challenges

Health facilities in Timor-Leste frequently operate with constrained resources, including inadequate medical equipment, vital medications, and infrastructure such as potable water, electricity, and transportation services. Rural health posts, which typically serve as the initial point of care for numerous communities, are particularly vulnerable to these shortages.

Furthermore, the nation grapples with a critical shortage of skilled healthcare professionals, encompassing doctors, nurses, and midwives. This shortage is exacerbated by challenges in recruiting and retaining qualified staff in rural areas. Many healthcare workers gravitate towards urban settings due to improved living conditions, professional opportunities, and access to education for their families.

Maternal and Child Health

Maternal and child health indicators underscore the imperative for targeted interventions. While significant progress has been achieved since independence in 2002, maternal mortality persists at a high level, with 192 maternal deaths per 100,000 live births in 2023 (WHO, 2023). Neonatal and under-five mortality rates also exhibit elevated levels, reaching 22.6 per 1000 live births and 51.42 per 1000 live births, respectively. These disparities can be attributed to limited access to antenatal care, skilled delivery services, and postnatal care (WHO, 2023).

Despite Timor-Leste's substantial progress in reconstructing its healthcare system since independence, substantial disparities persist. Securing universal healthcare access necessitates consistent investments in health infrastructure, human resources, and community engagement initiatives. Addressing these challenges is paramount to enhancing health outcomes, particularly for women and children residing in rural regions.

6.5.4 Education

Timor-Leste's educational system comprises pre-primary education, which spans from three to five years of age; six years of primary education, from six to eleven years of age; followed by three years of pre-secondary education, from twelve to fourteen years of age; and finally, three years of secondary education, from fifteen to seventeen years of age. This comprehensive curriculum concludes in twelve years of formal schooling.

According to the 'Situation Summary and Identification of Challenges' in the Education Sector Plan (ESP) 2020 – 2024, the country had 374 pre-primary schools, 1,282 primary schools, with 1,093 being public schools and 189 being private schools.

Timor-Leste Population and Housing Census 2022 shows that 54.6 percent of 3 to 29 years old population are actively attending school which consist of 55.7 percent females and 53.6 percent males (Table 6-3).

Table 6-3: Percentage of Population aged 3-29 years old attending school. (Source: INETL, I.P., 2023)

Education Level	Age Group	Total	Male	Female
	Years old	*Percentage*	*Percentage*	*Percentage*
Total		54.6	53.6	55.7
Pre-Primary	3 - 5	20.3	19.2	21.5
Primary	6-11	79.9	78.8	81.1
Pre-Secondary & Secondary	12-17	83.0	81.1	85.1
Higher Education	18-29	33.4	32.4	34.0

The statistics presented in Table 6-3 for children aged 3 to 5 years reveal a concerning disparity in early childhood development enrolment rates in Timor-Leste. In tertiary education, the net attendance ratio was 33.4%.3%, suggesting that a limited percentage of the population pursued higher education, as most higher education institutions are located in Dili. Notably, there has been a significant improvement in the education sector, with a higher percentage of female students attending school compared to males. This indicates equal access to education regardless of gender.

In addition, the Timor-Leste government has pledged to support students through initiatives through the Human Capital Development Fund. This fund allocated at least $150,000 in 2023 to assist up to three Timorese students in pursuing studies in the United States. Furthermore, the government collaborates with development partners to support students studying in Europe, Australia, New Zealand, China, Japan, and other countries. These collaborative efforts between the government and international partners aim to develop a skilled workforce capable of contributing to Timor-Leste's ongoing development, aligning with the educational objectives outlined in the SDP 2011–2030.

Despite these advancements, several challenges persist. A significant issue is the shortage of qualified teachers; many educators have only completed secondary education, with only half meeting the minimum qualifications for teaching. Infrastructure deficits and limited access to clean water and sanitation further hinder educational access, particularly in rural areas. Ageing facilities, insufficient classrooms, and limited educational resources contribute to high dropout rates and absenteeism. Additionally, language diversity poses challenges, as instruction is primarily in Portuguese and Tetum, which may not be the first languages of many students.

Government initiatives and international partnerships are being implemented to address the challenges facing education in Timor-Leste. These efforts focus on improving teacher training, updating curricula, and enhancing educational infrastructure. However, sustained investment and comprehensive strategies are crucial to overcome these obstacles and guarantee quality education for all Timorese children.

6.5.5 Religion

Timor-Leste does not have an official state religion, and the government respects diverse religious perspectives. The Catholic Church has historically held significant influence over Timor-Leste’s religious landscape, particularly due to Portuguese colonial rule. Protestantism, Animism, and Islam are also practiced by Timorese individuals. Notably, Animism is deeply ingrained in Timorese culture, with traditional animistic beliefs and practices persisting in certain rural areas. However, it is essential to recognize that Animism is primarily a cultural phenomenon rather than a formal religion.

6.5.6 Social Structures and Local Governance

Timor-Leste’s community structures are profoundly influenced by traditional systems, with customary practices (“adat”) playing a pivotal role in fostering social cohesion and conflict resolution. Local governance is structured through village-level councils (“sucos”), which are crucial for implementing development initiatives and resolving disputes. These councils collaborate with formal administrative systems established by the national government, thereby ensuring localized decision-making and community engagement.

6.6 Cultural Components

Cultural traditions are normally closely tied to mythology and intergenerational oral transmission, with animist spiritual elements (“Luliks”) associated with places/objects such as wells, streams, stones, and animals.

Important cultural expressions include Tais weaving (traditional textiles used in social, ceremonial and ritual contexts) and dance/music traditions such as Likurai, with the context noting historical influences linked to Portuguese and Indonesian periods.

6.6.1 Cultural Heritage

Cultural heritage encompasses maritime heritage, traditional fishing practices, and indigenous knowledge systems related to land and sea usage. Individuals often engage in customary rituals prior to ocean activities.

In the context of this project, there are “no known significant heritage or archaeological sites, shipwrecks, or marine heritage sites” within proximity, as the activities are conducted offshore, away from the coast of Timor-Leste.

6.6.2 Archaeological and Historical Sites

Historically, archaeological and historical accounts have depicted cultural patterns, particularly religious influences and cultural adaptations, resulting from Portuguese occupation and Indonesian cultural influences (in music, dance, and customs).

However, for the project-specific context, there are no known archaeological or historical sites in the vicinity. This is because the activities are conducted offshore, far from the coast of Timor-Leste.

6.6.3 Sacred Sites

In this project-relevant context, there are no known sacred sites in the vicinity, as the activities are conducted offshore, away from the coast of Timor-Leste.

6.6.4 Unique Landscape

In this project-specific context, the surrounding landscape presents unique features due to the offshore nature of the activities, which are situated away from the coast of Timor-Leste.

7. CLIMATE CHANGE

This section outlines climate change parameters relevant to the development within PSC 19-11, which includes the Kuda Tasi and Jahal oil fields. Development is planned via a FPSO with associated subsea infrastructure. The information is based on the Kuda Tasi and Jahal Metocean Study by ABL Group for Finder.

7.1 Historic Weather Observations and Trends

The Timor and Arafura Seas have a tropical maritime climate, dominated by the seasonal north–south movement of the Inter-Tropical Convergence Zone (ITCZ), with two main seasons: the northwest monsoon from November to March and the southeast monsoon from April to September. Short transitional periods occur in April and September/October, and tropical cyclones are common during the summer months.

7.2 Future Projections Under Projected Climate Change

7.2.1 Temperature

Climate change models project a significant rise in air and sea surface temperatures in the Timor Sea. Mid-century temperatures between 2041 and 2070 could increase by 1.5 to 3°C under the moderate RCP4.5 scenarios, while temperatures under the high-emission RCP8.5 could go up as high as 4°C. Such temperatures could affect operational performance and integrity, worker safety and cumulative climate risks as well as cause changes in marine life and habitats and the movement of species distribution.

7.2.2 Rainfall

Projections indicate that rainfall in the Timor Sea region is likely to be heavier, more variable and with a greater likelihood of extreme events. Wet season rainfall is likely to increase, and dry season rainfall decrease, with the latter being associated with greater variability. This may impact on offshore operations, drainage and water management, spill risk considerations and extreme weather interaction too.

7.2.3 Wave

Climate change may increase wave heights and storm surge frequency in the future, especially during the wet season as the monsoons are stronger. Higher waves can cause a greater risk of damage to offshore infrastructure like drilling rigs and platforms, a greater risk of spills, and a greater risk to worker health and safety conditions. There is a fair probability that periods of calm during the dry season will persist, although the overall energy due to wave action can be expected to increase with increased storm frequency.

7.2.4 Currents and Tides

Changes in projected global ocean circulation patterns, including the Indonesian Throughflow, are likely to alter the speed and/or direction of the currents at present experienced in the Timor Sea. Such changes would influence infrastructure loading and operability, drilling and marine operations, dispersion modelling and also the migration of marine species. The tidal patterns are likely to remain about the same, although local effects of sea level rise may alter tidal ranges in specific areas.

7.2.5 Sea Level

Sea level rise is likely to continue to accelerate, with a gain as high as 0.5 meters towards the end of the century under the high-emission variant scenario. Higher sea levels and storm surges might raise the vulnerability of infrastructures, marine operations and access, emergency response and spill preparedness. Sea level rise would also likely result in the increased flooding and erosion of coasts along Timor-Leste.

7.3 Climate Implication of the Proposed Project or Environment

Table 7-1: Summary of Climate Change implications on the proposed project and impact on the wider environment

Climate Impact sources	Impact Projection Analysis	Potential Impact on Project	Implication on Wider Environment
Waves	• Increase wave heights • Increased storm surge frequency	• Infrastructure operability. • Increased risk of damage to infrastructure. • Increased worker health and safety risk. • Increased risk of spills.	• Effects of increased storm and hazardous wave conditions on coastal communities and livelihood. • Increased safety risk.
Currents and tides	• Changes in global ocean circulation patterns. • Potential changes to the Indonesian Throughflow speed/direction.	• Infrastructure operability. • Dispersion modelling. • Migration of marine species.	• Effects of sea level rise may alter tidal ranges in specific coastal areas.
Temperature	• Increased temperature • Increase in sea-surface temperature • Increase evaporation • Increase humidity • Heatwaves	• Operational performance and integrity • Worker health and safety • Cumulative climate risks • Changes in marine species and migration patterns.	• Potential impacts on human health due to heatwaves, i.e. dehydration, fatigue • Potential increase in energy consumption due to cooling system • Acceleration of coral bleach, ocean acidification, and stress on coral reefs. • Drought effects on water storage and soil fertility
Rainfall	• Rainfall will be more variable - heavier in wet season (increased risk of flooding), less in dry season, (increased risk of droughts). s More extreme weather events e.g. cyclones	• Risk of damage to infrastructure • Effects on operationality due to extreme weather delays, e.g. mobilization, drilling activity.	• Increased risk of flooding. • Increased risk of drought.
Sea-Level	• Sea level increase risk of cyclone and storm surges • Physical changes to coastal zones	• Increased vulnerability of marine ecosystems. • Increased vulnerability to spills. • Increased vulnerability of workers health and safety, marine operations and access • Increased risk of damage to offshore infrastructure.	• Impacts to the physical coastal zones – inaccessible or unsafe • Increases impacts caused by cyclone-induced storm surge. • Increased impacts on coastal ecosystems e.g. mangroves • Increased in saltwater intrusion. • Increased vulnerability to storm surges and damage to coastal infrastructures. • Increased flooding and erosion of coasts along Timor-Leste.

7.4 Measures and Mitigations

Measures and mitigation strategies will be implemented to reduce climate-related risks to the Project and ensure operational resilience under plausible future climate scenarios. This will include ongoing monitoring of relevant environmental and oceanographic conditions, such as temperature, rainfall, sea state, currents, tides and extreme weather patterns, to inform adaptive management throughout the Project lifecycle. Climate projections and updated environmental datasets will be periodically reviewed to confirm that risk assessments, design assumptions and operational controls remain appropriate over the anticipated operational life of the development.

Operational and engineering measures will be incorporated to improve resilience to extreme weather and changing marine conditions. These may include climate-informed design criteria for offshore and coastal infrastructure, contingency planning for tropical cyclones and severe weather events, adaptive scheduling of marine activities during adverse conditions, and emergency preparedness procedures for reduced operability windows or environmental incidents. Inspection, maintenance and integrity management programs will also be implemented to address potential increases in environmental loading, corrosion risks and equipment performance issues associated with changing climatic conditions.

Environmental management measures will seek to minimise potential impacts on marine ecosystems that may experience increased sensitivity under climate change. This will include implementation of existing impact avoidance and minimisation controls, ongoing environmental monitoring where relevant, and application of adaptive management approaches to respond to changes in ecological conditions over time. Spill prevention and response systems, discharge management, and marine environmental protections will be maintained to reduce cumulative pressures on marine habitats and species that may already be affected by warming seas, changing oceanographic conditions and sea-level rise.

Through the application of these measures, the Project will seek to maintain operational safety, environmental performance and regulatory compliance while improving resilience to projected climate-related changes in the Timor Sea region.

Each future EMP will ***describe*** measures and mitigation undertaken to reduce any climate related risk and describes the roles and responsibilities of Finder Energy and its contractors in preventing any climate related risk and environmental degradation.

8. ALTERNATIVES

8.1 Alternatives Assessment

Finder considered alternative methods of development of the Kuda Tasi and Jahal oil fields. The fields locations ~150m south off the coast of Suai and water depths of 400m were important factors in reaching the conclusion that a centrally moored FPSO with subsea production systems, umbilicals, risers and flexible flowlines was the most appropriate development concept, and the only economic method to develop the fields.

The water depth precludes a feasible platform solution, and subsea developments in the region are suited to FPSO historically and supported by the low well count for the two fields. Reuse of a previously deployed FPSO brings environmental and economic advantages to the development concept.

The development options alternatives assessment has been undertaken using a qualitative multicriteria framework that considers environmental, technical, safety and economic factors. The KTJ development has several development elements that were considered during the concept selection phase, these include:

- Production, Storage and Offtake Facility
- FPSO location
- XT location
- Reservoir Well Orientation
- Drilling Fluids
- Artificial Lift
- Gas Handling
- Water Handling
- Lower completions
- Flowlines
- Chemical selections
- Approach to decommissioning

Each of these development option elements have alternative solutions. Each solution option was assessed and evaluated against the following multi factor criteria to demonstrate that the preferred development option represents an outcome where environmental risks have been reduced to ALARP while remaining technically and economically viable:

- HSE (Health, Safety, Environment)
- Economic
- Technical (including expandability)

This EIS assesses the impacts of the intended field development option. This work will assist to confirm the selected development option acceptable HSE risk profiles, and integrate with the field development multi factor analysis. Where detailed design information is not yet available, conservative assumptions and industry standard practices have been applied to enable meaningful assessment of the intended field development at the EIA stage.

Further detail is provided in the KTJ Field Development Plan.

A “no project” alternative has been listed to provide regulatory context, noting that while this option would avoid project related impacts, it would not meet the project objectives or Timor-Leste's national resource development goals.

Table 8-1: Assessment of Project Alternatives – KTJ Development

Project Element	Alternatives Considered	Environmental Considerations	Technical & Safety Considerations	Economic / Operational Considerations	Preferred Option	Justification for Selection (ALARP)
Production, Storage & Offtake Facility	FPSO with subsea wells; Fixed platform; tension leg platform (TLP)	FPSO redeployment – lower GHG impact. FPSO interaction with seabed only via mooring system. Reduced nearshore impacts	Water depth (~400–450 m) unsuitable for fixed platform; TLP not used in region and well count too small; FPSO proven in Timor Sea	Lower CAPEX; faster delivery; reuse of existing FPSO	FPSO with subsea tie-backs	Limited seabed footprint and construction impacts while meeting technical and safety requirements
FPSO Location & Mooring configuration	Alternative FPSO locations and mooring layouts	Mooring system footprints; interaction with benthic habitats; exclusion zones - Minimal flowline lengths – reduces seabed interaction	Station-keeping, cyclone response, marine safety, flow assurance	Installation feasibility; operational efficiency	Selected central FPSO location with turret mooring	Balances operational efficiency with minimised seabed disturbance; impacts confined to approved footprint
Subsea Infrastructure Locations	Alternative well, flowline and ESP layouts including grouping	Seabed disturbance extent; avoidance of sensitive habitats	Well access, drilling efficiency, integrity	Reduced tie-back lengths; simplified installation	Drill-centre wells at Kuda Tasi, with shared subsea systems	Minimises total footprint, vessel movements and seabed disturbance
Artificial lift	Gas lift; natural flow; downhole ESP; seabed ESP	Emissions profile; energy use	Reservoir performance (oil EUR); artificial lift reliability	Complexity; lifecycle costs	Seabed ESP-based artificial lift	Suitable for reservoir conditions; avoids additional gas infrastructure; lower ESP replacement cost utilising vessel rather than downhole ESP which required MODU intervention
Flowline & Umbilical Routing	Multiple routing corridors	Disturbance footprint; sediment resuspension	Installation feasibility; integrity	Length optimisation	Selected shortest practicable routes	Minimises seabed disturbance and installation duration
Flowline Materials	Flexible flowlines; rigid steel	Longevity; interaction with seabed	Fatigue resistance; installation safety; tieback distance	Industry availability; cost	Flexible flowlines	Proven performance in similar water depths;

						reduced installation risk
Flowline Protection	Trenching; rock dumping; mattresses; none	Sediment disturbance; habitat effects	Asset protection; safety	Installation effort	Protection where required only	Protection applied proportionate to risk, avoiding unnecessary disturbance
Riser Systems	Flexible riser; steel catenary riser	Localised seabed interaction	Fatigue, safety, operability; water depth	Constructability	Flexible riser	Proven FPSO solution with reduced seabed impact suitable to this water depth
Gas Handling	FPSO fuel & limited flaring; Gas reinjection; Gas export	Air and light emissions; GHG contribution	Utilisation of the gas resource	Operational feasibility; Insufficient gas for commercial – pipeline or sales – utilise the gas to minimise imported diesel use	Use gas as FPSO fuel, with limited flaring associated with excess gas FPSO ground flare reduces environmental impact compared to flare stack due to flare visibility	Gas resource utilised for power generation reduces excess gas flared
Produced Water Handling	Reinjection; overboard discharge once cleaned to acceptable industry standard	Marine exposure; water quality	Reservoir limits and pressures; system reliability and required pumping pressure	Energy demand; process cost and complexity	Overboard discharge once cleaned to acceptable industry standard	. Proven industry solution internationally and historically in Timor Leste. Meets industry best practice standard
Chemical Selection	Alternative chemical products	Toxicity; persistence	Functional performance; safety	Availability	OCNS-ranked low-hazard chemicals	Use of CEFAS OCNS ensures chemicals selected minimise environmental risk
Hazardous Waste Management	Offshore handling; onshore disposal	Pollution prevention	Handling safety; compliance	Logistics	Onshore disposal where practicable	Aligns with MARPOL and best practice waste hierarchy
Decommissioning	Full removal; partial removal; leave-in-situ	Seabed disturbance; waste generation	Safety at end of field life. Feasibility of removal of items	Cost; feasibility	To be determined	Options will be assessed at COP based on best practice and ALARP. Potential use of comparative assessment method

						for decommissioning decision making.
Drilling Fluids	Water based; Synthetic based; Oil based	Drilling fluids entrained on cuttings disposed overboard with additional cuttings treatment options	Borehole stability, filter cake, mud weight, reservoir damage,	Cost and availability of drilling fluid systems	Water based mud preferred but will be confirmed in detailed engineering and EMP	Technical and environmental performance
No-Project Alternative	No development	No project-related impacts	Resource remains undeveloped	Loss of economic and energy benefits to Timor Leste	Not selected	Does not meet project objectives or national energy strategy

9. IMPACT ASSESSMENT AND CONTROL MEASURES

9.1 Introduction

The proposed activity has the potential to result in a range of environmental impacts and risks, both planned and unplanned. Planned impacts are those that are inherent to the nature of the activity and can be managed through the implementation of control measures. These may include emissions, discharges to the marine environment, and disturbance to marine fauna. Each of these potential impacts has been assessed to ensure they are understood and managed.

Unplanned events, such as spills, equipment failure, or loss of containment, also present potential environmental risks. While the likelihood of such events is considered low, their potential consequences warrant assessment and the implementation of control measures.

The following sections describe the potential environmental impacts and risks associated with the project and their associated control measures.

9.1.1 Risk and Governance Standards

Finder's Risk and governance Standard Business Management System (BMS) process is implemented throughout the organisation to apply a standard risk identification, assessment and treatment procedure across all Finder facilities and activities to manage risk. This risk management process provides a corporate-level framework for the management of all risks and has been designed to be consistent with the risk management requirements of ISO 31000:2018 – Risk Management (principles, framework and process) and ISO 14001:2015 – Environmental Management Systems (identification and evaluation of environmental aspects and impacts). The process addresses risks from incidents (events), activities and ongoing practices and applies to all activities under Finder's operational control.

It is often not possible to eliminate a risk entirely, so it is appropriate for Finder to ascertain the level of residual risk acceptable to its business and stakeholders, while continuously improving controls and reducing risk to as low as reasonably practical (ALARP).

The Risk Management process will follow the procedure outlined in the ISO 31000:2018 Risk Management standard as outlined in Figure 9-1.

These frameworks provide a consistent basis for defining consequence categories, significance thresholds, and evaluation criteria, ensuring the assessment is systematic, transparent and defensible.

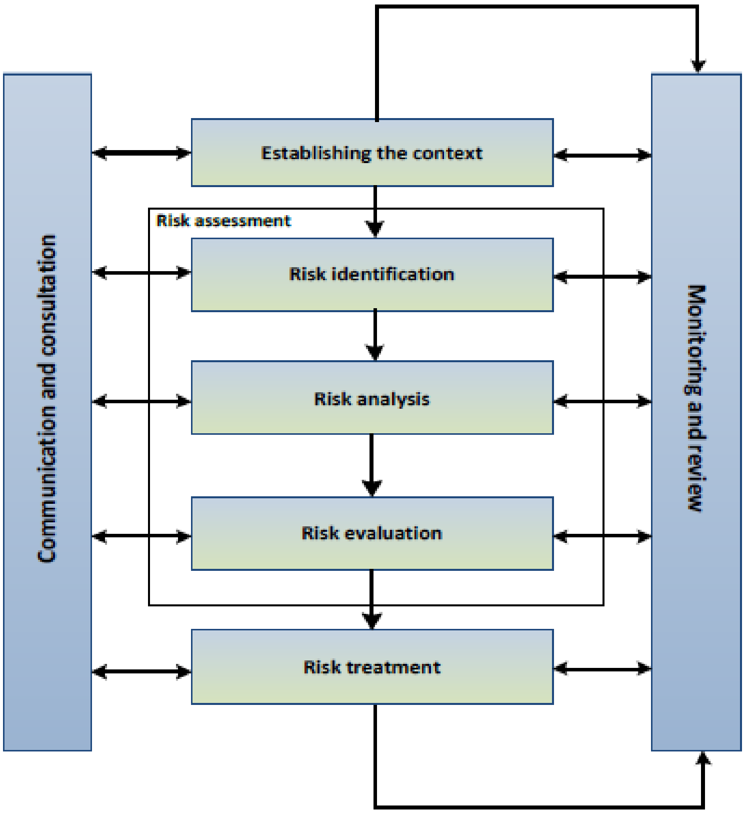


Figure 9-1: Risk Management Standard

9.2 Methodology and Approach

9.2.1 Risk Assessment

The risk assessment process evaluates impacts and risks associated with planned and unplanned events that will or have the potential to impact the environment. Impacts and risks are identified through an environmental risk identification workshop (ENVID).

The risks are identified by first understanding the proposed activity, and the existing environment and follow industry best practice for impact assessment.

Risks are assessed before and after controls and mitigations are applied using the risk evaluation criteria provided in

Table 9-1. For the purposes of the EIA, the environmental consequence is the main criterion considered for each of the identified aspect though people and reputation categories may also be relevant (for example when considering other users of the sea).

Both planned events that will occur during the activity, and unplanned events that could occur and result in an environmental consequence are considered in the ENVID.

Finder determines an acceptable level of risk for an activity as being a risk rating of low or moderate (i.e. green/ yellow), and an unacceptable level of risk as being high or extreme (i.e. orange or red) as per Figure 9-3. Finder requires that all practicable steps to reduce and manage risks are taken and use this heat map to prioritise risks and their reduction.

Given the hazardous nature of Finder's operations, achieving demonstrably tolerable levels may not be possible for all risks. For operating sites, some risks are likely to be in a region where regulations require risks to be further reduced to acceptable levels. For those risks found to have an unacceptable rating, return to the planning process for the activity is required to determine if an alternative approach to undertaking the activity can be identified.

Risk treatment is the process by which the control and mitigation options applied to an initial risk are considered and selected to reduce residual risks to a level that is as low as reasonably practicable (ALARP). This is also undertaken in the ENVID workshop.

Demonstration of a reduction of risks to a level that is ALARP may require a range of detailed technical studies. Finder defines quantified risks into three regions of Individual Risk Per Annum (IRPA):

- Intolerable region is $> 1 \times 10^{-3}$ – risks in this region are deemed unacceptable and must be reduced
- ALARP region lies between 1×10^{-3} and 1×10^{-5} – risks in this region should be reduced to ALARP
- Tolerable region is $< 1 \times 10^{-5}$ – Finder retains a duty to ensure that all practicable steps to manage risks are taken.

These three regions are described by the following ALARP Triangle shown in Figure 9-2.

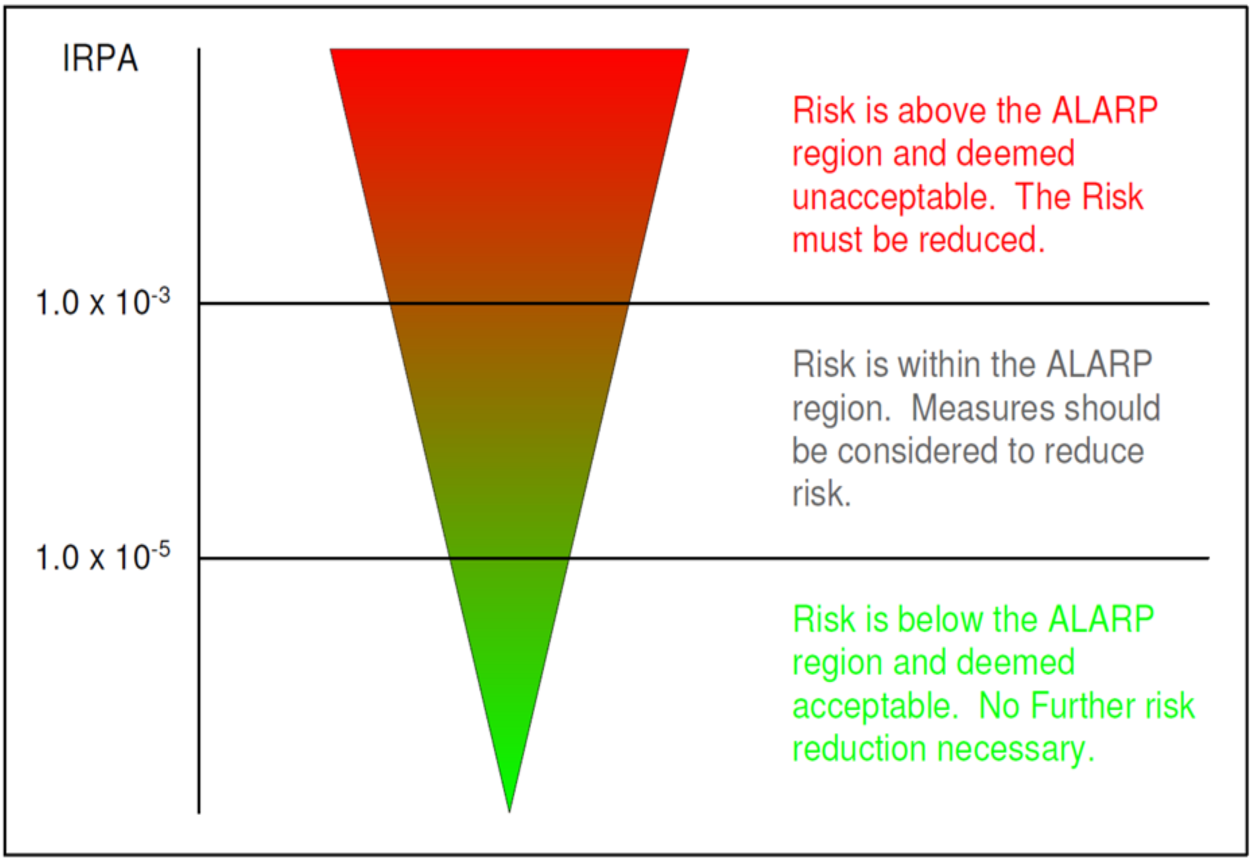


Figure 9-2: ALARP Triangle

Table 9-1: Consequence and Likelihood Rankings

Consequence	0	1 Slight	2 Minor	3 Local	4 Major	5 Extreme
Cost	Economic benefit	<$1 million	$1 – 10 million	$10 – 25 million	$25 – 100 million	$100 million
People	Beneficial effect to health	Slight health effect/illness	Minor health effect/illness	Major health effect/illness	Single fatality	Multiple fatalities
Assets	Improvement	Slight damage	Minor damage	Local damage	Major damage	Extensive damage
Environment	Beneficial effect or no effect	Slight effect – recovery in days to weeks	Minor effect – recovery in weeks to months	Local effect – recovery in months to a year	Major effect – recovery in multiple years	Catastrophic effect – recovery in decades
Reputation	Positive impact	Slight impact	Limited impact	Considerable impact	National impact	International impact
Likelihood		**1**	**2**	**3**	**4**	**5**
		Never heard of E&P industry	Heard of in E&P industry	Incident has occurred in similar E&P operations	Happens several times in a year in similar E&P operation	Happens several times a month in similar E&P operations

Heat Map

LIKELIHOOD	1	2	3	4	5
5	M	M	H	E	E
4	M	M	M	H	E
3	L	M	M	M	H
2	L	L	M	M	M
1	L	L	L	M	M

CONSEQUENCE

Figure 9-3: Risk Ranking Heat Map

9.2.2 Planned Impact Assessment

Planned impact assessment process is a three-step process:

1. Identification
2. Analysis
3. Evaluation

Identification

The planned impact assessment process was undertaken during the ENVID and includes the identification of impacts that will occur with planned activities and contingency arrangements across the entire life of the development. Planned impacts are assessed using the following guiding principles:

- Principles of ecologically sustainable development (ESD)
- Stakeholder feedback
- Reputational considerations, and
- Degree and extent of environmental perturbation.

Likelihood is not a consideration in the impact acceptability evaluation, as the impacts are planned – they will occur. This approach is consistent with international EIA practice and ensures that all planned impacts are evaluated on a consequence-only basis.

Analysis

The analysis process is used to ensure that a broad range of impact control and mitigation options are identified and that planned impacts are aggregated where the triggering event is common. This will produce impacts with multiple causes and consequences, each with controls and mitigations identified.

Impact effects may require further information during analysis (e.g. detailed modelling, stakeholder consultation, environmental evaluation) to understand aspects of the impact and the implications for risk treatments. Finder requires that all practicable steps to reduce and manage planned impacts are taken and ensure the impact is considered acceptable and ALARP.

Evaluation

All the information provided is considered, so that a consequence rating can be assigned. The final consequence rating for each aspect is provided in Table 9-2.

9.2.3 Unplanned Impact Assessment

Unplanned impact assessment is also undertaken in the ENVID workshop using the same steps as described above. However, the likelihood is also considered alongside the consequence as per

Table 9-1. The collective knowledge of the workshop participants determines the likelihood of an unplanned event occurring and having an environmental impact. The likelihood and consequence are then combined to determine the final risk rating as per the heat map provided in Figure 9-3 and summarised in Table 9-3, Table 9-4, Table 9-5, and Table 9-6.

9.2.4 Integration of Modelling and Baseline Data

Quantitative and semi-quantitative tools will be used, where appropriate, to support robust risk evaluation, including:

- Environmental baseline data (e.g. seabed characteristics, water quality, ecological information);
- Modelling studies (e.g. oil spill modelling, dispersion modelling, where relevant);
- Engineering calculations and design standards; and
- Findings from ENVID workshops, involving multidisciplinary technical, environmental and operations specialists.

These tools inform both the consequence magnitude and the spatial and temporal extent of impacts.

9.2.5 Identification of potential environmental and social impacts

The ENVID is conducted to identify impacts and risks arising from every component of the project—including drilling, surveys, subsea installation, FPSO operations, logistics, and support activities.

This includes both planned environmental impacts (e.g., noise, light, discharges, seabed disturbance) and unplanned events (e.g., spills, marine pest introduction, interactions with fauna, dropped objects).

An initial ENVID was attended in December 2025 by members of Finder Energy that have relevant technical knowledge and experience in the activities being assessed as well as environmental specialists MCC Sustainable Futures and Halona Serena. A second ENVID was completed in March 2026 for assessment of worst case hydrocarbon spills, based on preliminary modelling results.

During the ENVID, the impacts and risks were determined using the Finder risk matrix as described above. In addition, appropriate control measures to treat the events were identified. The ranking for each planned event is summarised in Table 9-2, and unplanned events in the subsequent tables for the various phases of the project.

Initially, a desktop literature review and gap analysis has been undertaken to understand existing environmental conditions (baseline) within the Study Area and to inform the ENVID and this EIS .Should the EBS identify any material differences from information used to undertake impact assessment in the initial EIA, Finder commits to updating the EIA and the Environmental Monitoring and Management Plans accordingly, ensuring all mitigation and monitoring measures reflect validated baseline conditions and maintain impacts and risks at ALARP by revieing the ENVID outputs.

9.3 Environmental Impact Summary

Table 9-2: Consequence (Impact) Ranking for Planned Events

Planned Event	Surveys	Drilling	Installation & Commissioning	Operations
Seabed and Benthic Habitat Disturbance	1 Slight	2 Minor	3 Local	2 Minor
Light Emissions	1 Slight	1 Slight	1 Slight	1 Slight
Noise Emissions	1 Slight	2 Minor	2 Minor	2 Minor
Atmospheric Emissions	2 Minor	2 Minor	2 Minor	2 Minor

Interaction with Other Users	3 Local	3 Local	3 Local	3 Local
Operational Discharges	2 Minor	2 Minor	2 Minor	2 Minor
Drilling Discharges	N/A	3 Local	N/A	N/A

Table 9-3: Risk Ranking for Unplanned Events – Surveys

Unplanned Event	Consequence	Likelihood	Ranking
Marine pest introduction	4 Major	2	Medium
Interaction with fauna	2. Minor	2	Low
Interaction with others (IUU and FADS)	2. Minor	2	Low
Unplanned release of solids (small objects)	1. Slight	4	Medium
Unplanned release of solids (large objects)	2. Minor	2	Low
Unplanned release of (non-hydrocarbon) liquids	1. Slight	3	Low
Unplanned release of hydrocarbons (diesel) – vessel collision	2. Minor	2	Low

Table 9-4: Risk Ranking for Unplanned Events – Drilling

Unplanned Event	Consequence	Likelihood	Ranking
Marine pest introduction	4. Major	3	Medium
Interaction with fauna	2. Minor	2	Low
Interaction with others (IUU and FADS)	2. Minor	2	Low
Unplanned release of solids (small objects)	1. Slight	4	Medium
Unplanned release of solids (large objects)	2. Minor	2	Low
Unplanned release of (non-hydrocarbon) liquids	1. Slight	3	Low
Unplanned release of hydrocarbons (diesel) – vessel collision	2. Minor	2	Low
Unplanned release of hydrocarbons (crude) - LOWC	4. Major	3	Medium

Table 9-5: Risk Ranking for Unplanned Events – Installation and Commissioning

Unplanned Event	Consequence	Likelihood	Ranking
Marine pest introduction	4. Major	3	Medium
Interaction with fauna	2. Minor	2	Low
Interaction with others (IUU and FADS)	2. Minor	2	Low
Unplanned release of solids (small objects)	1. Slight	4	Medium
Unplanned release of solids (large objects)	2. Minor	2	Low
Unplanned release of (non-hydrocarbon) liquids	1. Slight	3	Low
Unplanned release of hydrocarbons (diesel) – vessel collision	2. Minor	2	Low

Table 9-6: Risk Ranking for Unplanned Events – Operations

Unplanned Event	Consequence	Likelihood	Ranking
Marine pest introduction	4. Major	2	Medium
Interaction with fauna	2. Minor	2	Low
Interaction with others (IUU and FADS)	2. Minor	2	Low
Unplanned release of solids (small objects)	1. Slight	4	Medium

Unplanned release of solids (large objects)		2. Minor	2	Low
Unplanned release of (non-hydrocarbon) liquids		1. Slight	3	Low
Unplanned release of hydrocarbons (diesel) – vessel collision		2. Minor	2	Low
Unplanned release of hydrocarbons (crude) - LOWC		4. Major	3	Medium
Unplanned release of hydrocarbons (crude) – FPSO	Offtake tank rupture (FPSO cargo tank rupture - 45,000 barrels (7154m^2))	4 Major	2	Medium
	Release during offtake bunkering (not modelled). Volume TBC	1 Slight	3	Low
Unplanned release of hydrocarbons (crude) – flowline rupture		3 Local	2	Medium

9.4 Control Measures

Table 9-7, Table 9-8, and Table 9-9 provide a summary of the Activity, Impact and Control Measures for the proposed Activity.

9.4.1 Surveys – Planned and Unplanned Events

Table 9-7: Control Measures – Surveys

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
Planned Events				
Seabed and benthic habitat disturbance	Disturbance to the seabed from vessel and survey activities.	Temporary or permanent direct loss of benthic habitat and associated biota. Temporary and localised increase in water turbidity as a direct result of sediment disturbance.	Direct	Monitor inventory deployed to the field and track removal of equipment during activity.
				Position of infrastructure not on any sensitive seabed features (as informed by EBS)
				Equipment installed at pre-approved locations within Development Area
Light emissions	Artificial lighting: Navigational and deck lighting on the support vessels will generate light emissions.	Disorientation, attraction or repulsion. Disruption to natural behavioural patterns and cycles. Localised light glow may attract light-sensitive species, in turn affecting predator-prey dynamics.	Direct	Lighting in accordance with COLREGS, Navigation Act 2012, vessel class requirements and in allowing safe operation and activities (including emergency lighting).
Noise emissions	Machinery and equipment operations on decks and working areas of vessels. ROV Thruster and propeller sound from vessels. Helicopter operations in emergency.	Injury to hearing or other organs. Behavioural disturbance. Masking or interfering with biologically important sounds.	Direct	Immersible equipment planned maintenance system in place to ensure it is operating efficiently and not producing excessive noise.
				Vessel planned maintenance system in place to ensure it is operating efficiently and not producing excessive noise.
				Environmental Induction includes environmental requirements as required.
				Restrict vessel operating speeds in the DA to 8 knots or less in the vicinity of whales.
				Trained crew monitor for whales during daylight hours for 30 minutes prior to commencing GP operations (only for those activities that may have behavioural impact threshold).
				Vessel planned maintenance system in place to ensure it is operating efficiently and not producing excessive noise.
			Direct	International Air Pollution Prevention (IAPP) certificate valid.

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
Atmospheric emissions	Sources of atmospheric emissions include: • Power generation and process heating; • Engine exhausts; and • Fugitive emissions. • Helicopter operation in emergencies.	Localised, and temporary decrease in air quality; and Contribution to global GHG effect.		Vessels compliant with MARPOL Annex VI. Low sulphur diesel to be used in accordance with MODU / vessel specific procedures (under IMO requirements).
Interaction with other users	The presence of the 500 m radius Petroleum Safety Zone (PSZ) for restricted and controlled vessel access. Vessel physical presence in and out of the Development Area.	Disruption to commercial activities, including: • Exclusion of commercial vessels from Development Area • Potential reduction of commercial fish catches due to exclusion from licensed permits (where relevant) • Support vessels present an obstacle and potential navigational hazard for shipping traffic *Illegal fishing captured as an unplanned event and not discussed here.*	Direct	Vessels marked on charts (500m zone) (Maritime Transport Department) communication. Relevant stakeholders (inc. AMSA) communication Vessel navigational and communication equipment installed, maintained and operated. Recovery of all deployed equipment In accordance with Regulation: Report and secure from the ANP an authorization to enter the contract area and authorisation from MTD to enter Timor-Leste EEZ water for vessels, and aircraft for the activity. Report to the ANP the position / location and activity of such vessels and aircraft. Employ radio system for real-time communication. Vessel lighting in accordance with COLREGS, Navigation Act 2012, vessel class requirements and in allowing safe operation and activities (including emergency lighting). Ongoing communications with ANP throughout operations to prevent conflicts. Communication as per stakeholder management plan which defines relevant persons, responsibilities and timeframes for notifications
Operational discharges	Liquid discharges generated from vessels and routinely discharged to the	Potential impacts to marine fauna via: • Changes to the water quality through nutrient	Direct	Oily water filtering and monitoring equipment fitted and maintained. Direct oily water from deck washing and drainage systems to an onboard oily water separator before discharge. The oil concentration in discharged water must not exceed 15ppm, in accordance with the Protection of the Sea (Prevention of Pollution from Ships) Act 1983 (MARPOL requirements).

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
	marine environment include: • Slops water (Deck drainage, bilge water, tank washing) • Cooling water • Desalination Brine • Treated Sewage • Greywater • Putrescible food waste	enrichment and increased biological oxygen demand; • Impact to predator-prey dynamics. • Changes in temperature, salinity, toxicity of water		Garbage record book maintained (MARPOL)
				Brine will only be discharged to sea if the oil-in-water content does not exceed 15ppm in accordance with Protection of the Sea (Prevention of Pollution from ships) Act 1983 D MARPOL Annex I (as appropriate for vessel classification) D Regulations for the Prevention of Pollution by oil. If brine has oil-in-water content over 15ppm, the brine will be contained and treated to <15ppm or disposed of onshore.
				All sewage to be treated and discharged in accordance with MARPOL. Implementation of a preventative maintenance schedule as per Manufacturer's specification for sewerage treatment & macerator equipment and recording in the rig maintenance management system.
				Garbage that has been ground to particles <25mm: >3NM from the nearest land in accordance to MARPOL Annex IV and Protection of the Sea (Prevention of Pollution from Ships) Act 1983, prior to discharge.
				Fuels, oils, and chemicals to be stored within contained and bunded areas and in accordance with their MSDS.
				Contaminated drainage from decks, machinery spaces or bunded areas will be treated through a MARPOL approved oily-water separator prior to discharge to achieve MARPOL oil-in-water content (15ppm).
				All chemicals planned for discharge to the marine environment will be managed as per Chemical Register and approved by ANP prior to use.
Unplanned Events				
Marine pest introduction	Potential for vessels to transfer IMS from international or Australian waters into the Development Area through ballast water or from vessel hulls	Localised impact on native marine fauna and flora, including: • Competition, predation or displacement of native species; • Alteration of natural ecological processes; • Introduction of pathogens with the potential to impact human and/or ecological health;	Direct	Legislative requirements are adhered to - biofouling and ballast.

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
		Reduction and/or competition with commercial fish and aquaculture species		
Interaction with fauna	Movement of support vessels, and helicopters in the Development Area that may physically interact with or disrupt fauna	Potential risk of ship collision with cetaceans and marine reptiles (Emergency) Helicopter strike on seabirds Behavioural changes for marine fauna	Direct	Support vessels will observe speed restrictions in Development Area and in vicinity of whales - as per noise
				Environmental Induction includes environmental requirements as required.
				Restrict vessel operating speeds in the DA to 8 knots or less in the vicinity of whales.
				Trained crew monitor for whales during daylight hours for 30 minutes prior to commencing GP operations (only for those that may have behavioural impact threshold).
				Marine fauna collisions reported to ANP.
Interaction with other users (IUU and FADS)	Movement of support vessels and helicopters in the Development Area that may physically interact with or disrupt other illegal users of the sea	Potential risk of ship collision other small fishing vessels that are illegally in the area	Direct	Relevant stakeholders communication.
				Environmental Induction will include the possibility of other illegal users
				Vessel navigational and communication equipment installed, maintained and operated.
				In accordance with Regulation: Report and secure from the ANP an authorization to enter the Development Area and authorisation from MTD to enter Timor-Leste EEZ waters for vessels and aircraft for the activity. Report to the ANP the position / location and activity of such vessels and aircraft.
				Employ radio system for real-time communication.
				Recovery of all deployed equipment
				Vessel lighting in accordance with COLREGS, Navigation Act 2012, vessel class requirements and in allowing safe operation and activities (including emergency lighting).
				Report third-party vessel entry to the area
Unplanned release of solids	Release of solid wastes may occur as a result of overfull and/or uncovered bins,	Solid waste items have the potential to pollute marine habitats and injure or kill	Direct	Waste generated during operations will be managed in accordance with the waste Management Plan
				Environmental Induction cover off waste management
				PMS on crane and lifting equipment to ensure fit for purpose

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
	incorrectly disposed items or spills during transfer of waste between vessels	fauna through ingestion or exposure. Marine fauna entanglement risk in waste plastics, which can also be ingested when mistaken as prey.		Lift plans in place for the specific activity Competent crew undertake lifts under a permit to work system Recovery of dropped objects where the environmental consequence is not negligible and it is safe to do so
Unplanned release of (non-hydrocarbon) liquids	There may be accidental releases/ discharges to the marine environment of a variety of potentially hazardous materials and chemicals (liquid) which are stored and utilised or produced on vessels/MODU/FPSO.	Localised decline in water quality Ingestion or physical contact with chemical compounds within the water column or sediment Accumulation and biomagnification of chemicals within the food chain	Direct	Bunkering and transfers will be conducted in accordance with the bunkering and transfer procedures. Spill response kits Hose integrity checks
Unplanned release of hydrocarbons (diesel) – vessel collision	Release of diesel may occur from vessel collision within the Development Area during surveys. The worst-case diesel spill scenario is due to collision of a vessel with a third-party vessel resulting in damage to a fuel oil tank and diesel released to the ocean. The maximum worst-case credible spill volume of diesel has been calculated as 400 m3 based on the largest fuel oil tank on the proposed vessels, though it is considered	Decrease in water quality Potential toxicity and smothering impacts to fauna Direct/indirect toxic or physiological effects on benthic habitats Pygmy blue whales may occur within the spill area	Direct	Shipboard Oil Pollution Emergency Plan valid and tested to ensure ability to respond to spills as required by MARPOL Vessel crew will be adequately qualified, trained, and competent in accordance with Flag State regulations, to navigate vessels Ongoing communications with ANP throughout operations to prevent conflicts. No HFO/IFO planned to be used Vessels to have stocks of spill response kits/bins available and accessible onboard to respond to an onboard spill as per their SOPEP In the event of a Tier 2 or Tier 3 oil spill implement the OPEP to reduce environmental impacts due to spill Drills and exercises undertaken in accordance with the OPEP and SOPEP Bulk liquids transferred in accordance with bulk transfer procedure to reduce the risk of a release to sea. Prevent third-party vessel entry to the immediate area unless authorised by vessel masters OPEP describes minimum competency requirements of incident response personnel

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
	more likely that smaller vessels would be used. GPGT EMP assumes no bunkering.			Vessels will be equipped with approved navigation systems in accordance with COLREGS
				Hydrocarbon and chemical storage areas will have appropriate loss prevention features such as spill containment bunds.
				In accordance with Regulations, Finder will: Report and secure from the ANP an authorization to enter the Timor-Leste EEZ waters for vessels and aircraft of which are acquired for operations. Report daily to the ANP the position / location and activity of such vessels and aircraft.
				Monitor and communicate with vessels approaching to reduce the risk of vessel collision.
				Communication as per stakeholder management plan which defines relevant persons, responsibilities and timeframes for notifications
				Development marked on charts (500m zone) (Maritime Transport Department) communication. Relevant stakeholders (inc. AMSA) communication
				Vessel navigational and communication equipment installed, maintained and operated.
				Recovery of all deployed equipment
				Vessel lighting in accordance with COLREGS, Navigation Act 2012, vessel class requirements and in allowing safe operation and activities (including emergency lighting).

9.4.2 Drilling – Planned and Unplanned Events

Table 9-8: Control Measures – Drilling

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
Planned Events				
Seabed and benthic habitat disturbance	Disturbance to the seabed from drilling activities.	Temporary or permanent direct loss of benthic habitat and associated biota. Temporary and localised increase in water turbidity as a direct result of sediment disturbance.	Direct	Monitor inventory deployed to the field and track removal of equipment during activity.
				Follow standard procedures for MODU move, anchoring, deployment, and retrieval to minimise anchor damage, chain drag on seabed.
Light emissions	Artificial lighting: Navigational and deck lighting on the support vessels will generate light emissions. From support vessels and MODU.	Disorientation, attraction or repulsion. Disruption to natural behavioural patterns and cycles. Localised light glow may attract light-sensitive species, in turn affecting predator-prey dynamics.	Direct	Lighting in accordance with COLREGS, Navigation Act 2012, vessel class requirements and in allowing safe operation and activities (including emergency lighting).
Noise emissions	Drilling will be non-impulsive and continuous	Injury to hearing or other organs. Behavioural disturbance. Masking or interfering with biologically important sounds.	Direct	Environmental Induction includes environmental requirements as required.
				Restrict vessel operating speeds in the DA to 8 knots or less in the vicinity of whales.
				All opportunistic sightings of marine fauna will be recorded and forwarded to ANP.
				Vessel planned maintenance system in place to ensure it is operating efficiently and not producing excessive noise.
				Planned maintenance system on MODU in place to ensure it is operating efficiently and not producing excessive noise.
Atmospheric emissions	Sources of atmospheric emissions include: • Power generation and process heating;	Localised, and temporary decrease in air quality; and Contribution to global GHG effect.	Direct	International Air Pollution Prevention (IAPP) certificate valid.
				Vessels compliant with MARPOL Annex VI.
				Low sulphur diesel to be used in accordance with MODU / vessel specific procedures (under IMO requirements).

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
	• Engine exhausts; and • Fugitive emissions. • Helicopter operation in emergencies. • Drilling flaring •			Compliance with DST / flaring program and well clean-up plan.
				Management of flaring equipment maintenance and inspection in CMMS
Interaction with other users	The presence of the 500 m radius Petroleum Safety Zone (PSZ) for restricted and controlled vessel access. Vessel physical presence in and out of the Development Area.	Disruption to commercial activities, including: • Exclusion of commercial vessels from Development Area • Potential reduction of commercial fish catches due to exclusion from licensed permits (where relevant) • Support vessels/MODU present an obstacle and potential navigational hazard for shipping traffic *Illegal fishing captured as an unplanned event and not discussed here.*	Direct	Vessels and MODU marked on charts (500m zone) (Maritime Transport Department) communication. Relevant stakeholders (inc. AMSA) communication
				Vessel navigational and communication equipment installed, maintained and operated.
				Recovery of all deployed equipment
				MODU will be positioned in accordance with the MODU Position Plan; Anchors will be deployed and retrieved in accordance with the MODU Position Plan.
				MODU Marine Operations Manual including-A 500m radius petroleum safety zone will be maintained around the around the MODU. Vessel Master's will obtain the permission of the OIM, or on tour Barge Supervisor, before entering or leaving the 500m safety zone around the MODU.
				Rig move and rig deployment procedures.
				In accordance with Regulation: Report and secure from the ANP an authorization to enter the contract area and authorisation from MTD to enter Timor-Leste EEZ water for vessels, MODU, FPSO and aircraft for the activity. Report to the ANP the position / location and activity of such vessels and aircraft.
				Employ radio system for real-time communication.
				Vessel lighting in accordance with COLREGS, Navigation Act 2012, vessel class requirements and in allowing safe operation and activities (including emergency lighting).
				Ongoing communications with ANP throughout operations to prevent conflicts.

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
				Monitor and communicate with vessels approaching MODU to reduce the risk of vessel collision.
				Communication as per stakeholder management plan which defines relevant persons, responsibilities and timeframes for notifications
Operational discharges	Liquid discharges generated from vessels and routinely discharged to the marine environment include: • Slops water (Deck drainage, bilge water, tank washing) • Cooling water • Desalination Brine • Treated Sewage • Greywater • Putrescible food waste	Potential impacts to marine fauna via: • Changes to the water quality through nutrient enrichment and increased biological oxygen demand; • Impact to predator-prey dynamics. • Changes in temperature, salinity, toxicity of water	Direct	Oily water filtering and monitoring equipment fitted and maintained. Direct oily water from deck washing and drainage systems to an onboard oily water separator before discharge. The oil concentration in discharged water must not exceed 15ppm, in accordance with the Protection of the Sea (Prevention of Pollution from Ships) Act 1983 (MARPOL requirements).
				Garbage record book maintained (MARPOL)
				Brine will only be discharged to sea if the oil-in-water content does not exceed 15ppm in accordance with Protection of the Sea (Prevention of Pollution from ships) Act 1983 D MARPOL Annex I (as appropriate for vessel classification) D Regulations for the Prevention of Pollution by oil. If brine has oil-in-water content over 15ppm, the brine will be contained and treated to <15ppm or disposed of onshore.
				All sewage to be treated and discharged in accordance with MARPOL. Implementation of a preventative maintenance schedule as per Manufacturer's specification for sewerage treatment & macerator equipment and recording in the rig maintenance management system.
				Garbage that has been ground to particles <25mm: >3NM from the nearest land in accordance to MARPOL Annex IV and Protection of the Sea (Prevention of Pollution from Ships) Act 1983, prior to discharge.
				MODU will have secondary containment including a functioning deck drainage system.
				Fuels, oils, and chemicals to be stored within contained and bunded areas and in accordance with their MSDS.
				Contaminated drainage from decks, machinery spaces or bunded areas will be treated through a MARPOL approved oily-water separator prior to discharge to achieve MARPOL oil-in-water content (15ppm).
				All chemicals planned for discharge to the marine environment will be managed as per Chemical Register and approved by ANP prior to use.

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
Drilling discharges	Discharge of drilling fluids, cuttings at seabed and sea surface during the activity	Potential impacts to marine fauna via: • Changes to the water quality; • Changes in temperature, salinity, toxicity of water • Changes in sediment quality at seabed	Direct	All chemicals planned for discharge to the marine environment will be managed as per Chemical Register and approved by ANP prior to use.
				Cuttings management system is installed and functional to ensure discharges overboard are minimised and maximum volumes available for re-use
				Drilling fluids Management Plan adhered to for the use, management, handling and disposal.
				Treatment of SBM coated cuttings (if used) to target residual base fluid on cuttings as per drilling fluids management plan.
				Well sections that require SBM will be drilled using a closed riser system in accordance with the Drilling Well Plan.
				MODU Permit to work procedure, including all pit dump valves have locks and a permit to work is required to open them [planned and unplanned discharge].
				MODU Pit / tank cleaning procedures to include all SBM to be recovered to a containment tank for onshore disposal and/or future reuse.
				Minimise inventories of chemicals and bulk products to reduce wastage.
				Transport and storage dry cement in bulk storage tanks and the volume of cement used will be planned in accordance with the basis of design.
				Onboard separation of drilling muds for reuse as much as practicable to minimise drilling fluids discharge to the marine water.
				A designated and proper storage area for chemical and hazardous materials must be provided on the rig.
				The storage area should be sheltered and bunded to prevent rainwater collection and to contain spills.
				Use less hazardous alternative chemicals, whenever possible.
				Handling of chemicals and hydrocarbons should comply with strict procedures, including transfer and disposal procedures.
				Spill kits, absorbents and containers to be made available for clean-up of spills or leaks on deck.
Unplanned Events				
Marine pest introduction	Potential for drilling activities to transfer IMS	Localised impact on native marine fauna and flora, including:	Direct	Legislative requirements are adhered to - biofouling and ballast.

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
	from international or Australian waters into the Development Area.	• Competition, predation or displacement of native species; • Alteration of natural ecological processes; • Introduction of pathogens with the potential to impact human and/or ecological health; Reduction and/or competition with commercial fish and aquaculture species		
Interaction with fauna	Movement of support vessels, and helicopters in the Development Area that may physically interact with or disrupt fauna	Potential risk of ship collision with cetaceans and marine reptiles (Emergency) Helicopter strike on seabirds Behavioural changes for marine fauna	Direct	Support vessels will observe speed restrictions in Development Area and in vicinity of whales - as per noise
				Environmental Induction includes environmental requirements as required.
				Restrict vessel operating speeds in the DA to 8 knots or less in the vicinity of whales.
				Marine fauna collisions reported to ANP
Interaction with other users (IUU and FADS)	Movement of support vessels and MODU presence, and helicopters in the Development Area that may physically interact with or disrupt other illegal users of the sea	Potential risk of ship collision other small fishing vessels that are illegally in the area	Direct	Relevant stakeholders communication.
				Environmental Induction will include the possibility of other illegal users
				Vessel navigational and communication equipment installed, maintained and operated.
				In accordance with Regulation: Report and secure from the ANP an authorization to enter the Development Area and authorisation from MTD to enter Timor-Leste EEZ waters for vessels and aircraft for the activity. Report to the ANP the position / location and activity of such vessels and aircraft.
				Monitor and communicate with vessels approaching MODU to reduce the risk of vessel collision. Employ radio system for real-time communication.
				Recovery of all deployed equipment

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
				Vessel lighting in accordance with COLREGS, Navigation Act 2012, vessel class requirements and in allowing safe operation and activities (including emergency lighting).
				Report third-party vessel entry to the area
Unplanned release of solids	Release of solid wastes may occur as a result of overfull and/or uncovered bins, incorrectly disposed items or spills during transfer of waste between vessels and MODU.	Solid waste items have the potential to pollute marine habitats and injure or kill fauna through ingestion or exposure. Marine fauna entanglement risk in waste plastics, which can also be ingested when mistaken as prey.	Direct	Environmental Induction cover off waste management
				PMS on crane and lifting equipment to ensure fit for purpose
				Lift plans in place for the specific activity
				Competent crew undertake lifts under a permit to work system
				Recovery of dropped objects where the environmental consequence is not negligible and it is safe to do so
Unplanned release of (non-hydrocarbon) liquids	There may be accidental releases/ discharges to the marine environment of a variety of potentially hazardous materials and chemicals (liquid) which are stored and utilised or produced on vessels/MODU.	Localised decline in water quality Ingestion or physical contact with chemical compounds within the water column or sediment Accumulation and biomagnification of chemicals within the food chain	Direct	Drilling fluid bunkering and transfers will be conducted in accordance with the bunkering and transfer procedures.
				Spill response kits
				Hose integrity checks
Unplanned release of hydrocarbons (diesel) – vessel collision	Release of diesel may occur from vessel collision within the Development Area during drilling. The worst-case diesel spill scenario is due to collision of a vessel with a third-party vessel resulting in damage to a fuel oil tank and diesel released to the ocean. The maximum worst-	Decrease in water quality Potential toxicity and smothering impacts to fauna Direct/indirect toxic or physiological effects on benthic habitats Pygmy blue whales may occur within the spill area	Direct	Shipboard Oil Pollution Emergency Plan valid and tested to ensure ability to respond to spills as required by MARPOL
				Vessel crew will be adequately qualified, trained, and competent in accordance with Flag State regulations, to navigate vessels
				Ongoing communications with ANP throughout operations to prevent conflicts.
				No HFO/IFO planned to be used
				Vessels to have stocks of spill response kits/bins available and accessible onboard to respond to an onboard spill as per their SOPEP
				In the event of a Tier 2 or Tier 3 oil spill implement the OPEP to reduce environmental impacts due to spill
				Drills and exercises undertaken in accordance with the OPEP and SOPEP

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
	case credible spill volume of diesel has been calculated as 400 m3 based on the largest fuel oil tank on the proposed vessels, though it is considered more likely that smaller vessels would be used.			Bulk liquids transferred in accordance with bulk transfer procedure to reduce the risk of a release to sea.
				Prevent third-party vessel entry to the immediate area around MODU unless authorised by OIM/vessel masters
				OPEP describes minimum competency requirements of incident response personnel
				Vessels will be equipped with approved navigation systems in accordance with COLREGS
				Hydrocarbon and chemical storage areas will have appropriate loss prevention features such as spill containment bunds.
				In accordance with Regulations, Finder will: Report and secure from the ANP an authorization to enter the Timor-Leste EEZ waters for vessels and aircraft of which are acquired for drilling operations. Report daily to the ANP the position / location and activity of such vessels and aircraft. Attain ANP approval for movement of MODU.
				Monitor and communicate with vessels approaching MODU to reduce the risk of vessel collision.
				Communication as per stakeholder management plan which defines relevant persons, responsibilities and timeframes for notifications
				Vessels and MODU marked on charts (500m zone) (Maritime Transport Department) communication. Relevant stakeholders (inc. AMSA) communication
				Vessel navigational and communication equipment installed, maintained and operated.
				Recovery of all deployed equipment
				MODU will be positioned in accordance with the MODU Position Plan; Anchors will be deployed and retrieved in accordance with the MODU Position Plan.
				MODU Marine Operations Manual including-A 500m radius petroleum safety zone will be maintained around the around the MODU.

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
				Vessel Master's will obtain the permission of the OIM, or on tour Barge Supervisor, before entering or leaving the 500m safety zone around the MODU.
				Rig move and rig deployment procedures.
				In accordance with Regulation: Report and secure from the ANP an authorization to enter the contract area and authorisation from MTD to enter Timor-Leste EEZ water for vessels, MODU and aircraft for the activity. Report to the ANP the position / location and activity of such vessels and aircraft.
				Employ radio system for real-time communication.
				Vessel lighting in accordance with COLREGS, Navigation Act 2012, vessel class requirements and in allowing safe operation and activities (including emergency lighting).
Unplanned release of hydrocarbons (crude) – LOWC	Unplanned release of crude from subsea well due to loss of well control.	Decline in water quality. May cause chemical (e.g., toxic) and physical (e.g., coating of emergent habitats, oiling of wildlife at sea surface) impacts to marine species.	Direct	Crews will be adequately qualified, trained, and competent in well control techniques and will be supervised
				Implement OPEP in the event of a spill of hydrocarbons to the marine environment
				Drills and exercises undertaken in accordance with the OPEP
				OPEP describes minimum competency requirements of incident response personnel
				MODU crew will be adequately qualified, trained, and competent trained, in accordance with Flag State regulations, to navigate MODU
				Overall well activity management processes and life cycle activities undertaken including well integrity performance monitoring and well integrity incidents excursion management in accordance with Drilling Management System – 'Well Integrity Manual' and the Application to Drill
				A Permit to Work (PTW) system is implemented to assure competent personnel and implementation of relevant procedures during activities
				MODU well control equipment is maintained in accordance with the MODU PMS
				Maintain contract with tertiary well control provider
				Implementation of the Blowout Contingency Plan
				In the event of a Tier 2 or Tier 3 oil spill implement the OPEP
				Maintain a register of available and capable MODU to respond to LOWC

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
				Installation of Blow Out Preventer (BOP) system that can be closed rapidly in the event of an uncontrolled influx of formation fluids or completion fluids and which allows the well to be circulated safely by venting the gas at surface.
				Implement the Incident Management Team Response Plan in the event of a spill of hydrocarbons to the marine environment
				Continuous monitoring of pressure reading during drilling to detect any abnormal pressures.
				Maintaining well bore pressure by effectively estimating formation fluid pressures and strength of subsurface formations.
				Periodical test and maintenance on the BOP during the operations.
				BOP verification testing undertaken in accordance with ANP accepted Application for Approval to Drill.
				All well design and control activities to be undertaken in accordance with an approved Application for Approval to Drill.
				Shallow Hazard Study undertaken prior to drilling activity.
				Intervention actions to be undertaken in the event of loss of well control in accordance with the "Source Control Plan".
				Finder can access the 2022 Mutual Aid MOU (AEP, formally APPEA) as the Development Area falls within the offshore region defined in the MOU. The purpose of the MOU is to facilitate and expedite the mobilisation of a relief well
				Well Design and Delivery Process includes: Engineering Basis of Design Well Design Envelope, including Well Control System and BOP control system. • Casing Shoe Setting Criteria • Kick Tolerance • Well Barriers All permeable zones containing hydrocarbons or over-pressured water which are intersected by a well shall be isolated from the surface by a minimum of two barriers. The well barriers will be verified as appropriate to the required function and location. • Shallow Hazard Study • Critical Well Review

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
				Well Control Manual includes original equipment manufacturer specifications, including BOP stack and shear ram capability. Operates and inspected to API or applicable Industry Standards. • Drill pipe shearing capability verified. • BOP system is installed and tested in accordance with API standard 53: Blowout Prevention Systems for Drilling Wells
				Selection of drilling fluid to maintain required hydrostatic pressure / success in managing pore pressure.
				Implementation of the DST / Well Clean-up Plan if required, to include: • Emergency Shut Down • Continuous propane pilot light at the burner • Use of appropriate well clean-up equipment
				Implementation of the Well Clean-Up Plan if required, to include: • Well clean-up procedures, including pre-start communications meetings, HAZID and HAZOP reporting. • Flowing of hydrocarbons to surface, to commence well clean-up will only be allowed during day light hours. • Continuous monitoring of hydrocarbon falls out during flare watch.

9.4.3 Installation and Commissioning - Planned and Unplanned Events

Table 9-9: Control Measures - Installation and Commissioning

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
Planned Events				
Seabed and benthic habitat disturbance	Disturbance to the seabed from development activities.	Temporary or permanent direct loss of benthic habitat and associated biota. Temporary and localised increase in water turbidity as	Direct	Monitor inventory deployed to the field and track removal of equipment during activity.
				Position of infrastructure not on any sensitive seabed features (as informed by EBS)
				Equipment installed at pre-approved locations within Development Area

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
		a direct result of sediment disturbance.		Establish and maintain a comprehensive and accurate inventory of subsea infrastructure and locations.
Light emissions	Artificial lighting: Navigational and deck lighting on the support vessels will generate light emissions. From support vessels and FPSO.	Disorientation, attraction or repulsion. Disruption to natural behavioural patterns and cycles. Localised light glow may attract light-sensitive species, in turn affecting predator-prey dynamics.	Direct	Lighting in accordance with COLREGS, Navigation Act 2012, vessel class requirements and in allowing safe operation and activities (including emergency lighting).
Noise emissions	Machinery and equipment operations on decks and working areas of support vessels and FPSO. ROV Thruster and propeller sound from vessels. Helicopter operations in emergency.	Injury to hearing or other organs. Behavioural disturbance. Masking or interfering with biologically important sounds.	Direct	Vessel planned maintenance system in place to ensure it is operating efficiently and not producing excessive noise. Restrict vessel operating speeds in the DA to 8 knots or less in the vicinity of whales. Environmental Induction includes environmental requirements as required. All opportunistic sightings of marine fauna will be recorded and forwarded to ANP. Vessel and FPSO planned maintenance system in place to ensure it is operating efficiently and not producing excessive noise.
Atmospheric emissions	Sources of atmospheric emissions include: • Power generation and process heating; • Engine exhausts; and • Fugitive emissions. • Helicopter operation in emergencies. • Development flaring	Localised, and temporary decrease in air quality; and Contribution to global GHG effect.	Direct	International Air Pollution Prevention (IAPP) certificate valid. Vessels compliant with MARPOL Annex VI. Low sulphur diesel to be used in accordance with MODU / vessel specific procedures (under IMO requirements). Management of flaring equipment maintenance and inspection in CMMS Implement leak detection and repair programs.
Interaction with other users	The presence of the 500 m radius Petroleum Safety Zone (PSZ) for restricted and controlled vessel access.	Disruption to commercial activities, including:	Direct	Vessels and Development marked on charts (500m zone) (Maritime Transport Department) communication. Relevant stakeholders (inc. AMSA) communication

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
	Vessel physical presence in and out of the Development Area.	• Exclusion of commercial vessels from Development Area • Potential reduction of commercial fish catches due to exclusion from licensed permits (where relevant) • Support vessels/FPSO present an obstacle and potential navigational hazard for shipping traffic *Illegal fishing captured as an unplanned event and not discussed here.*		Vessel navigational and communication equipment installed, maintained and operated. Recovery of all deployed equipment Employ radio system for real-time communication. Vessel lighting in accordance with COLREGS, Navigation Act 2012, vessel class requirements and in allowing safe operation and activities (including emergency lighting). Berthing handbook Ongoing communications with ANP throughout operations to prevent conflicts. Monitor and communicate with vessels approaching FPSO to reduce the risk of vessel collision. Communication as per stakeholder management plan which defines relevant persons, responsibilities and timeframes for notifications
Operational discharges	Liquid discharges generated from vessels and routinely discharged to the marine environment include: • Slops water (Deck drainage, bilge water, tank washing) • Cooling water • Desalination Brine • Treated Sewage • Greywater • Putrescible food waste • Produced formation water	Potential impacts to marine fauna via: • Changes to the water quality through nutrient enrichment and increased biological oxygen demand; • Impact to predator-prey dynamics. • Changes in temperature, salinity, toxicity of water	Direct	Oily water filtering and monitoring equipment fitted and maintained. Direct oily water from deck washing and drainage systems to an onboard oily water separator before discharge. The oil concentration in discharged water must not exceed 15ppm, in accordance with the Protection of the Sea (Prevention of Pollution from Ships) Act 1983 (MARPOL requirements). Garbage record book maintained (MARPOL) Waste generated during operations (on the FPSO) will be managed in accordance with the waste Management Plan Brine will only be discharged to sea if the oil-in-water content does not exceed 15ppm in accordance with Protection of the Sea (Prevention of Pollution from ships) Act 1983 D MARPOL Annex I (as appropriate for vessel classification) D Regulations for the Prevention of Pollution by oil.

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
				If brine has oil-in-water content over 15ppm, the brine will be contained and treated to <15ppm or disposed of onshore.
				All sewage to be treated and discharged in accordance with MARPOL. Implementation of a preventative maintenance schedule as per Manufacturer's specification for sewerage treatment & macerator equipment and recording in the rig maintenance management system.
				Garbage that has been ground to particles <25mm: >3NM from the nearest land in accordance to MARPOL Annex IV and Protection of the Sea (Prevention of Pollution from Ships) Act 1983, prior to discharge.
				Fuels, oils, and chemicals to be stored within contained and bunded areas and in accordance with their MSDS.
				Contaminated drainage from decks, machinery spaces or bunded areas will be treated through a MARPOL approved oily-water separator prior to discharge to achieve MARPOL oil-in-water content (15ppm).
				All chemicals planned for discharge to the marine environment will be managed as per Chemical Register and approved by ANP prior to use.
				Produced water treatment management plan in place (details in future EMP).
Unplanned Events				
Marine pest introduction	Potential for development activities to transfer IMS from international or Australian waters into the Development Area.	Localised impact on native marine fauna and flora, including: • Competition, predation or displacement of native species; • Alteration of natural ecological processes;	Direct	Legislative requirements are adhered to - biofouling and ballast.

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
		• Introduction of pathogens with the potential to impact human and/or ecological health; Reduction and/or competition with commercial fish and aquaculture species		
Interaction with fauna	Movement of support vessels, and helicopters in the Development Area that may physically interact with or disrupt fauna	Potential risk of ship collision with cetaceans and marine reptiles (Emergency) Helicopter strike on seabirds Behavioural changes for marine fauna	Direct	Environmental Induction includes environmental requirements as required.
				Restrict vessel operating speeds in the DA to 8 knots or less in the vicinity of whales.
				Marine fauna collisions reported to ANP
Interaction with other users (IUU and FADS)	Movement of support vesselsand FPSO presence, and helicopters in the Development Area that may physically interact with or disrupt other illegal users of the sea	Potential risk of ship collision other small fishing vessels that are illegally in the area	Direct	Relevant stakeholders communication.
				Environmental Induction will include the possibility of other illegal users
				Vessel navigational and communication equipment installed, maintained and operated.
				In accordance with Regulation: Report and secure from the ANP an authorization to enter the Development Area and authorisation from MTD to enter Timor-Leste EEZ waters for vessels and aircraft for the activity. Report to the ANP the position / location and activity of such vessels and aircraft.
				Monitor and communicate with vessels approaching FPSO to reduce the risk of vessel collision. Employ radio system for real-time communication.
				Recovery of all deployed equipment

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
				Vessel lighting in accordance with COLREGS, Navigation Act 2012, vessel class requirements and in allowing safe operation and activities (including emergency lighting).
				Report third-party vessel entry to the area
Unplanned release of solids	Release of solid wastes may occur as a result of overfull and/or uncovered bins, incorrectly disposed items or spills during transfer of waste between vessels and FPSO.	Solid waste items have the potential to pollute marine habitats and injure or kill fauna through ingestion or exposure. Marine fauna entanglement risk in waste plastics, which can also be ingested when mistaken as prey.	Direct	Waste generated during operations will be managed in accordance with the waste Management Plan
				Environmental Induction cover off waste management
				PMS on crane and lifting equipment to ensure fit for purpose
				Lift plans in place for the specific activity
				Competent crew undertake lifts under a permit to work system
				Recovery of dropped objects where the environmental consequence is not negligible and it is safe to do so
Unplanned release of (non-hydrocarbon) liquids	There may be accidental releases/ discharges to the marine environment of a variety of potentially hazardous materials and chemicals (liquid) which are stored and utilised or produced on vessels/FPSO.	Localised decline in water quality Ingestion or physical contact with chemical compounds within the water column or sediment Accumulation and biomagnification of chemicals within the food chain	Direct	Spill response kits
				Hose integrity checks
Unplanned release of hydrocarbons (diesel) – vessel collision	Release of diesel may occur from vessel collision within the Development Area during operations. The worst-case diesel spill scenario is due to collision of a vessel with a third-party vessel resulting in damage to a fuel oil tank and diesel released to the ocean. The maximum worst-case credible spill volume of diesel has been calculated as 400 m3 based on the largest fuel oil tank on the proposed vessels, though it is considered more likely that smaller vessels would be used.	Decrease in water quality Potential toxicity and smothering impacts to fauna Direct/indirect toxic or physiological effects on benthic habitats Pygmy blue whales may occur within the spill area	Direct	Shipboard Oil Pollution Emergency Plan valid and tested to ensure ability to respond to spills as required by MARPOL
				Vessel crew will be adequately qualified, trained, and competent in accordance with Flag State regulations, to navigate vessels
				Ongoing communications with ANP throughout operations to prevent conflicts.
				No HFO/IFO planned to be used

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
				Vessels to have stocks of spill response kits/bins available and accessible onboard to respond to an onboard spill as per their SOPEP
				In the event of a Tier 2 or Tier 3 oil spill implement the OPEP to reduce environmental impacts due to spill
				Drills and exercises undertaken in accordance with the OPEP and SOPEP
				Bulk liquids transferred in accordance with bulk transfer procedure to reduce the risk of a release to sea.
				Prevent third-party vessel entry to the immediate area around FPSO unless authorised by OIM/vessel masters
				OPEP describes minimum competency requirements of incident response personnel
				Vessels will be equipped with approved navigation systems in accordance with COLREGS
				Hydrocarbon and chemical storage areas will have appropriate loss prevention features such as spill containment bunds.
				In accordance with Regulations, Finder will: Report and secure from the ANP an authorization to enter the Timor-Leste EEZ waters for vessels and aircraft of which are acquired for drilling operations. Report daily to the ANP the position / location and activity of such vessels and aircraft.
				Monitor and communicate with vessels approaching FPSO to reduce the risk of vessel collision.
				Communication as per stakeholder management plan which defines relevant persons, responsibilities and timeframes for notifications
				Vessels and Development marked on charts (500m zone) (Maritime Transport Department) communication. Relevant stakeholders (inc. AMSA) communication

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
				Vessel navigational and communication equipment installed, maintained and operated.
				Recovery of all deployed equipment
				In accordance with Regulation: Report and secure from the ANP an authorization to enter the contract area and authorisation from MTD to enter Timor-Leste EEZ water for vessels, FPSO and aircraft for the activity. Report to the ANP the position / location and activity of such vessels and aircraft.
				Employ radio system for real-time communication.
				Vessel lighting in accordance with COLREGS, Navigation Act 2012, vessel class requirements and in allowing safe operation and activities (including emergency lighting).
				Berthing handbook
Unplanned release of hydrocarbons (crude) - FPSO	Release of crude from FPSO	Decrease in water quality Potential toxicity and smothering impacts to fauna Direct/indirect toxic or physiological effects on benthic habitats Pygmy blue whales may occur within the spill area	Direct	Permit-to-work documentation is complete and signed off to ensure offtake is undertaken
				Monitoring of hawser
				Static tow in place
				In the event of a tank breach, crude is transferred from damaged tank to an alternative tank if available
				Vessel crew qualified in accordance with competency system
				The SIS are tested according to the assurance plan which is planned and managed using CMMS
				Emergency Shutdown (ESD) push buttons located in the central control room and throughout the FPSO tested and fit for purpose
				ESDVs are regularly tested and fit for purpose
				Hydrocarbon containing equipment is inspected and maintained and found fit for purpose
				PSVs undergo inspection(s) as per CMMS

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
				A Permit to Work (PTW) system is implemented to assure competent personnel and implementation of relevant procedures during offtake.
				Facility Berthing Handbook details offtake procedure including hose requirements
				Lifting Operations Procedure includes offtake hose deployment and storage
				Asset integrity and maintenance inspections of facilities and critical equipment undertaken as planned
				Implement OPEP in the event of a spill of hydrocarbons to the marine environment
				Implement the Incident Management Team Response Plan in the event of a spill of hydrocarbons to the marine environment
				Shipboard Oil Pollution Emergency Plan valid and tested to ensure ability to respond to spills as required by MARPOL
				Vessel crew will be adequately qualified, trained, and competent in accordance with Flag State regulations, to navigate vessels
				Ongoing communications with ANP throughout operations to prevent conflicts.
				No HFO/IFO planned to be used
				Vessels to have stocks of spill response kits/bins available and accessible onboard to respond to an onboard spill as per their SOPEP
				Drills and exercises undertaken in accordance with the OPEP and SOPEP
				Bulk liquids transferred in accordance with bulk transfer procedure to reduce the risk of a release to sea.
				Prevent third-party vessel entry to the immediate area around FPSO unless authorised by OIM/vessel masters

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
				OPEP describes minimum competency requirements of incident response personnel
				Vessels will be equipped with approved navigation systems in accordance with COLREGS
				Hydrocarbon and chemical storage areas will have appropriate loss prevention features such as spill containment bunds.
				In accordance with Regulations, Finder will: Report and secure from the ANP an authorization to enter the Timor-Leste EEZ waters for vessels and aircraft of which are acquired for drilling operations. Report daily to the ANP the position / location and activity of such vessels and aircraft.
				Monitor and communicate with vessels approaching FPSO to reduce the risk of vessel collision.
				Communication as per stakeholder management plan which defines relevant persons, responsibilities and timeframes for notifications
				Vessels and Development marked on charts (500m zone) (Maritime Transport Department) communication. Relevant stakeholders (inc. AMSA) communication
				Vessel navigational and communication equipment installed, maintained and operated.
				Recovery of all deployed equipment
				In accordance with Regulation: Report and secure from the ANP an authorization to enter the contract area and authorisation from MTD to enter Timor-Leste EEZ water for vessels, FPSO and aircraft for the activity. Report to the ANP the position / location and activity of such vessels and aircraft.
				Employ radio system for real-time communication.

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
				Vessel lighting in accordance with COLREGS, Navigation Act 2012, vessel class requirements and in allowing safe operation and activities (including emergency lighting).
				Emergency shutdown systems and shutdown/safety valves are routinely tested and maintained to ensure integrity and function is maintained as per CMMS

9.4.4 Operations - Planned and Unplanned Events

Table 9-10: Control Measures – Operations

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
Planned Events				
Seabed and benthic habitat disturbance	Disturbance to the seabed from development activities.	Temporary or permanent direct loss of benthic habitat and associated biota. Temporary and localised increase in water turbidity as a direct result of sediment disturbance.	Direct	Monitor inventory deployed to the field and track removal of equipment during activity.
				Position of infrastructure not on any sensitive seabed features (as informed by EBS)
				Equipment installed at pre-approved locations within Development Area
				Establish and maintain a comprehensive and accurate inventory of subsea infrastructure and locations.
Light emissions	Artificial lighting: Navigational and deck lighting on the support vessels will generate light emissions. From support vessels and FPSO.	Disorientation, attraction or repulsion. Disruption to natural behavioural patterns and cycles. Localised light glow may attract light-sensitive species, in turn affecting predator-prey dynamics.	Direct	Lighting in accordance with COLREGS, Navigation Act 2012, vessel class requirements and in allowing safe operation and activities (including emergency lighting).
Noise emissions	Machinery and equipment operations on decks and working areas of support vessels and FPSO. ROV	Injury to hearing or other organs. Behavioural disturbance.	Direct	Vessel planned maintenance system in place to ensure it is operating efficiently and not producing excessive noise.

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
	Thruster and propeller sound from vessels. Helicopter operations in emergency.	Masking or interfering with biologically important sounds.		Restrict vessel operating speeds in the DA to 8 knots or less in the vicinity of whales.
				Environmental Induction includes environmental requirements as required.
				All opportunistic sightings of marine fauna will be recorded and forwarded to ANP.
				Vessel and FPSO planned maintenance system in place to ensure it is operating efficiently and not producing excessive noise.
Atmospheric emissions	Sources of atmospheric emissions include: • Power generation and process heating; • Engine exhausts; and • Fugitive emissions. • Helicopter operation in emergencies. • Development flaring	Localised, and temporary decrease in air quality; and Contribution to global GHG effect.	Direct	International Air Pollution Prevention (IAPP) certificate valid.
				Vessels compliant with MARPOL Annex VI.
				Low sulphur diesel to be used in accordance with MODU / vessel specific procedures (under IMO requirements).
				Management of flaring equipment maintenance and inspection in CMMS
				Implement leak detection and repair programs.
Interaction with other users	The presence of the 500 m radius Petroleum Safety Zone (PSZ) for restricted and controlled vessel access. Vessel physical presence in and out of the Development Area.	Disruption to commercial activities, including: • Exclusion of commercial vessels from Development Area • Potential reduction of commercial fish catches due to exclusion from licensed permits (where relevant) • Support vessels/FPSO present an obstacle and potential navigational hazard for shipping traffic	Direct	FPSO and Development marked on charts (500m zone) (Maritime Transport Department) communication. Relevant stakeholders (inc. AMSA) communication
				Vessel navigational and communication equipment installed, maintained and operated.
				Recovery of all deployed equipment
				Employ radio system for real-time communication.
				Vessel lighting in accordance with COLREGS, Navigation Act 2012, vessel class requirements and in allowing safe operation and activities (including emergency lighting).
				Berthing handbook
				Ongoing communications with ANP throughout operations to prevent conflicts.
				Monitor and communicate with vessels approaching FPSO to reduce the risk of vessel collision.

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
		Illegal fishing captured as an unplanned event and not discussed here.		Communication as per stakeholder management plan which defines relevant persons, responsibilities and timeframes for notifications
Operational discharges	Liquid discharges generated from vessels and routinely discharged to the marine environment include: • Slops water (Deck drainage, bilge water, tank washing) • Cooling water • Desalination Brine • Treated Sewage • Greywater • Putrescible food waste • Produced formation water	Potential impacts to marine fauna via: • Changes to the water quality through nutrient enrichment and increased biological oxygen demand; • Impact to predator-prey dynamics. • Changes in temperature, salinity, toxicity of water	Direct	Oily water filtering and monitoring equipment fitted and maintained. Direct oily water from deck washing and drainage systems to an onboard oily water separator before discharge. The oil concentration in discharged water must not exceed 15ppm, in accordance with the Protection of the Sea (Prevention of Pollution from Ships) Act 1983 (MARPOL requirements). Garbage record book maintained (MARPOL) Waste generated during operations (on the FPSO) will be managed in accordance with the waste Management Plan Brine will only be discharged to sea if the oil-in-water content does not exceed 15ppm in accordance with Protection of the Sea (Prevention of Pollution from ships) Act 1983 D MARPOL Annex I (as appropriate for vessel classification) D Regulations for the Prevention of Pollution by oil. If brine has oil-in-water content over 15ppm, the brine will be contained and treated to <15ppm or disposed of onshore. All sewage to be treated and discharged in accordance with MARPOL. Implementation of a preventative maintenance schedule as per Manufacturer's specification for sewerage treatment & macerator equipment and recording in the rig maintenance management system. Garbage that has been ground to particles <25mm: >3NM from the nearest land in accordance to MARPOL Annex IV and Protection of the Sea (Prevention of Pollution from Ships) Act 1983, prior to discharge. Fuels, oils, and chemicals to be stored within contained and bunded areas and in accordance with their MSDS.

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
				Contaminated drainage from decks, machinery spaces or bunded areas will be treated through a MARPOL approved oily-water separator prior to discharge to achieve MARPOL oil-in-water content (15ppm).
				All chemicals planned for discharge to the marine environment will be managed as per Chemical Register and approved by ANP prior to use.
				Produced water treatment management plan in place (details in future EMP).
Unplanned Events				
Marine pest introduction	Potential for development activities to transfer IMS from international or Australian waters into the Development Area.	Localised impact on native marine fauna and flora, including: • Competition, predation or displacement of native species; • Alteration of natural ecological processes; • Introduction of pathogens with the potential to impact human and/or ecological health; Reduction and/or competition with commercial fish and aquaculture species	Direct	Legislative requirements are adhered to - biofouling and ballast.
Interaction with fauna	Movement of support vessels, and helicopters in the Development Area that may physically interact with or disrupt fauna	Potential risk of ship collision with cetaceans and marine reptiles (Emergency) Helicopter strike on seabirds Behavioural changes for marine fauna	Direct	Environmental Induction includes environmental requirements as required.
				Restrict vessel operating speeds in the DA to 8 knots or less in the vicinity of whales.
				Marine fauna collisions reported to ANP
			Direct	Relevant stakeholders communication.

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
Interaction with other users (IUU and FADS)	Movement of support vesselsand FPSO presence, and helicopters in the Development Area that may physically interact with or disrupt other illegal users of the sea	Potential risk of ship collision other small fishing vessels that are illegally in the area		Environmental Induction will include the possibility of other illegal users Vessel navigational and communication equipment installed, maintained and operated. In accordance with Regulation: Report and secure from the ANP an authorization to enter the Development Area and authorisation from MTD to enter Timor-Leste EEZ waters for vessels and aircraft for the activity. Report to the ANP the position / location and activity of such vessels and aircraft. Monitor and communicate with vessels approaching FPSO to reduce the risk of vessel collision. Employ radio system for real-time communication. Recovery of all deployed equipment Vessel lighting in accordance with COLREGS, Navigation Act 2012, vessel class requirements and in allowing safe operation and activities (including emergency lighting). Report third-party vessel entry to the area
Unplanned release of solids	Release of solid wastes may occur as a result of overfull and/or uncovered bins, incorrectly disposed items or spills during transfer of waste between vessels and FPSO.	Solid waste items have the potential to pollute marine habitats and injure or kill fauna through ingestion or exposure. Marine fauna entanglement risk in waste plastics, which can also be ingested when mistaken as prey.	Direct	Waste generated during operations will be managed in accordance with the waste Management Plan Environmental Induction cover off waste management PMS on crane and lifting equipment to ensure fit for purpose Lift plans in place for the specific activity Competent crew undertake lifts under a permit to work system Recovery of dropped objects where the environmental consequence is not negligible and it is safe to do so
Unplanned release of (non-hydrocarbon) liquids	There may be accidental releases/ discharges to the marine environment of a variety of potentially hazardous materials and chemicals (liquid) which are stored and utilised or produced on vessels/FPSO.	Localised decline in water quality Ingestion or physical contact with chemical compounds within the water column or sediment	Direct	Spill response kits Hose integrity checks

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
		Accumulation and biomagnification of chemicals within the food chain		
Unplanned release of hydrocarbons (diesel) – vessel collision	Release of diesel may occur from vessel collision within the Development Area during operations. The worst-case diesel spill scenario is due to collision of a vessel with a third-party vessel resulting in damage to a fuel oil tank and diesel released to the ocean. The maximum worst-case credible spill volume of diesel has been calculated as 400 m3 based on the largest fuel oil tank on the proposed vessels, though it is considered more likely that smaller vessels would be used.	Decrease in water quality Potential toxicity and smothering impacts to fauna Direct/indirect toxic or physiological effects on benthic habitats Pygmy blue whales may occur within the spill area	Direct	Shipboard Oil Pollution Emergency Plan valid and tested to ensure ability to respond to spills as required by MARPOL
				Vessel crew will be adequately qualified, trained, and competent in accordance with Flag State regulations, to navigate vessels
				Ongoing communications with ANP throughout operations to prevent conflicts.
				No HFO/IFO planned to be used
				Vessels to have stocks of spill response kits/bins available and accessible onboard to respond to an onboard spill as per their SOPEP
				In the event of a Tier 2 or Tier 3 oil spill implement the OPEP to reduce environmental impacts due to spill
				Drills and exercises undertaken in accordance with the OPEP and SOPEP
				Bulk liquids transferred in accordance with bulk transfer procedure to reduce the risk of a release to sea.
				Prevent third-party vessel entry to the immediate area around FPSO unless authorised by OIM/vessel masters
				OPEP describes minimum competency requirements of incident response personnel
				Vessels will be equipped with approved navigation systems in accordance with COLREGS
				Hydrocarbon and chemical storage areas will have appropriate loss prevention features such as spill containment bunds.
				In accordance with Regulations, Finder will: Report and secure from the ANP an authorization to enter the Timor-Leste EEZ waters for vessels and aircraft of which are acquired for drilling operations. Report daily to the ANP the position / location and

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
				activity of such vessels and aircraft.
				Monitor and communicate with vessels approaching FPSO to reduce the risk of vessel collision.
				Communication as per stakeholder management plan which defines relevant persons, responsibilities and timeframes for notifications
				Vessels and Development marked on charts (500m zone) (Maritime Transport Department) communication. Relevant stakeholders (inc. AMSA) communication
				Vessel navigational and communication equipment installed, maintained and operated.
				Recovery of all deployed equipment
				In accordance with Regulation: Report and secure from the ANP an authorization to enter the contract area and authorisation from MTD to enter Timor-Leste EEZ water for vessels, FPSO and aircraft for the activity. Report to the ANP the position / location and activity of such vessels and aircraft.
				Employ radio system for real-time communication.
				Vessel lighting in accordance with COLREGS, Navigation Act 2012, vessel class requirements and in allowing safe operation and activities (including emergency lighting).
				Berthing handbook
Unplanned release of hydrocarbons (crude) - FPSO	Release of crude from FPSO	Decrease in water quality Potential toxicity and smothering impacts to fauna Direct/indirect toxic or physiological effects on benthic habitats Pygmy blue whales may occur within the spill area	Direct	Permit-to-work documentation is complete and signed off to ensure offtake is undertaken
				Monitoring of hawser
				Static tow in place
				In the event of a tank breach, crude is transferred from damaged tank to an alternative tank if available
				Vessel crew qualified in accordance with competency system
				The SIS are tested according to the assurance plan which is planned and managed using CMMS

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
				Emergency Shutdown (ESD) push buttons located in the central control room and throughout the FPSO tested and fit for purpose
				ESDVs are regularly tested and fit for purpose
				Hydrocarbon containing equipment is inspected and maintained and found fit for purpose
				PSVs undergo inspection(s) as per CMMS
				A Permit to Work (PTW) system is implemented to assure competent personnel and implementation of relevant procedures during offtake.
				Facility Berthing Handbook details offtake procedure including hose requirements
				Lifting Operations Procedure includes offtake hose deployment and storage
				Asset integrity and maintenance inspections of facilities and critical equipment undertaken as planned
				Implement OPEP in the event of a spill of hydrocarbons to the marine environment
				Implement the Incident Management Team Response Plan in the event of a spill of hydrocarbons to the marine environment
				Shipboard Oil Pollution Emergency Plan valid and tested to ensure ability to respond to spills as required by MARPOL
				Vessel crew will be adequately qualified, trained, and competent in accordance with Flag State regulations, to navigate vessels
				Ongoing communications with ANP throughout operations to prevent conflicts.
				No HFO/IFO planned to be used
				Vessels to have stocks of spill response kits/bins available and accessible onboard to respond to an onboard spill as per their SOPEP
				Drills and exercises undertaken in accordance with the OPEP and SOPEP

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
				Bulk liquids transferred in accordance with bulk transfer procedure to reduce the risk of a release to sea.
				Prevent third-party vessel entry to the immediate area around FPSO unless authorised by OIM/vessel masters
				OPEP describes minimum competency requirements of incident response personnel
				Vessels will be equipped with approved navigation systems in accordance with COLREGS
				Hydrocarbon and chemical storage areas will have appropriate loss prevention features such as spill containment bunds.
				In accordance with Regulations, Finder will: Report and secure from the ANP an authorization to enter the Timor-Leste EEZ waters for vessels and aircraft of which are acquired for drilling operations. Report daily to the ANP the position / location and activity of such vessels and aircraft.
				Monitor and communicate with vessels approaching FPSO to reduce the risk of vessel collision.
				Communication as per stakeholder management plan which defines relevant persons, responsibilities and timeframes for notifications
				Vessels and Development marked on charts (500m zone) (Maritime Transport Department) communication. Relevant stakeholders (inc. AMSA) communication
				Vessel navigational and communication equipment installed, maintained and operated.
				Recovery of all deployed equipment
				In accordance with Regulation: Report and secure from the ANP an authorization to enter the contract area and authorisation from MTD to enter Timor-Leste EEZ water for vessels, FPSO and aircraft for the activity.

Aspect	Activity	Impact	Direct/Indirect Impact	Control Measures
				Report to the ANP the position / location and activity of such vessels and aircraft.
				Employ radio system for real-time communication.
				Vessel lighting in accordance with COLREGS, Navigation Act 2012, vessel class requirements and in allowing safe operation and activities (including emergency lighting).
Unplanned release of hydrocarbons (crude) – flowline rupture	Dropped objects on flowlines	Unplanned release of crude due to flowline rupture. Pygmy blue whales may migrate through area of entrained oil > No shoreline contact	Direct	Planned subsea and offshore maintenance in accordance with CMMS.
				Emergency shutdown systems and shutdown/safety valves are routinely tested and maintained to ensure integrity and function is maintained as per CMMS
				Implementation of control measures for dropped objects that reduce the risk of objects entering the marine environment: • Lifting equipment certification and inspection • Lifting crew competencies • Heavy-lift procedures • Preventive maintenance on cranes. Lifting operations managed in accordance with Vessel work instructions or procedures. Objects dropped overboard are recovered (if possible) to mitigate the environmental consequences from objects remaining in the marine environment, unless the environmental consequences are negligible, or safety risks are disproportionate to the environmental consequences.
				Implement OPEP in the event of a spill of hydrocarbons to the marine environment
				In the event that the integrity of a flowline is compromised or there is an unplanned hydrocarbon release from the facility, systems are initiated to activate the Isolation of the flowline

10. PLANNED IMPACTS

10.1 Seabed and Benthic Habitat Disturbance

10.1.1 Description of Hazard

Throughout the project, routine activities have the potential to disturb seabed habitats, resulting in localised damage to benthic habitat and associated fauna across all phases of the Project due to the temporary placement of equipment and the interaction of vessels and subsea infrastructure with the seabed. Seabed disturbance may also occur from activities such as sediment relocation, stabilisation works, and inspection or maintenance activities that require contact with the seabed.

Surveys

The geotechnical surveys will be performed using standard industry equipment and will consist of in situ testing and the recovery of soil/rock samples at locations within the study area to ground truth existing geophysical data and provide geotechnical data for engineering design.

Geotechnical surveys may include penetration testing, cored boreholes, piston cores, gravity cores and other and sampling techniques.

Environmental baseline surveys may include sediment and benthic infauna sampling.

These techniques will disturb small areas of the seabed, typically less than 1m^3 per sample taken throughout the study area. Further details are provided in the EBS SOW and the GTGP EMP (Appendix A and Appendix B).

Additional seabed disturbance during surveys may occur from:

- Deployment of ROVs, AUVs, survey tools, and associated baskets or frames, including temporary wet-parking of equipment on the seabed.
- Sampling of seabed sediments or biota for environmental monitoring or baseline characterisation.
- Minor sediment resuspension caused by thruster wash or equipment contact during close-proximity inspection.

Drilling

Drilling activities will be undertaken at 3 well locations using a floating MODU. It is likely that the MODU will be anchored with 8-12 anchors. Seabed disturbance from this activity will occur from MODU positioning and drilling.

<u>MODU Positioning</u>

Drilling operations will be undertaken using a floating MODU. The MODU will use a mooring system to remain in position that will result in short-term seabed disturbance. Each mooring will consist of:

8 to 12 anchors, each covering an area of approximately 30 – 60 m^2.

8 to 12 mooring chains which will partially rest on the seabed (~1000m of the chain length). The chains are typically 0.3m wide. Thus resulting in an area of disturbance of approximately 3600m^2 per well

The total area of short-term seabed disturbance per well is assumed to be approximately 3,660 m^2, which is approximately 0.004% of the Development Area (88 km^2).

Additional seabed disturbance during drilling may occur from:

- Placement of temporary subsea equipment such as guide bases, intervention tooling, and deployment aids.
- Sediment relocation or seabed levelling required to access wellheads or correct free spans.

- Stabilisation or rectification works, including placement of grout bags, mattresses or other stabilisation materials where required.
- Temporary anchoring or positioning systems associated with support vessels.

Drilling

Drilling of the wells will result in short-term seabed disturbance from the discharge of drilling fluids and cuttings to the seabed during drilling of the upper well sections. The upper well sections of each well will be drilled riserless with drilling fluids and cuttings discharged in the near vicinity of the hole. Seabed disturbance from upper well section drilling fluids and cuttings discharges is expected to be within 1 km of the well location (Neff, 2005).

Drill cuttings from the bottom hole sections will be discharged at the sea surface from the MODU after being processed and will disperse further and settle on to the seabed. These impacts have been evaluated as part of Section 10.7.

Installation and commissioning

The FPSO's anchors, wellheads and subsea infrastructure are static facilities fixed to the sea floor. Temporary or permanent direct loss of benthic habitat and associated biota will occur under the footprint of subsea infrastructure.

Subsea systems infrastructure, including umbilicals, flowlines and subsea structures (wellheads, manifolds, skids), will be placed on the seabed resulting in long-term seabed disturbance through the life of the development (expected to be 10 years).

As a conservative estimate, based on the proposed footprint of the development, the total seabed disturbance footprint is ~1 km^2. This is approximately 1.2% of the entire Development Area.

Additional seabed disturbance during installation and commissioning may occur from:

- installation and pre-commissioning of subsea infrastructure, including placement of stabilisation materials such as grout bags, mattresses or gravel bags
- span rectification or stabilisation of subsea infrastructure where required
- sediment relocation to allow access for installation or to correct free spans
- temporary placement of ROV tooling baskets, deployment frames or other subsea equipment
- marine growth removal from subsea components prior to tie-in, resulting in sediment resuspension
- temporary anchoring or DP-vessel thruster wash during installation activities

Operations

Inspection, Maintenance and Repair (IMR)

IMR activities may result in small areas of disturbance to the seabed due to placement of stabilisation mattresses and disturbance to sediments around the infrastructure. This will result in highly localised and short-term seabed disturbance.

Additional IMR-related seabed disturbance may occur from:

- cleaning activities requiring marine growth removal, which may lead to sediment resuspension
- placement of stabilization materials (grout bags, mattresses, gravel bags) to support or protect subsea infrastructure
- replacement, maintenance or repair of subsea equipment components
- rectification of spans or settlement issues along subsea infrastructure
- temporary placement of ROV baskets, tooling frames or inspection equipment

Well Intervention and Workovers

Well intervention and workover operations may necessitate actions such as well servicing, temporary suspension, plugging, or permanent abandonment. These activities can disturb the seabed and their frequency depends on the well's performance. Seabed disturbance footprint for well intervention and workovers is anticipated to be the same as for drilling as described in Section 10.7.

Additional disturbance may occur from:

- marine growth removal at wellheads leading to sediment resuspension
- temporary placement of intervention equipment on the seabed

Decommissioning

A lightweight intervention vessel will be used to remove subsea infrastructure including flowlines, umbilicals, subsea structures and plug and abandonment of wells. The seabed disturbance footprint for decommissioning will be similar to the footprints for drilling and installation.

Additional seabed disturbance during decommissioning may occur from:

- removal, cutting and lifting of subsea infrastructure, including disturbance of stabilization materials
- sediment relocation required to expose buried infrastructure for recovery
- temporary placement of recovery frames, tooling baskets or subsea equipment
- placement or removal of stabilization materials to support recovery operations

Support Operations

The use of an ROV or AUV during operations may result in temporary seabed disturbance through turbidity or from temporary wet parking of equipment or ROV baskets. In the event a ROVs or ROV baskets are required to temporarily park on the seabed, the short-term seabed disturbance footprint is estimated to be <5m^2.

Summary of disturbance

Table 10-1: Summary of disturbance to seabed and benthic habitats

Activity	Footprint	Duration / notes
Short-term disturbance		
Surveys (geotechnical and environmental baseline sampling)	Typically < 1 m^3 of seabed disturbed per sample	Small, highly localised disturbance distributed across the study area (footprint depends on number of samples).
Drilling – MODU positioning (anchors)	~240–720 m^2 per well ~0.002 km^2 total	Short-term disturbance associated with mooring installation and presence.
Drilling – MODU positioning (mooring chains resting on seabed)	~3600 m^2 per well ~ 0.011 km^2 total	Short-term disturbance associated with mooring installation and presence.
Operations – ROV/AUV support activities (temporary wet parking)	Estimated < 5 m^2	Short-term, localised disturbance, if required
Operations – well intervention and workovers	~3,660m^2 per well ~0.011 km^2 total	Frequency depends on well performance; disturbance similar to drilling activities.
Decommissioning	~0.011 km^2 + 1km^2 (the subsea infrastructure footprint)	Short-term disturbance during removal and plug & abandonment activities.
Long term disturbance		
Drilling – riserless upper well sections (fluids and cuttings discharged to seabed)	~1km radius ~3km^2 per well	Medium term impact with cuttings piles dispersed over time
Installation and commissioning (subsea infrastructure footprint)	~1 km^2	(1.2%).of Development Area
TOTAL		<6 Km^2

10.1.2 Impact Assessment

Sediments in the Timor Sea are predominantly composed of fine sand, silt, and clay. Earlier surveys in the region documented largely flat and uniform seabed conditions with occasional rocky outcrops. The PSC19-11 area, located on the outer shelf and upper continental slope at depths of 400-450m, is likely to display similar seabed characteristics. The benthos in the deeper continental slope waters to the north of the Sahul Shelf are characterised by sparse invertebrate assemblages as discussed in Section 6.3.1 (Pinceratto and Oliver, 1996) and to be confirmed through EBS surveys (Section 4.13).

Table 10-2: Impact pathways for key environmental receptors associated with seabed and benthic habitat disturbance

Activity	
Physical Environment	
Water Quality	Through disturbance to benthic habitats there may be disturbance to sediment which can increase turbidity in the water column and cause a reduction in the penetration of light available for photosynthesising benthic organisms. Given the water depths of the area, this potential impact is not considered credible. Activities such as placement of subsea infrastructure, sediment relocation to access equipment, or marine growth removal may generate a localised and temporary plume of suspended sediment. Sediment within the plume will settle out over a short period, resulting in minor and temporary increases in turbidity and localised deposition around the disturbance footprint. Given the water depths of the area and the absence of light-dependent benthic communities, any reduction in light penetration is not considered ecologically meaningful. Turbidity plumes are expected to remain highly localised and short-lived, with no credible pathway for broader water-quality impacts.
Sediment Quality	Potential disturbance to benthic habitats from activities at any stage of the development may result in the mortality of any flora and sessile fauna within the disturbance footprint and potentially the mortality of benthic infauna associated with the habitat. Disturbance will be confined to localised areas around subsea infrastructure, stabilisation materials or temporary equipment placement, typically within soft-sediment habitats that are widespread and well represented in the region. Following habitat disturbance, the soft sediment will be left disturbed, but will remain a viable habitat that would be expected to recolonise with benthic species within weeks to months following removal of the disturbance (Geoscience Australia, 2011). Temporary increases in sediment deposition may occur where sediment is resuspended during activities such as marine growth removal, sediment relocation or placement of stabilisation materials; however, these effects are minor, short-lived and limited to the immediate disturbance footprint. Overall the approximately 6km^2 disturbed in the context of the region represents approximately 6.8% % of the Development Area.
Air Quality	N/A
Ecological Environment	
Benthic Fauna	Smothering and physical disturbance of the seabed can result in direct mortality and habitat disruption for benthic fauna. During seabed activities such as those associated with surveys, small areas of seabed will be impacted through the taking of cores and seabed samples affecting turbidity and very small areas of seabed resulting in impacts to sessile and low-mobility species (e.g. infauna and attached epifauna), by: • physically burying individuals • clogging feeding and respiratory structures • reducing oxygen exchange within sediments Seabed disturbance associated with MODU and FPSO anchoring, infrastructure placement, and installation activities can cause: • direct removal or crushing of benthic fauna within the disturbance footprint

<table>
<tr><td></td><td>displacement of mobile species from affected areas
alteration of sediment structure, affecting habitat suitability
Impacts are expected to be localised to the immediate footprint and deposition area, with recovery dependent on sediment type and faunal community characteristics. In soft sediment environments expected within the Development Area, benthic communities typically exhibit relatively rapid recolonisation (weeks to months) following removal of the disturbance, though the area will be occupied by installed infrastructure for a period of years prohibiting recolonisation of the seabed during this period immediately beneath the infrastructure.
Indirect impacts may also occur through temporary increases in turbidity, which can further affect feeding efficiency and habitat quality for some species.</td></tr>
<tr><td>Coastal Habitats</td><td>N/A</td></tr>
<tr><td>Marine Mammals</td><td rowspan="2">Seabed disturbance at the proposed scale is not anticipated to significantly affect marine mammals or reptiles. The area of seabed disturbed within the OAs also represents a negligible portion of the habitat available for Threatened, migratory or local fauna.

No significant impacts are expected to other marine fauna including marine reptiles and cetaceans due to the typical surface feeding behaviour and the deep waters of the area, the limited spatial extent of turbidity effects and the absence of critical habitat or key ecological dependencies in the immediate impact area.</td></tr>
<tr><td>Marine Reptiles</td></tr>
<tr><td>Fish, Sharks and Rays</td><td>Seabed disturbance at the proposed scale is not anticipated to significantly affect fish, sharks, and rays. The area of seabed disturbed within the OAs also represents a negligible portion of the habitat available for Threatened, migratory or local fauna.

Pelagic species, including fish that utilise near-seabed habitats, may experience minor and temporary disturbance during drilling and installation activities. Potential impacts may include:
Temporary displacement from the immediate area due to seabed disturbance and increased turbidity
Short-term reduction in feeding efficiency where suspended sediments affect visibility or prey availability
Localised avoidance behaviour in response to physical activity and habitat disturbance
These impacts are expected to be low in magnitude and short-term, with mobile species likely to rapidly return once activities cease and sediment conditions stabilise.</td></tr>
<tr><td>Birds</td><td>N/A</td></tr>
<tr><td>Fisheries</td><td>N/A</td></tr>
<tr><td colspan="2">Socioeconomic and Cultural</td></tr>
<tr><td>Livelihoods and economy</td><td rowspan="3">Overall, due to the deepwater location, limited spatial footprint, and absence of overlapping uses, impacts to socio-economic values are expected to be negligible to none.
TBC post consultation period</td></tr>
<tr><td>Cultural heritage</td></tr>
<tr><td>Archaeological and Historical</td></tr>
</table>

Consequence assessment

Table 10-3: Consequence assessment of seabed and benthic habitat disturbance for each project phase

Activity	Consequence Ranking
Surveys	1 - Slight: Slight effect – recovery in days to weeks
Drilling	3 - Local: Local effect – recovery in months to years
Installation and commissioning	4 - Major: Major effect – recovery in multiple years
Operations	4 - Major: Major effect – recovery in multiple years

10.1.3 Mitigation and management

Controls considered and adopted for the activity are summarised in Section 9.4.

10.1.4 ALARP Assessment

Alternatives to the development are considered in Section 8.

Additional controls considered are provided in Table 10-4.

Table 10-4: ALARP assessment of additional controls

Activity	Additional Control	Reject Reasoning
Surveys	Do not use geotechnical survey equipment close to or on the seabed.	Control not feasible – required to meet survey objectives.
Drilling	No mooring footprint at seabed	The MODU must be on location for the proposed drilling program.
	Drill ship	The use of a drill ship which maintains station using DP during the activity is not an option due to vessel availability.
	Jackup rig	The use of a jackup is not an option due to the deep water depth.
	Only use workboat for transfer of personnel instead of helicopters	Eliminating the use of helicopters for personnel transfer removes the risk of helicopter strike to avifauna. However, the sea state for workboat use is considered further and this may not be practicable as the weather conditions may adversely impact payload availability resulting in the need to increase the number of flights to the MODU.
Installation and commissioning	No Trenching	Not feasible – required for the activity
Operations	Using only dynamic positioning / no anchors	Not technically suitable or available for all vessels/activities, and for operations may introduce other safety, operational or emissions trade-offs

Seabed disturbance has been reduced to ALARP through site selection that will be informed by EBS and GPGT surveys, use of the same mooring configuration for the Kuda Tasi wells and the MODU will kedge between the locations, recovery of temporary equipment and dropped objects where safe and practicable, and verification surveys before and after installation to confirm disturbance is limited to the smallest practicable area.

Additional controls that were either not technically feasible, or grossly disproportionate for this type of activity were rejected. In the instance of rejected controls, the additional effort would not result in significant reductions in risk levels. With implementation of the existing management measures, it is considered the risk associated with this planned impact are reduced to ALARP as per the criteria in Section 9.

10.2 Light Emissions

10.2.1 Description of Hazard

Light generated during activities is associated with the use of project vessels, MODU and FPSO, as described in Section 4.6. These vessels require external lighting to ensure safe navigation and safe deck operations at night, with lighting levels typically managed to maintain adequate visibility while preserving crew night vision. Lighting also serves to communicate a vessel's presence and operational status to other marine users. As lighting is essential for safe offshore operations, it cannot be reasonably eliminated.

Flaring during drill stem testing (<48 hours during drilling operations), and from the ground flare on the FPSO will also emit light.

Artificial lighting has the potential to alter natural behavioural patterns of marine organisms. Many species are adapted to predictable natural light cycles, including daily transitions between daylight and darkness and broader lunar cycles. Some fauna, such as turtles and seabirds, rely on natural light cues for orientation at night. Artificial lighting can override these cues and disrupt natural behaviours, leading to disorientation, attraction or avoidance responses. Localised light glow may also attract light-sensitive species, potentially influencing predator–prey interactions.

Surveys

Survey activities will be undertaken using offshore vessels equipped with navigation lighting, working-deck lighting and equipment-specific lighting required for safe 24-hour operations. Lighting will be used during night-time vessel movements, deployment and retrieval of geophysical and geotechnical equipment, and during ROV/AUV operations where underwater illumination is required for visibility.

Light emissions during surveys will occur from vessel-mounted lighting above the waterline and, where ROVs are deployed, from underwater lighting systems used to support seabed imaging and inspection tasks. These emissions will be temporary and limited to the duration of survey campaigns, which are a maximum of 60 days per year and are spatially constrained to the survey footprint.

Further details are provided in the EBS SOW and the GTGP EMP (Appendix A and Appendix B).

Drilling

Drilling activities will be undertaken using a floating MODU, which will operate with continuous lighting to support drilling operations, crew movement, helideck operations, and safety requirements. Lighting sources include mast and navigation lights, deck floodlights, crane lighting, helideck lighting and process-area illumination.

Underwater lighting will also be used during ROV operations associated with BOP installation, wellhead inspection and post-drilling surveys. If well flowback is required, the MODU's flare system will generate short-term, high-intensity light emissions during flaring events. These flaring events are intermittent and of short duration, consistent with standard offshore drilling operations.

Support vessels assisting the MODU will contribute additional navigation and deck lighting during anchor handling, supply runs and personnel transfers.

Installation and commissioning

Installation and commissioning activities will involve construction support vessels, pipelay vessels and ROV-equipped vessels, all of which will operate with continuous navigation and deck lighting to support subsea installation, lifting operations and flowline/umbilical deployment.

ROVs used during installation will generate underwater light emissions during subsea positioning, metrology, connection of infrastructure and inspection of installed equipment. Lighting will be present for the duration of installation activities and will be concentrated around active work areas.

During hook-up and commissioning (HUC), additional vessels will be present in the field for approximately three months, contributing continuous surface lighting. Following HUC, initial start-up activities may require support vessel presence for approximately four months, resulting in intermittent but sustained lighting in the Development Area.

Limited flaring may occur during commissioning (typically less than 48 hours per well), generating short-duration high-intensity light emissions.

Operations

During operations, the FPSO will be the primary source of light emissions within the Development Area. The FPSO will operate with permanent navigation, aviation obstruction, deck, accommodation and process-area lighting to support 24-hour production, maintenance and safety requirements. This lighting will be continuous for the life of the field.

Additional light emissions will occur during offtake tanker operations, which require high-intensity deck and navigation lighting during loading. ROV operations for inspection, maintenance and repair will also generate underwater illumination. Support vessels conducting logistics and crew transfer activities will contribute additional surface lighting during their presence in the field.

During the initial year or two when production of oil is high, any gas not used as fuel gas for the generators will be flared by the onboard flare system. Intermittent flaring may also occur during non-routine operating scenarios, generating short-duration high-intensity light emissions. All gas is incinerated inside the ground flare thus eliminating radiation from the flare. This allows simultaneous flaring and off-loading of oil.

Planned inspection campaigns along subsea infrastructure may occur approximately every three years, requiring vessel lighting for approximately three weeks as the vessel transits slowly along the infrastructure. IMMR campaigns may occur every three to five years (or as required), typically lasting 14–30 days and involving continuous vessel lighting during operations.

Decommissioning

Decommissioning activities will involve a MODU or light-well-intervention vessel and construction support vessels, all operating with continuous navigation and deck lighting to support well plug and abandonment and subsea infrastructure removal.

ROVs used during disconnection and recovery of subsea equipment will generate underwater lighting. Light emissions during decommissioning will be temporary and will cease once vessels demobilise from the field.

Campaign vessels associated with decommissioning will be present for defined periods, typically ranging from several weeks to several months depending on the scope of removal activities. Lighting will remain localised to the immediate work area.

Support Operations

The use of an ROV or AUV during operations may generate underwater lighting. Support vessels will also contribute intermittent surface lighting during routine logistics, crew transfer and IMMR activities.

Summary of disturbance

Table 10-5: Summary of disturbance from light emissions

Activity	Impact radius	Duration / notes
Short-term disturbance		
Surveys (geotechnical and environmental baseline sampling)	<20km	For duration of GPGT surveys (typically 20-60 days)
Drilling – MODU and vessel lighting	<20km	For duration of activity (50-55 days per well)

Drilling – Underwater lighting from ROV operations	localised	For duration of activity (50-55 days per well)
Installation – vessels and ROV/AUV support activities	<20km	For duration of activity ~2-3 months
Operations – vessels and ROV/AUV support activities	<20km	For duration of activity ~40 days per campaign
Operations – well intervention and workovers	<20km	For duration of activity ~40 days per campaign
Decommissioning	<20km	For duration of activity (unknown
Long term disturbance		
Operations – FPSO lighting	<20km	~10 years
Operations – potential flaring	<20km	Intermittently over 10 year operations

10.2.2 Impact Assessment

Table 10-6: Impact pathways for key environmental receptors associated with light emissions

Activity	
Physical Environment	
Water Quality	N/A
Sediment Quality	N/A
Air Quality	N/A
Ecological Environment	
Benthic Fauna	Light emissions are not expected to directly affect benthic fauna because light from vessels, MODUs and the FPSO including from flaring does not penetrate to seabed depths within the Development Area. Temporary, highly localised illumination may occur at the seabed during ROV operations when subsea lighting is used to support surveys, drilling, installation or inspection activities. Potential effects are limited to: • brief illumination of small areas of seabed during ROV tasks • temporary behavioural responses of mobile benthic species within the immediate vicinity of ROV lights No long-term or broad-scale effects on benthic fauna or benthic habitat are expected.
Coastal Habitats	N/A
Marine Mammals	Marine mammals are not known to be attracted to light sources at sea. Cetaceans predominantly use acoustic senses to monitor their environment, rather than visual cues (Simmonds et al., 2004), and there is no evidence to suggest artificial light sources adversely affect the migratory, feeding or breeding behaviours of marine mammals. Light emissions from vessels, the MODU and the FPSO and from intermittent flaring during drilling, commissioning and/or operations may be visible to marine mammals and reptiles at the surface. Potential effects include: • temporary attraction or avoidance behaviour in the vicinity of illuminated structures or the FPSO • minor changes in surface behaviour during night-time operations These effects are expected to be low in magnitude due to the offshore location, the absence of critical habitat for mammals, and the transient presence of most marine mammals in the area. Additionally, the ground flare on the FPSO is low in height and therefore visibility is reduced. Since mammals use variations in the length of day to anticipate environmental changes and time their reproduction, light pollution that affects day length perception (such as 24 hour lighting on the FPSO for the life of the project) could lead to changes in biological functions. However, marine mammals occurring within the region will be transient in the Development Area. There is potential for opportunistic foraging, should prey abundance be increased, particularly as fish species may pool in areas of light spill; dolphins particularly may be indirectly attracted to lit structures or illuminated marine environments for foraging purposes.

	Individuals are unlikely to be exposed to artificial light including from flaring for durations sufficient to impact biological functions. Impacts are expected to be limited to the light spill on surface waters immediately around the light source on the FPSO and vessels. They will not result in population level impacts.
Marine Reptiles	Light emissions from vessels, the MODU and the FPSO, including flaring, may be visible to marine reptiles at the surface. Potential effects include: • temporary attraction or avoidance behaviour in the vicinity of illuminated structures or the FPSO • minor changes in surface behaviour during night-time operations These effects are expected to be low in magnitude due to the offshore location, the absence of critical habitat for reptiles (i.e. nesting beaches in the vicinity). Studies have shown sea snakes display varying responses to light. For example, Hydrophine species appear to be attracted to light and have been observed floating on the sea surface and swimming up to light (pers. comm. M. Guinea, Charles Darwin University, 2014). However, Aispysurus species of sea snake do not appear to be attracted to light and are not seen on the surface at night (pers. comm. M. Guinea, Charles Darwin University, 2014). It is recognised some pelagic sea snake individuals (*Pelamis genus*) may occur in the Development Area and may be attracted to the light from the activities. However, while such individuals may come to investigate the light source, it is considered unlikely they will stay within the area (pers. comm. M. Guinea, Charles Darwin University, 2014). Sea turtles may occur within the Development Area year-round, although numbers are expected to be low. Light emissions from vessels, the MODU and the FPSO and from flaring may be visible to turtles at the surface. Adult turtles in offshore waters show limited behavioural response to artificial light, with attraction or disorientation effects mainly associated with hatchlings near nesting beaches rather than pelagic adults (Pendoley 2005; Salmon 2003). Any responses offshore are expected to be minor and temporary, and no critical habitat (e.g. nesting beaches or internesting areas) occurs in the vicinity. The low height of the ground flare and the short-term use of flaring during drill stem testing or commissioning further reduce the potential for light emissions to be visible at great distances. Overall, potential effects are expected to be low in magnitude, and confined to the immediate area around illuminated structures.
Fish, Sharks and Rays	Artificial lighting can influence the behaviour of pelagic fish and elasmobranchs. Potential effects include: • temporary attraction to illuminated areas around vessels or the FPSO • localised aggregation of fish around light sources • short-term changes in feeding or movement patterns Responses to artificial light vary widely among fish species and are influenced by light intensity, wavelength and habitat. Some pelagic fish are known to be photopositive, with studies showing attraction to light sources at distances of up to ~90 m. Increased illumination can also concentrate plankton, enhancing foraging opportunities for small pelagic species, which may lead to short-term aggregations around illuminated structures. Light can also modify predator–prey interactions, as many predatory fish rely on visual cues to locate prey. Behavioural responses may include phototaxis (movement toward or away from light), changes in swimming activity, aggregation, or altered diel vertical migration patterns. These effects are expected to remain confined to areas where light is directly visible at the sea surface, such as the immediate halo of light spill around vessels or the FPSO. Sharks and rays are generally not strongly attracted to artificial light; however, they may occasionally be drawn to aggregations of prey species around illuminated areas. Species that may transit offshore waters are not expected to experience

	population-level impacts, and no biologically important areas for these species occur within the Development Area. Light is not considered a key threat for migrating species such as whale sharks, and although individuals may opportunistically forage around illuminated structures, this is unlikely to alter migration or habitat use. These effects are expected to be localised to the immediate vicinity of lighting sources including flaring and will not result in long-term changes to populations or habitat use.
Birds	Birds are one of the most sensitive receptors to offshore lighting. Potential effects include: • attraction to illuminated vessels and the FPSO during night-time or poor-visibility conditions • increased risk of collision with structures • temporary disorientation or circling behaviour around bright light sources The risk of collision with infrastructure is low due to the low height of infrastructure and lighting and will result in birds avoiding the infrastructure and thus changing behaviour, but not significantly enough to impact migration flyways (Masden et al., 2010). Artificial lighting may also indirectly attract seabirds by concentrating marine life around illuminated structures, creating enhanced foraging opportunities at night. Some species may use lit structures as temporary resting points during migration, particularly during non-routine flaring or periods of elevated illumination. The low height of the ground flare and the short-term use of flaring during drill stem testing or commissioning further reduce the potential for light emissions to be visible at great distances. Overall, potential effects are expected to be low in magnitude, and confined to the immediate area around illuminated structures. Weather plays a major role in the severity of impacts. Under clear conditions, well-lit offshore structures have a reduced influence on avifauna. In contrast, fog, mist or light rain can increase light reflectance and intensify disorientation, although such conditions are infrequent and short-lived in the region, making large-scale mortality events unlikely. Nocturnal species may pass through the area but are expected only in low numbers given the distance to the nearest land >100km away and are typically adults, which are less sensitive to light than fledglings. Species with nocturnal fledging behaviour, such as shearwaters, are the most vulnerable to artificial light. Adults may traverse offshore waters but are less susceptible to disorientation and are not expected in significant numbers. Effects are expected to be intermittent and weather-dependent, with the highest likelihood during migration periods or low-visibility conditions.
Fisheries	There is the potential for three types of tuna fisheries in the region however these are Australian based and unlikely to occur in Timorese waters, there are currently no commercial fisheries operating in the Development Area. Therefore, there are likely to be no impacts on commercial fisheries. Illegal fishers may be present and this is addressed in Section 11.3.
Socioeconomic and Cultural	
Livelihoods and economy	N/A
Cultural heritage	
Archaeological and Historical	

Consequence assessment

Table 10-7: Consequence assessment of light emissions for each project phase

Activity	Consequence Ranking
Surveys	1 - Slight: Slight effect – recovery in days to weeks
Drilling	3 - Local: Local effect – recovery in months to years
Installation and commissioning	4 - Major: Major effect – recovery in multiple years
Operations	4 - Major: Major effect – recovery in multiple years

10.2.3 Mitigation and management

Controls considered and adopted for the activity are summarised in Section 9.4.

10.2.4 ALARP Assessment

Additional controls considered are provided in Table 10-8.

Table 10-8: ALARP assessment of additional controls

Activity	Additional Control	Reject Reasoning
Surveys Drilling Installation and commissioning	All activities completed in daylight hours only	Daylight operations only would increase cost whilst delivering little/no environmental benefit. Light from these activities will not illuminate beaches where receptors sensitive to light emissions are present and will not have population level impacts. Only behavioural disturbance is predicted to occur.
	Switching off all lighting during periods of fauna presence or at night	Rejected because continuous minimum lighting is required to maintain vessel/MODU/FPSO safety, collision avoidance and regulatory compliance
	Full shielding or blackout of marine and aviation lighting	Rejected because shielding or blackout measures could compromise required visibility for navigation, aviation safety and emergency response
Operations	Use of no-flaring / no visible flame at all times	Rejected because flaring may be required for safety, commissioning, upset conditions or emergency hydrocarbon management, and cannot be fully eliminated

Light emissions have been reduced to ALARP by restricting lighting to that necessary for navigation, aviation and safe operations, minimising unnecessary illumination where practicable, and managing operational lighting to reduce the duration and extent of artificial light exposure, thereby limiting the potential for attraction, disorientation and behavioural disturbance to marine fauna.

Additional controls that were either not technically feasible, or grossly disproportionate for this type of activity were rejected. In the instance of rejected controls, the additional effort would not result in significant reductions in risk levels. With implementation of the existing management measures, it is considered the risk associated with this planned impact are reduced to ALARP as per the criteria in Section 9.

10.3 Noise Emissions

10.3.1 Description of Hazard

Throughout the development noise emissions will be generated in air and underwater throughout the project. Sensitive receptors to noise include seabirds, marine mammals, reptiles, fish, sharks and rays. Marine fauna use sound in a range of functions including social interaction (e.g., communication, breeding), foraging and orientation. Marine fauna have unique hearing sensitivities and therefore respond differently when exposed to noise from anthropogenic sources. There are even significant hearing sensitivities between different cetacean species, and it is important to identify which species are more at risk, but also to what type of noise risk they are susceptible to, and how they may respond to the sound, and to predict their exposure (Erbe et al. 2014, Erbe 2012, Erbe, Dunlop, and Dolman 2018). Effects of noise on marine fauna depend on source characteristics (e.g. source level/type of noise), such as the ambient noise levels, local sound-propagation conditions, and receiver characteristics (frequency-dependent hearing sensitivity) (Cato 2012). Noise can impact on marine fauna either directly or indirectly, and these impacts have the potential to cause physiological effects, ranging from nonauditory injury to hearing loss, or to more subtle effects, such as auditory masking (i.e., when noise interferes with the ability to communicate and hear other important sounds) or changes in behaviour (McLean et al. 2024, Hawkins and Popper 2017, Popper et al. 2024, Southall et al. 2007, Southall et al. 2019). The noise generating activities associated with the development are discussed below.

Surveys

Geophysical surveys will collect acoustic data to map seabed features and shallow sub-seabed layers. A range of industry-standard systems may be used, selected based on seabed conditions and required resolution and penetration. These systems operate at different sound levels and frequencies and may be deployed anywhere within the Development Area and potentially at any time. Proposed survey techniques include:

- multibeam echosounder (MBES),
- side scan sonar,
- sub-bottom profilers,
- magnetometers, and
- Ultra-Short Baseline (USBL) positioning systems.

Geophysical equipment may be deployed from a survey vessel using hull-mounted systems, towfish, towed catamarans, or ROVs/AUVs. Equipment may operate at various depths in the water column ranging from near surface to tens of metres above the seabed, depending on the system used. For example, side-scan sonar systems and sub-bottom profilers generally operate in the 100-500 kHz frequency range with sound source levels of around 210-226dB re: 1µPa @ 1m (UK Department of Energy and Climate Change, 2011).

The geotechnical surveys that may be performed are as follows, and will be performed using standard industry equipment and will consist of in situ testing and the recovery of soil/rock samples at locations within the operational are:

- Penetration testing using a penetrometer (probe) into the seabed
- Piston Core /Gravity Core and Vibrocore Sampling, and
- Box core and grab sampling

Drilling

Drilling activities will be undertaken at 3 well locations (1 in Jahal, 2 in Kuda Tasi oil fields) using a MODU. The MODU will be anchored on location at Kuda Tasi to drill 2 wells, and will have a separate anchoring location in Jahal.

The two Kuda Tasi wells will be positioned in what is essentially a "drill-centre" format where both well heads and production trees are located within a nominal distance 50 m from each other. This provides environmental benefits by reducing the number of drill locations and reduces the footprint on the seafloor by halving the rig moves and anchoring thus reducing operational noise. However, there will be cumulative drilling noise emitted. The reservoir well orientation will be deviated.

The drilling rig will produce a continuous non-impulsive sound throughout the campaign, with small fluctuations during loading of the drill string (APPEA 2005). Underwater noise generated by drilling activities generally falls within the range of 110 - 117 dB re 1 µPa (McCauley and Duncan, 2003; McCauley, 1998). A comparative study of an exploration drilling rig Ocean General with 8 anchor mooring system have shown underwater noise emanated from three sources (McCauley, 1998):

- The rig working but not drilling with the tender on anchor.

The primary noise sources were from mechanical plant, discharged fluids, pumping systems and miscellaneous banging of gear on the rig. The overall noise level was low, at 117 dB re 1 µPa at 125 m from the wellhead. Under this operating condition and the calm sea conditions encountered, the rig noise was audible for 1-2 km.

- The rig actively drilling and the rig tender on anchor.

The drill string produced dominant tones, notably in the 31 and 62 Hz 1/3 octaves. The drill string was considered to be a vertical line source some 3.8 km long comprising a steel tube (drill string) rotating in a steel (in water) or concrete (subsea) casing. Thus, two sources were active, the rig itself and the drill string. For the rig drilling, the highest noise levels were 115-117 dB re 1 µPa at 405 and 125 m respectively, with the rig audible out to 11 km.

- A rig tender standing by the rig for loading purposes.

The tenders stood off the port or starboard side on a bow anchor. The use of the thrusters or main propellers under load produced very high levels of cavitation noise at 137 dB re 1 µPa at 405 m astern the rig, levels of 120 dB re 1 µPa recorded at 3-4 km, and the noise audible at up to 20 km (McCauley, 1998).

Noise levels emanating from active drilling have been shown to attenuate to ambient conditions within 3 km from the drilling rig (APPEA 2005). There will be cumulative underwater noise impacts resulting from drilling in well 50 m apart.

During the drilling campaign, noise will be emitted from the drill rig, offshore support vessels (OSVs), and helicopters further discussed below.

Installation and commissioning

Installation and commissioning activities will involve construction support vessels, pipelay vessels and ROV-equipped vessels. ROVs used during installation will be used during subsea positioning, metrology, connection of infrastructure and inspection of installed equipment and generate underwater noise through their thrusters, pumps, and electrical systems. The predominate noise emitted will be from the installation vessels and vessel engines. Taking the largest vessel size ≥ 100 - <200 m (Class 4), and ≥200 m (Class 5) will generate 159 – 193 dB re 1 µPa m (Peel et al., 2021).

The wells will require artificial lift as the reservoirs start to produce water using a seabed skid mounted Electric Submersible Pump (ESP) for artificial lift. Two ESPs are planned at each oil field. Underwater noise emitted from ESPs will be constant but minimal and typically <150dB re 1 µPa m.

Operations

<u>FPSO</u>

The production, processing and storage of hydrocarbons will be undertaken using a floating FPSO *Petrojarl I.* The FPSO will be positioned between the Kuda Tasi and Jahal fields and will be permanently moored with an 8-line mooring system. The FPSO is 215 m long. Vessels of this size (class 5, ≥200 m), typically may emit noise levels between 175 –190 dB re 1 µPa m when transiting to and from location (Peel et al., 2021).

Operational noise will be emitted during the operation of onboard machinery, including diesel engines, mud pump, ventilation fans and electrical generators. Underwater noise will be emitted from the processing plant that is on deck and transmitted through the hull into the water column. Noise will also be emitted from the dynamic positioning of the thrusters and propellers (commonly used during offloading); from service vessels; and from the FPSO's own propeller, which is often left slowly turning to avoid it seizing up (Erbe et al. 2025). Operating noise onboard a FPSO is highly variable, Erbe et al. (2013, 2025) took a statistical approach to quantify the radiated noise spectrum from six comparative FSPOs, with the median percentile ranging between 153 – 175 dB re 1 µPa m.

Oil will be exported from the FPSO to tanker periodically, and the tanker will then transport the crude oil from the Development Area and from the territory of Timor-Leste. The shuttle tanker mooring and crude oil offloading system is situated at the stern of *Petrojarl I*.

Shuttle oil tankers

Shuttle oil tankers will then transport the crude oil from the Development Area and from the territory of Timor-Leste. Typically, oil tankers are likely to emit sound at 197 dB re 1 µPa m, with the highest sound (median 201 dB re 1 µPa m) for vessels >250 m in length when steaming (Erbe et al., 2025). Noise emitted during an offloading LNG noise was modelled much and was found to be lower, 130–140 dB re 1 µPa, and would abate to 120 dB re 1 µPa within 8 km of the source location (INPEX 2010).

OSV

Support vessels emit noise from propeller cavitation, thrusters, hydrodynamic flow around the hull, and operation of machinery and equipment. Typically, marine vessels produce low frequency sound (i.e. below 1 kHz) from the operation of machinery onboard; from hydrodynamic flow noise around the hull; and from propellers (Ross 1987; 1993 in Skjoldal et al. 2009). The engine is the loudest and dominate source of noise, and expected to be higher than those emitted from equipment or machinery on the vessels. Usually, the larger the vessel, or the faster a vessel moves, the more noise generated (Richardson et al. 1995). Underwater noise generated by OSV movements often exceeded 120 dB re 1 µPa. Offshore support vessels in the 50–100 m size (class 3) typically emit noise within a broadband source level between 145 and 179 dB re 1 µPa (Southall 2009, Peel et al., 2021).

Studies have measured underwater noise emanating from similar rig tender vessels, the *Pacific Ariki* and *Pacific Frontier*, 64 m length, 5 m draught maintaining position at the rig for supply purposes and steaming at 11 knots. The noise of the *Pacific Ariki* and the *Reef Venture* underway was audible out to about 10 and 5.5 km from each vessel respectively, with the 120 dB re 1P µPa contour at 0.5-1 km for the *Pacific Ariki* and 250 m for the *Reef Venture* (McCauley, 1998).

Helicopters

Sound emitted from helicopter operations is typically below 500 Hz, localised and short in duration. Sound pressure in the water directly below a helicopter is greatest at the sea surface but diminishes quickly with depth. Noise levels reported for Bell 212 helicopter during fly-over is 162 dB re 1µPa and for Sikorsky-61 is 108 dB re 1µPa at 305 m (Simmonds et al. 2004). The TL guidelines for cetaceans recommend a 500 m no-fly zone over whales to avoid noise disturbance which will be implemented in the control measures identified in Section X.

Inspection, Maintenance and Repair (IMR)

Noise generated during IMR activities may result in localised and short-term noise and is not expected to produce a higher level of noise than that generated by the action of drilling, apart from the use of OSVs.

Well Intervention and Workovers

Well intervention and workover operations may necessitate actions such as well servicing, temporary suspension, plugging, or permanent abandonment. These activities can generate underwater noise and is not expected to produce a higher level of noise than that generated by the action of drilling.

Decommissioning

A MODU or lightweight intervention vessel will likely be used to remove subsea infrastructure including flowlines, umbilicals, subsea structures and plug and abandonment of wells. Noise generated will be localised and short-term noise, with the highest level of noise generated by vessel engine. Vessels in size ≥ 100 - <200 m (Class 4), and ≥200 m (Class 5) may generate underwater noise (predominantly from the engine) in the range of 159 – 193 dB re 1 µPa m (Peel et al., 2021).

Support Operations

The use of an ROV or AUV during operations may result in temporary localised underwater noise.

Summary of potential noise generating activities

Table 10-9: Typical Noise Emissions Generated Throughout the Development

Activity	Typical noise emissions	Duration / notes
Short-term		
Surveys (geotechnical and environmental baseline sampling)	210-226dB re: 1µPa	(Department of Energy and Climate Change, 2011).
FPSO (drilling and operational equipment)	175 –190 dB re 1 µPa m when vessel is transiting. 153 – 175 dB re 1 µPa m onboard operational noise.	(Peel et al. 2021). (Erbe et al. 2013).
Drilling activities	115 - 117 dB re 1 µPa	Noise levels may reach ambient conditions within 3 km from the drilling rig (McCauley and Duncan (2003), McCauley (1998), APPEA 2005).
Installation and commissioning (subsea infrastructure footprint)	159 – 193 dB re 1 µPa	The predominate noise emitted will be from installation vessels and vessel engines. Taking the largest vessel size size ≥ 100 - <200 m (Class 4), and ≥200 m (Class 5) (Peel et al., 2021).
FPSO (when transiting)	175 –190 dB re 1 µPa	When transiting to and from location (Peel et al., 2021).
OSV	145 - 179 dB re 1 µPa	When operating with vessel size 50–100 m (Southall 2009, Peel et al.,2021).
Helicopters	162 dB re 1µPa	For short duration (<5 mins) (Simmonds et al. 2004).
Decommissioning	159 – 193 dB re 1 µPa	Vessels in size ≥ 100 - <200 m (Class 4), and ≥200 m (Class 5) (Peel et al., 2021)
Operations	159 – 193 dB re 1 µPa	The predominate noise emitted will be from vessel engines. Taking the largest vessel size ≥ 100 - <200 m (Class 4), and ≥200 m (Class 5) (Peel et al., 2021).
Shuttle oil tanker	130–140 dB re 1 µPa (off-loading) 201 dB re 1 µPa (vessels >250 m in length) in transit.	(INPEX 2010, Erbe et al., 2025).
Long-term		
Cumulative impact	For the drilling rig the sound expected is 115-117 dB re 1 µPa at 405 and 125 m respectively.	During drilling, rig tender and vessel activities in an oil field the rig tender vessel

	However, taking account 2 wells 50 m apart would extend the zone by 50m. Cumulative sound from 1 operating tender would emit 120 dB re 1mPa at 0.5-1 km, and extend out to around 3-5 km from the rig. With these studies in mind the cumulative sound emitted is below the TTS thresholds for marine fauna.	produced the highest levels of noise overall (McCauley 1998).

Cumulative noise

For the drilling rig the sound expected is 115-117 dB re 1 µPa at 405 and 125 m respectively. However, taking in account two wells 50 m apart this would extend the contour by 50 m. Cumulative sound from one operating tender would emit 120 dB re 1 µPa at 0.5-1 km, and extend out to around 3-5 km from the rig. With these studies and measurements in mind, the cumulative sound emitted is below the TTS thresholds for marine fauna.

10.3.2 Impact Assessment

Sensitive or endangered marine fauna in the Development Area

The KTJ Development Area is located in open waters of the Timor Sea at depths of approximately 400–450 m. The general ambient underwater noise levels in the Timor Sea under calm conditions has been recorded at 90 dB re 1 µPa (McCauley, 1998). It is not situated within, or immediately adjacent to, any sensitive shoal or bank features (Section 6). Benthic habitats around the KTJ Development Area are likely typical of the wider Timor Sea with deep-sea and slope habitats that are dominated by soft sediments with varying bioturbation, low abundance and diversity of infauna, and isolated hard substrates supporting low-to-medium cover of filter feeders and soft corals. There are no shallow coral reef or seagrass habitats found within PSC 19-11 and are not likely to occur due to the depth. Planned geophysical, geotechnical and EBS surveys of the PSC 19-11 area will provide more site-specific information on benthic habitat, infauna, and sediment characteristics to inform future EMPs.

The recovery plans and conservation advice for whales and sea turtles identifies anthropogenic sources of noise and acoustic disturbance/interference as a key threat to species of conservation importance (Pilcher 2022, Commonwealth of Australia 2015). Sensitive receptors and species of conservation value that may occur in the Development Area throughout the project lifespan (though not exhaustive) are discussed in Section 6.3.4.

Impact Assessment

Industry best practice indicates that marine mammals are likely to be behaviourally disturbed when exposed to underwater noise above root-mean-square (RMS) received temporary threshold shifts (TTS) levels of 120 dB re 1 µPa for continuous (e.g., vibratory pile driving, drilling) and 160 dB re 1 µPa for non-explosive, impulsive (e.g., seismic airguns, impact pile driving) or intermittent (e.g., scientific, non-tactical sonar) sources (Southall 2007, 2019, 2021; JNCC, 2010, 2017; NMFS, 2024a, b, 2025a, b). Further guidance thresholds for the onset of auditory injury (AUD INJ) based on impulsive (e.g. seismic, impact piling) and non-impulsive (e.g. vibrational piling) sound for the hearing ranges for marine mammal species categorised by their hearing groups (low, high, very-high frequency sound) is provided in Table 10-10 (Southall 2021; NMFS, 2024b).

The hearing range for sea turtles is broad and differs depending on the species 50-1200 Hz (Prideaux, 2017; Viada et al 2008, Martin et al 2012, Popper et al 2014). For example, the green turtle has been shown to detect frequencies between 100-500 Hz with their most sensitive hearing between 200-400 Hz (Prideaux, 2017). The US NMFS (2025a) recommended the TSS for sea turtles for impulsive sources (e.g. seismic and impact piling) is 169 dB and for non-impulsive sources is 178 dB re 1 µPa2s (see Table 10-10). Data on the behavioural reaction of sea turtles to sound sources is limited however, NMFS (2025b) recommend a threshold for behavioural disturbance of RMS SPL 175 dB for non-explosives.

Fin Fish behaviour is strongly impacted by an approaching seismic source above received levels of 145–150 dB re 1 µPa2s (SEL) (McCauley et al., 2003), which equates to around 2–10 km using measured air gun arrays > 2000 cui (Prideaux, 2017). Exposure to repeated pile driving suggest physical injury (organ damage) arises at levels equivalent to 1920 strikes at 179 dB re 1 µPa2s or 960 strikes at 182 dB re 1 µPa2s, or an equivalent single strike SEL of 210– 211 dB re 1 µPa2s (Halvorsen et al., 2012). Elasmobranchs have been poorly studied with respects to impacts from underwater acoustics, with most knowledge available for more “visible” species such as large sharks. For these, observed impacts refer mostly to short-term avoidance responses to loud, sudden bursts of sound in their audible range (Prideaux, 2017). Research determined the hearing range of sharks to be between 40 Hz to approximately 800 Hz (Myrberg, 2001), with possible limits for elasmobranchs in general at 20–1000 Hz (Casper and Mann, 2006, 2010). The US NMFS (2025a) recommended the Injury onset for impulsive sources (e.g. seismic and impact piling) for all species of fish by weight as (Fish ≥ 2g) 187 dB and (Fish < 2g) 183 dB re 1 µPa2s (see Table 10-10). Although not ‘formal’ the threshold for behavioural disturbance in all species of fish (e.g. elasmobranchs and teleosts) and sizes is recommended at RMS SPL 150 dB for all sources of sound (NMFS 2025).

Table 10-10: The TTS and AUDINJ Thresholds for Impulsive and Non-impulsive Sound for Marine Fauna

Hearing Group	Generalised Hearing Range	Examples of listed species that are known to, likely to, or may occur	TSS Onset Criteria		Auditory Injury (AUDINJ) Onset Criteria	
			Impulsive Impact piling	Non-impulsive Vibratory piling	Impulsive Impact piling	Non-impulsive Vibratory piling
Marine mammals - underwater						
Low-frequency (LF) cetaceans (baleen whales)	7 Hz to 36 kHz	• Southern Right Whale *(Eubalaena australis)* – Migratory, endangered • Minke Whale (*Balaenoptera acutorostrata*) – Migratory • Bryde’s Whale *(Balaenoptera edeni*) – Migratory • Blue Whale (*Balaenoptera musculus*) – Migratory, endangered • Pygmy Right Whale (*Caperea marginate*) – Migratory • Humpback Whale *(Megaptera novaeangliae*) – Migratory, vulnerable	$L_{p,0-pk,flat}$: 216 dB $L_{E,p,\ LF,24h}$: 168 dB	$L_{E,p,\ LF,24h}$: 177 dB	$L_{p,0-pk,flat}$: 222 dB $L_{E,p,\ LF,24h}$: 183 dB	$L_{E,p,\ LF,24h}$: 197 dB
High-frequency (HF) cetaceans (dolphins, toothed whales, beaked whales, bottlenose whales)	150 Hz to 160 kHz	• Bottlenose Dolphin (*Tursiops truncates*) • Common Dolphin (*Delphinus delphis*) • Dusky Dolphin (*Lagenorhynchus obscurus*) – Migratory • Killer Whale (*Orcinus orca*) – Migratory • Spotted Bottlenose Dolphin (*Tursiops aduncus*)	$L_{p,0-pk,flat}$: 224 dB $L_{E,p,\ HF,24h}$: 178 dB	$L_{E,p,\ HF,24h}$: 181 dB	$L_{p,0-pk,flat}$: 230 dB $L_{E,p,\ HF,24h}$: 193 dB	$L_{E,p,\ HF,24h}$: 201 dB

Very High-frequency (VHF) cetaceans (Other toothed whales)	200 Hz to 165 kHz	Porpoises	$L_{p,0\text{-}pk,flat}$: 196 dB $L_{E,p,VHF,24h}$: 144 dB	$L_{E,p,VHF,24h}$: 161 dB	$L_{p,0\text{-}pk,flat}$: 202 dB $L_{E,p,VHF,24h}$:159 dB	$L_{E,p,VHF,24h}$:181 dB
Sea Turtles						
High to Very High Frequency	50-1200 Hz	Green turtle (*Chelonia mydas*); hawksbill (*Eretmochelys imbricata*); loggerhead (*Caretta caretta*); leatherback (*Dermochelys coriacea*); olive ridley (*Lepidochelys olivacea*), flatback turtle *(Natator depressus)*.	$L_{p,0\text{-}pk.flat}$: 224 dB $L_{E,p,PW,24h}$: 169 dB	$L_{E,p,PW,24h}$: 178 dB	$L_{p,0\text{-}pk.flat}$: 230 dB $L_{E,p,PW,24h}$:184 dB	$L_{E,p,PW,24h}$: 198 dB
Fish						
High to Very High Frequency	20–1000 Hz	All species			Fish ≥ 2g $L_{p,0\text{-}pk.flat}$: 206 dB $L_{E,p,PA,24h}$: 187 dB Fish < 2g $L_{p,0\text{-}pk.flat}$: 206 dB $L_{E,p,PA,24h}$: 183 dB	

Source: Adapted from Southall (2007, 2019, 2021), NMFS (2024a, b, 2025a, b)

Noise generated in air is not likely to directly impact on any sensitive receptors. Seabirds may avoid operational noise generated resulting in a change in behaviour however, this is likely to be localised.

Underwater noise will be emitted throughout the project. The loudest source of underwater noise will result from geophysical surveys as shown in Table 10-9. However, these will be short-term and localised in nature with control measures implemented to minimise impacts. The engines of OSVs are also considered loud by comparison to the noise emitted during the project operation. The OSV size (detailed in Table 10-9) correlates to the noise emitted; larger the vessel, the louder the noise emitted (Peel at al., 2021). The speed at which the vessel steams is also relevant. Additionally, the faster a vessel steams the more noise is generated. For example, MacGillivray et al. (2019) demonstrated that slowing down to 11 knots reduced vessel source levels of tankers by 6.1 dB. The risk of underwater noise impacts is deemed minor with control measures recommended in Section 9.4 implemented. The impact resulting from underwater noise during the surveys is considered slight.

Underwater noise levels generated during installation, drilling, and operations within the Development Area are generally low, localised, and do not have the intensity and characteristics likely to cause physiological injury to marine fauna and is considered to be minor. Sensitive species that may occur within the Development Area are likely to be in low numbers and infrequent. Controls have been recommended to be implemented to mitigate and manage any potential impacts from underwater noise. Therefore, the impact resulting from underwater noise during the development is considered minor.

Table 10-11: Impact pathways for key environmental receptors associated with noise emissions

Activity	
Physical Environment	
Water Quality	N/A
Sediment Quality	N/A
Air Quality	N/A
Ecological Environment	
Benthic Fauna	There are no sensitive shoal or bank features, shallow coral reef or seagrass habitats found within PSC 19-11 and are not likely to occur due to the depth. Underwater noise is not expected to significantly impact on benthic fauna.
Coastal Habitats	N/A
Marine Mammals	Marine mammals of conservation importance may occur within the Development Area seasonally and year-round. Underwater noise from surveys, drilling, installation, vessel activity and operations has the potential to cause temporary behavioural disturbance, avoidance and masking of biologically important sounds. The likelihood of physiological injury is low given the predicted source characteristics, localised nature of the activities, low expected occurrence of sensitive species, and implementation of control measures.
Marine Reptiles	Sea turtles may occur within the Development Area year-round, although numbers are expected to be low. Underwater noise has the potential to cause localised behavioural disturbance or temporary avoidance; however, impacts are expected to be minor due to the short-term and localised nature of the higher-noise activities and the implementation of management controls.
Fish, Sharks and Rays	Fish, sharks and rays may occur within the Development Area year-round. Underwater noise may result in temporary behavioural responses, including avoidance or disruption to normal behaviour, particularly during survey and vessel activities. Given the offshore setting, localised footprint and expected low occurrence of sensitive species, impacts are expected to be localised and minor.
Birds	Seabirds within the Development Area are likely to be migratory and may avoid operational noise resulting in a change in behaviour however, this is likely to be localised.
Fisheries	There is the potential for three types of tuna fisheries in the region however these are Australian based and unlikely to occur in Timorese waters, there are currently no commercial fisheries operating in the Development Area. Therefore, there are likely to be no impacts on commercial fisheries. Illegal fishers may be present and this is addressed in Section 11.3.
Socioeconomic and Cultural	
Livelihoods and economy	Overall, due to the deep water location, limited spatial footprint, and absence of overlapping uses, impacts to socio-economic values are expected to be negligible to none. TBC post consultation period
Cultural heritage	
Archaeological and Historical	

Consequence assessment

Table 10-12: Consequence assessment of noise emissions for each project phase

Activity	Consequence Ranking
Surveys	1 – Slight: Slight effect – recovery in days to weeks
Drilling	2 – Minor: effect – recovery in weeks to months
Installation and commissioning	2 - Minor: Minor effect – recovery in weeks to months
Operations	2 - Minor: Minor effect – recovery in weeks to months

10.3.3 Mitigation and management

Controls considered and adopted for the activity are summarised in Section 9.4.

10.3.4 ALARP Assessment

Alternatives to the development are considered in Section 8.

Additional controls considered are provided in Table 10-13.

Table 10-13: ALARP assessment of additional controls

Activity	Additional Control	Reject Reasoning
Surveys Drilling Installation and commissioning Operations	Provide additional muffling on machinery, or design to reduce noise emissions	Machinery is generally designed with human health hearing requirements taken into consideration, reducing operating noise to as low as efficiently and cost effectively as possible. The level of noise impact from vessels/MODU/FPSO is considered to be negligible and further reduction is not feasible.
	Do not undertake the activity in times/ areas of sensitivity for pygmy blue whale	The level of noise impacts is expected to only result in behavioural impacts if any impacts do occur and given the schedule of the proposed activities include activity year round, this was considered grossly disproportionate. The location of the activity cannot be amended. A BIA for pygmy blue whale overlaps the Development Area. To avoid these times of the year when key behaviours are occurring is difficult when a vessel of opportunity is being selected and when under a tight schedule and given the weather in the area can result in very high seas and conditions that are not conducive to the activity. To ensure the safety of personnel and a successful activity, a favourable weather window and the right vessels must be selected which may be at any time of year.
	Do not undertake the activity in areas/times of sensitivity for the whale shark	The level of noise impacts is expected to only result in behavioural impacts if any impacts do occur. The location of the activity cannot be amended. Impacts to fish and sharks are considered negligible from the activity due to vessel noise posing a low risk of causing fish mortality and a moderate risk of temporary threshold shifts (TTS) when fish are within tens of metres of the vessel. Avoiding these times of the year when key behaviours are occurring is difficult when a vessel or MODU of opportunity is being selected and given the weather in the area can result in very high seas and conditions that are not conducive to the activity. To ensure the safety of personnel and a successful activity, a favourable weather window and the right vessel must be selected which may be at any time of year.
	Anchor vessel instead of using DP to minimise noise source	This would result in further seabed disturbance from the deployment of anchors. Anchoring a vessel does not allow it to hold its position as easily as on DP and could result in a failure to recover samples during GPGT, or maintain position during operational activities including IMMR . DP is considered the most reliable and appropriate type of vessel positioning to use for this activity.
	Turn off DP if a whale is seen within 2 km of vessel.	If the vessel DP is turned off mid-way through activities, there is the risk of damage to ROV or subsea infrastructure during IMMR, surveys and other activities. With the controls in place the potential for physiological or behavioural impacts to whales is significantly reduced, this option was considered grossly disproportionate to the potential benefit.

Noise emissions have been reduced to ALARP through selection and maintenance of vessels, MODU, FPSO and subsea equipment to operate efficiently and without unnecessary noise generation, use of standard offshore procedures to minimise avoidable high-noise activities where practicable, implementation of vessel speed restrictions and application of operational controls to limit the duration and extent of elevated underwater noise exposure during survey, drilling, installation and operations.

Additional controls that were either not technically feasible, or grossly disproportionate for this type of activity were rejected. In the instance of rejected controls, the additional effort would not result in significant reductions in risk levels. With implementation of the existing management measures, it is considered the risk associated with this planned impact are reduced to ALARP as per the criteria in Section 9.

10.4 Atmospheric Emissions

10.4.1 Description of Hazard

Atmospheric emissions generated from survey, drilling and development activities are associated with vessel operation, drilling and operations. Atmospheric emissions can be classified into two categories:

- Atmospheric pollutants generated from vessel, drilling and development operations include combustion-derived gases and particulates such as CO, NO_x, SO_2, PM_{10}, VOCs and BTEX, which may affect local air quality and biota.
- Greenhouse gas emissions arising from the same activities include CO_2, CH_4, N_2O and other long-lived gases (e.g. PFCs, HFCs, SF_6) that contribute to radiative forcing and climate change.

Sources of atmospheric emissions include:

- Power generation and process heating
- Engine exhausts
- Fugitive emissions
- Helicopter operations in emergencies.

GHG and atmospheric emissions are generated by the support vessels and if helicopters are needed in a Medivac scenario. Sources of emissions are from fuel use in combustion engines and fugitive emissions as well as small volumes of refrigerants. The types of volumes of emissions vary depending on the types of activities undertaken.

Atmospheric emissions may also arise from intermittent flaring, venting and unintentional equipment leaks associated with offshore petroleum operations. Support and campaign vessels may generate additional emissions from onboard waste incineration and closed-loop refrigeration systems containing small quantities of ozone-depleting substances. These emissions contribute to localised reductions in air quality but are typical of offshore activities of this scale.

Surveys

Atmospheric emissions during survey activities will be generated from the operation of survey vessels undertaking geophysical, geotechnical and environmental baseline surveys. Emissions will result from fuel combustion in vessel engines and generators used for propulsion, onboard power supply and operation of survey equipment.

These emissions will occur for the duration of survey campaigns and will be limited to the survey vessel(s) operating within the study area. Further details are provided in the EBS SOW and the GTGP EMP (Appendix A and Appendix B).

No flaring or process-related emissions are expected during surveys, and emissions will be short-term and spatially limited to the survey footprint.

Drilling

Atmospheric emissions during drilling will be generated from the operation of the floating MODU and associated support vessels. Emissions will arise from:

- MODU power generation systems used to support drilling operations, well control systems, accommodation and onboard equipment
- diesel combustion from thrusters or mooring-related power demand
- support vessel movements for resupply, crew transfer and standby functions

If well flowback is required, flaring of hydrocarbons will generate additional short-term atmospheric emissions. These emissions are associated with well clean-up and commissioning activities and are limited to the flowback period.

Short-duration flaring may also occur during well clean-up or non-routine events. Fugitive emissions may arise from valves, flanges and other MODU equipment. Support vessels may contribute additional emissions from fuel combustion, onboard incinerators and refrigeration systems. These emissions are temporary and confined to the drilling campaign.

Installation and Commissioning

Atmospheric emissions during installation and commissioning will be generated from construction support vessels, pipelay vessels, heavy-lift vessels and ROV-support vessels. Emissions will result from fuel combustion required for:

- Subsea infrastructure installation
- Flowline and umbilical deployment
- FPSO mooring installation
- ROV operations and onboard power generation

These emissions will occur for the duration of installation activities and will be concentrated around active work areas within the Development Area.

Additional emissions may occur during cold-commissioning and initial start-up, including diesel combustion for temporary power generation, limited commissioning flaring, and venting associated with system testing (e.g. nitrogen or helium leak testing). Campaign vessels may be present for several weeks to months, contributing short-term increases in vessel-related emissions.

Operations

Atmospheric emissions during operations will be dominated by the FPSO, which will operate continuously for power generation, processing and utility systems. Emissions will arise from:

- Combustion of produced gas, crude oil or diesel for power generation
- Flaring of surplus associated gas during early field life
- Support vessel movements for logistics, offloading and maintenance
- Helicopter operations for crew transfer (if applicable)

These emissions will occur throughout the production life of the field and represent the primary long-term atmospheric emission source for the project.

Additional emissions may arise from intermittent flaring during planned maintenance or upset conditions, venting from storage tank blanketing systems or thermal oxidiser operation, and fugitive emissions from process equipment. Support vessels and helicopters will contribute further combustion emissions during routine logistics and maintenance activities.

Decommissioning

Atmospheric emissions during decommissioning will be generated from the MODU or light-well-intervention vessel used for plug and abandonment, and from construction support vessels used to remove subsea infrastructure. Emissions will arise from fuel combustion for propulsion, power generation and ROV operations.

The scale and duration of emissions during decommissioning will be similar to those associated with drilling and installation activities.

Campaign vessels may be present for several weeks to months, generating temporary increases in vessel-related emissions. Emissions will cease once decommissioning vessels demobilise from the field.

HOLD for final EIS – Some calculations are still being developed and assumptions developed for all phases

Table 10-14: Summary of disturbance from atmospheric emissions

Phase	Vessel	Fuel/emissions	Usage	Duration	Quantity (tonnes)	Estimated emissions (tCO_2e)
Surveys	Vessel	Diesel	Uses ~ 5 t fuel/day (per vessel)	Max 60 days per year operating 24/7	300	974
Total						974
Drilling	Floating MODU	Diesel	~15 tonne fuel/day	150-165 days (50-55 days per well)	2475	8032
	Flaring/drill stem test	Light crude	3,000 bbls of crude per well	Total flow period of 12 hrs per well, for 3 wells	1085	3433
	Helicopter (for crew change)	Aviation fuel	Uses ~0.766 t fuel/round trip	115 (5 round trips per week for 23 weeks)	88.09	285
	Supply vessel	Diesel	Uses ~ 5 t fuel/day (per vessel)	58 trips (~ 2.5 per week for 23 weeks)	290	941
	Support/Standby Vessel	Diesel	Uses ~ 8 t fuel/day (per vessel)	150-165 days (50-55 days per well)	1320	4284
Total						16976
Mooring Pre-Installation	AHT	MGO	25 t/day	60 days	1500	4868
	HCV	MGO	25 t/day	60 days	1500	4868
Mooring Hook Up	AHT	MGO	20 t/day	14 days	280	909
	Tugs x 2	MGO	40 t/day	14 days	560	1817
SURF installation	HCV	MGO	25 t/day	70 days	1750	5679
	HLV	MGO	6 t/day	70 days	420	1363
	PSV	MGO	12 t/day	Allow 20 runs (i.e. 2 per week during SURF installation)	240	779
	Helicopter	Aviation Fuel oil	2 t/day	Allow three runs per week	2	6
Total						20290
Operations	FPSO	Diesel	~15 tonne fuel/day	365 days/year for 5 years	27375	75867
	FPSO	Fuel Gas	HOLD	HOLD	HOLD	HOLD
	FPSO	Various Fugitives	HOLD	HOLD	HOLD	HOLD
	FPSO	Gas (flared)	HOLD	HOLD	HOLD	HOLD
	Supply vessel	Diesel	Uses ~ 5 t fuel/day (per vessel)	1 trips per week for 5 years	1300	4219

	Support/Standby Vessel	Diesel	HOLD	HOLD	HOLD	HOLD
	IMMR Vessels	Diesel	HOLD	HOLD	HOLD	HOLD
Total						127
Decommissioning: Plug and abandonment drilling	Floating MODU	Diesel	~15 tonne fuel/day	45 days (15 days per well)	675	2191
	Helicopters (for crew change)	Aviation fuel	Uses ~0.766 t fuel/round trip	38 trips	29	94
	Supply vessel	Diesel	Uses ~ 5 t fuel/day (per vessel)	19 trips	95	308
	Support/Standby Vessel	Diesel	Uses ~ 8 t fuel/day (per vessel)	45 days (15 days per well)	360	1168
Total						13542
Decommissioning: Infrastructure removal	Vessels to support approved decommissioning activities	Diesel	HOLD	HOLD	HOLD	HOLD
	Supply vessel	Diesel	HOLD	HOLD	HOLD	HOLD
	Support/Standby Vessel	Diesel	HOLD	HOLD	HOLD	HOLD
	Helicopters	Aviation fuel	HOLD	HOLD	HOLD	HOLD
Total						0

Greenhouse gas emissions are estimated by multiplying the relevant emission factor by the corresponding quantity of activity data. Professional judgement has been applied to prioritise Australian emission factors from the Australian National Greenhouse Accounts Factors 2025. Where Australian factors were unavailable, 2025 DEFRA emission factors were used as a secondary source.

For aviation fuel, kerosene was assumed in place of gasoline due to the absence of specific fuel type information. This assumption is considered more conservative, as kerosene typically results in higher emissions estimates. A conversion factor of 1.253 was applied to convert tonnes of kerosene to kilolitres.

10.4.2 Impact Assessment

Localised, and temporary decrease in air quality; and contribution to global GHG emissions. Further detailed assessment of potential impacts from GHG emissions will be provided in future EMPS when all emissions sources are known. At this stage of the project, it is not possible to quantify all emissions sources in detail.

Table 10-15: Impact pathways for key environmental receptors associated with atmospheric emissions

Activity	
Physical Environment	
Water Quality	N/A
Sediment Quality	N/A
Air Quality	Atmospheric emissions from vessel engines, MODU power generation, FPSO power systems, flaring (where applicable), and fugitive releases will contribute to localised increases in atmospheric pollutants (NOx, SO_2, CO, PM_{10}, VOCs including BTEX) and greenhouse gases (CO_2, CH_4, N_2O). These emissions are dispersed rapidly in offshore conditions and are not expected to result in exceedances of relevant air quality criteria. Short-duration flaring during commissioning or non-routine events may temporarily increase combustion emissions, but these are infrequent and localised.
Ecological Environment	
Benthic Fauna	N/A
Coastal Habitats	N/A
Marine Mammals	N/A
Marine Reptiles	
Fish, Sharks and Rays	
Birds	Long-term behavioural impacts e.g. avoidance, to seabirds may occur where seabird flight paths overlap the location of the facility. No decrease in local population size or area of occupancy of species, loss or disruption of critical habitat or disruption to the breeding cycle.
Fisheries	N/A
Socioeconomic and Cultural	
Livelihoods and economy	Overall, due to the deepwater location, limited spatial footprint, and absence of overlapping uses, impacts to socio-economic values are expected to be negligible to none. To date no stakeholder concerns have been raised with regards to impacts from atmospheric emissions on sensitive receptors.
Cultural heritage	
Archaeological and Historical	

Consequence assessment

Table 10-16: Consequence assessment of atmospheric emissions for each project phase

Activity	**Consequence Ranking**
Surveys	2 – Minor: Minor effect – recovery in weeks to months
Drilling	2 – Minor: Minor effect – recovery in weeks to months
Installation and commissioning	2 – Minor: Minor effect – recovery in weeks to months
Operations	2 – Minor: Minor effect – recovery in weeks to months

10.4.3 Mitigation and management

Controls considered and adopted for the activity are summarised in Section 9.4.

10.4.4 ALARP Assessment

Alternatives to the development are considered in Section 8.

Additional controls considered are provided in Table 10-17.

Table 10-17: ALARP assessment of additional controls

Activity	Additional Control	Reject Reasoning
Surveys Drilling Installation and commissioning Operations	All emissions producing equipment is substituted for equipment that does not produce emissions	All equipment as listed is required; no opportunities for substitution were identified.
	Equipment is re-designed/ replaced with equipment designed to reduce emissions.	Risk and impact reduction are achieved through planned maintenance ensuring clean and efficient running of engines.
	All emissions producing equipment is substituted for equipment that does not produce emissions	All equipment as listed is required; no opportunities for substitution were identified.

Atmospheric emissions have been reduced to ALARP through the selection of efficient equipment and operating modes, use of low sulphur fuel in accordance with applicable requirements, maintenance and inspection of engines, combustion and flaring equipment, implementation of leak detection and repair programs where applicable, and compliance with MARPOL Annex VI and valid International Air Pollution Prevention certification requirements.

Additional controls that were either not technically feasible, or grossly disproportionate for this type of activity were rejected. In the instance of rejected controls, the additional effort would not result in significant reductions in risk levels. With implementation of the existing management measures, it is considered the risk associated with this planned impact are reduced to ALARP as per the criteria in Section 9.

10.5 Interaction with Other Users

10.5.1 Description of Hazard

Throughout the development, the physical presence of project vessels, the MODU, the FPSO and associated subsea infrastructure will result in temporary or long-term interaction with other marine users. These interactions primarily relate to vessel movements, temporary exclusion zones, and the presence of subsea infrastructure that may pose a hazard to third-party vessels and fishing equipment.

A 500 m Petroleum Safety Zone (PSZ) will be established around the MODU, FPSO and subsea infrastructure to minimise the risk of collision, entanglement or damage to third-party vessels (illegal vessels are addressed in Section 11.3. Exclusion from this area may temporarily restrict access for other marine users. Once subsea infrastructure is removed during decommissioning, the PSZ will no longer be required.

Surveys

Survey activities will involve the presence and movement of survey vessels within the Development Area. Interaction with other marine users may occur through:

- Temporary exclusion of third-party vessels from the immediate vicinity of survey operations
- Vessel transit to and from the survey area
- Short-term presence of towed equipment, ROVs or AUVs that require safe separation distances

These interactions are temporary and limited to the duration of survey campaigns. Further details are provided in the EBS SoW and the GTGP EMP (Appendix A and Appendix B).

Drilling

Drilling activities will be undertaken using a floating MODU supported by standby and supply vessels. Interaction with other marine users may occur through:

- The MODU will have a 500 m PSZ in place for the duration of drilling. This zone restricts access to third-party vessels to prevent collision, entanglement or interference with drilling operations.
- Support vessels travelling to and from the MODU may temporarily interact with other marine traffic along transit routes.
- The MODU and associated vessels represent physical obstacles that other users must navigate around. These interactions are temporary and limited to the drilling period.

Installation and commissioning

Installation and commissioning activities will involve construction support vessels, pipelay vessels and heavy-lift vessels operating within the Development Area. Interaction with other marine users may occur through:

- Temporary exclusion of third-party vessels from installation work areas
- Establishment of a 500 m PSZ around the FPSO mooring installation and subsea infrastructure installation sites
- Vessel movements associated with flowline, umbilical and subsea structure deployment

The presence of subsea infrastructure (e.g., wellheads, ESP skids, UTAs, flowlines) represents a potential snagging hazard for fishing gear should the PSZ be breached.

Operations

During operations, the FPSO will be the primary long-term presence within the Development Area. Interaction with other marine users may occur through:

- FPSO Presence and PSZ: A permanent 500 m PSZ will be maintained around the FPSO and associated subsea infrastructure for the duration of production. This zone restricts access to third-party vessels and prevents potential damage to fishing equipment or the subsea system.
- Offtake Tankers and Support Vessels: Regular tanker offtake operations and support vessel movements may temporarily interact with other marine traffic.
- Well Intervention and IMR Activities: Occasional intervention or inspection vessels may temporarily increase vessel presence and require short-term exclusion zones.

These interactions are limited to the operational footprint and do not extend beyond the Development Area.

Decommissioning

Decommissioning will involve a MODU or light-well-intervention vessel and construction support vessels to remove subsea infrastructure and plug and abandon wells. Interaction with other marine users may occur through:

- Temporary exclusion zones around decommissioning vessels
- Vessel movements associated with infrastructure recovery
- Short-term navigational constraints during lifting and retrieval operations

Once all subsea infrastructure is removed, the 500 m PSZ will be lifted and no ongoing interaction with other marine users will remain.

Table 10-18: Summary of disturbance from interaction with other users

Activity	Footprint	Duration / notes
Short-term disturbance		
Surveys (geotechnical and environmental baseline sampling)	500m radius	For duration of GPGT surveys (typically 20-60 days)
Drilling – MODU	PSZ	For duration of activity (50-55 days per well)
Operations – ROV/AUV support activities	PSZ	For duration of activity ~40 days per campaign
Decommissioning	PSZ	For duration of activity (unknown
Long term disturbance		
Installation and commissioning (subsea infrastructure footprint)	PSZ	~10 years of operations
Operations	PSZ	~10 years of operations

10.5.2 Impact Assessment

Disruption to commercial activities, including:

- Exclusion of commercial vessels from Development Area
- Potential reduction of commercial fish catches due to exclusion from licensed permits (where relevant)
- Support vessels present an obstacle and potential navigational hazard for shipping traffic.

**Illegal fishing captured as an unplanned event and not discussed here.*

Table 10-19: Impact pathways for key environmental receptors associated with interaction with other users

Activity	
Physical Environment	
Water Quality	N/A
Sediment Quality	
Air Quality	
Ecological Environment	
Benthic Fauna	N/A
Coastal Habitats	
Marine Mammals	
Marine Reptiles	
Fish, Sharks and Rays	
Birds	
Fisheries	There is the potential for three types of tuna fisheries in the region however these are Australian based and unlikely to occur in Timorese waters, there are currently no commercial fisheries operating in the Development Area. Therefore, there are likely to be no impacts on commercial fisheries. Illegal fishers may be present and this is addressed in Section 11.3.
Socioeconomic and Cultural	
Livelihoods and economy	Overall, due to the deepwater location, limited spatial footprint, and absence of overlapping uses, impacts to socio-economic values are expected to be negligible to none. TBC post consultation period
Cultural heritage	
Archaeological and Historical	

Consequence assessment

Table 10-20: Consequence assessment of interaction with other users for each project phase

Activity	Consequence Ranking
Surveys	3 - Local: Local effect – recovery in months to years
Drilling	3 - Local: Local effect – recovery in months to years
Installation and commissioning	3 - Local: Local effect – recovery in months to years
Operations	3 - Local: Local effect – recovery in months to years

10.5.3 Mitigation and management

Controls considered and adopted for the activity are summarised in Section 9.4.

10.5.4 ALARP Assessment

Alternatives to the development are considered in Section 8.

Additional controls considered are provided in Table 10-21

Table 10-21: ALARP assessment of additional controls

Activity	Additional Control	Reject Reasoning
Surveys Drilling Installation and commissioning Operations	Reduce or remove vessel use during key periods	The planned EBS and GPGT activity is of short duration and is within a very small area of operations; the activity timing is also reliant on vessel availability and weather windows, making it difficult to plan around key periods. Drilling activities will be dependent on MODU availability and relatively short duration. Operations will be ongoing throughout the period and not possible to avoid
	Additional support vessels on location to inform third party vessels in the vicinity of the activity	The additional cost of 24/7 vessel presence in field is considered grossly disproportionate to the benefit gained given the infrastructure and PSZ is marked on hydrographic charts. The radio room on the vessel is manned 24/7 allowing contact to be made with 3rd party vessels in the vicinity as required.

Interaction with other users has been managed to ALARP by minimising the infrastructure footprint, and using common drill centres and shared corridors where feasible. Temporary equipment and any dropped objects are recovered where it is safe and practicable to do so, and verification surveys are conducted before and after installation to ensure any disturbance is restricted to the smallest practicable area. Through communication with other users and engaging in public consultation, potential impacts should be reduced.

Additional controls that were either not technically feasible, or grossly disproportionate for this type of activity were rejected. In the instance of rejected controls, the additional effort would not result in significant reductions in risk levels. With implementation of the existing management measures, it is considered the risk associated with this planned impact are reduced to ALARP as per the criteria in Section 9.

10.6 Operational Discharges

10.6.1 Description of Hazard

Operational discharges will occur throughout the development from routine vessel operations, drilling activities, installation works and FPSO production operations. These discharges include liquid wastes generated from normal marine operations (e.g., bilge water, cooling water, treated sewage, greywater, desalination brine, putrescible food waste) and, where applicable, drilling fluids used during geotechnical borehole activities. Discharges may enter the marine environment following treatment in accordance with regulatory requirements (Drilling discharges from a MODU are addressed separately in Section 10.7).

These discharges are typically small in volume and are expected to cause only localised, short-term changes to water quality in the direction of prevailing currents. The area affected by operational discharges is expected to remain confined to the Development Area due to rapid dilution and dispersion in offshore conditions (to be confirmed through EBS surveys (Section 4.13).

Surveys

Survey activities will involve the operation of offshore vessels undertaking geophysical, geotechnical and environmental baseline surveys. Routine vessel discharges during surveys may include:

- Slops water, including deck drainage and bilge water
- Cooling water from onboard machinery
- Desalination brine from freshwater generation systems
- Treated sewage and greywater from vessel accommodation
- Putrescible food waste, discharged in accordance with MARPOL requirements

Geotechnical surveys may also require boreholes at proposed mooring and foundation locations. These boreholes may use seawater as the base drilling fluid, with drilling fluid additives used only where required to achieve appropriate drilling properties. Any drilling fluids proposed for use will be subject to advance approval by ANP. Discharges associated with geotechnical boreholes are limited to small volumes of drilling fluid and cuttings released at the seabed.

Further details are provided in the EBS SoW and the GTGP EMP (Appendix A and Appendix B).

These discharges are low-volume and disperse rapidly, with no expected overlap with discharges from other project phases.

Drilling

Drilling activities will be undertaken using a floating MODU supported by supply and standby vessels. Operational discharges during drilling may include:

- Bilge water, deck drainage and slops water from the MODU and support vessels
- Cooling water from MODU power generation and drilling systems
- Treated sewage, greywater and food waste from accommodation facilities
- Desalination brine from freshwater production systems

In addition to routine vessel discharges, drilling activities may generate drilling fluids and cuttings. Discharges associated with drilling fluids and cuttings are addressed separately in Section 10.7.

Support vessels will also generate routine operational discharges during transit, standby and resupply activities.

Installation and Commissioning

Installation and commissioning activities will involve construction support vessels, pipelay vessels and heavy-lift vessels. Operational discharges during this phase may include:

- Slops water, including deck drainage and bilge water
- Cooling water from onboard machinery
- Desalination brine

- Treated sewage and greywater
- Putrescible food waste

These discharges occur as part of normal vessel operations and are managed in accordance with MARPOL requirements. No additional discharges are generated by subsea installation activities beyond those associated with routine vessel operations.

During commissioning, additional discharges may include subsea commissioning fluids, treated seawater or freshwater used for flushing, leak testing and dewatering of subsea infrastructure. These discharges disperse rapidly (typically within 100 m of the release point) and are not expected to interact with FPSO-related discharges at the sea surface.

Operations

During operations, the FPSO will be the primary source of operational discharges. Routine discharges may include:

- Cooling water from power generation and processing systems
- Desalination brine from freshwater production
- Treated sewage and greywater from accommodation facilities
- Slops water, including deck drainage and bilge water
- Putrescible food waste discharged in accordance with MARPOL
- Produced water, treated to meet regulatory oil-in-water limits prior to discharge (addressed separately in Section 10.8)

Support vessels involved in logistics, offtake operations, IMR activities and crew transfer will also generate routine operational discharges consistent with MARPOL requirements.

Additional FPSO-specific discharges may include steam turbine generator condensate, inert gas generator cooling water, firefighting system test water (PFAS-free), riser guide tube marine growth prevention system discharges, and intermittent subsea commissioning fluids during start-up. Water-based hydraulic fluids and subsea control fluids may also be released in small volumes during normal subsea system operation. These discharges are low-volume, intermittent and rapidly diluted.

Inspection, Maintenance and Repair (IMR)

IMR vessels will generate routine operational discharges during inspection and maintenance campaigns. These discharges are limited to vessel-based waste streams (e.g., bilge water, sewage, greywater).

Near-seabed discharges may occur from marine growth cleaning, hydraulic control fluids, subsea control fluids or residual chemicals released during valve cycling, leak testing or equipment replacement. These discharges are minor, localised and disperse rapidly.

Well Intervention and Workovers

Intervention vessels may generate operational discharges similar to those produced during drilling and IMR activities.

Additional discharges may include well completion fluids, formation water, MEG, methanol and other chemicals used during intervention. These discharges are intermittent and limited to the duration of the intervention campaign.

Decommissioning

Decommissioning activities will involve a MODU or light-well-intervention vessel and construction support vessels. Operational discharges during decommissioning may include:

- Bilge water, deck drainage and slops water
- Cooling water
- Desalination brine
- Treated sewage and greywater
- Putrescible food waste

These discharges are consistent with routine vessel operations and will be managed in accordance with MARPOL requirements. No additional discharges are generated beyond those associated with vessel presence and well abandonment activities.

Small volumes of subsea control fluids or residual chemicals may be released during disconnection, flushing or recovery of subsea equipment. These discharges are minor and localised.

Routine, Infrequent, and Concurrent Discharges

Routine discharges

Routine operational discharges from the FPSO and vessels will occur daily and include treated sewage and greywater, putrescible waste, desalination brine, cooling water, steam turbine condensate, deck drainage, treated bilge water, riser guide tube marine growth prevention discharges, and small volumes of subsea control fluids. Localised changes to water quality may occur during discharge but conditions return to background within minutes to hours due to rapid dilution.

Infrequent and one-off discharges

Infrequent discharges may occur during planned campaign vessel activities (typically 14–30 days every 3–5 years), light well intervention, commissioning and initial start-up. These discharges include routine vessel waste streams and small volumes of chemicals or residual hydrocarbons associated with cold-commissioning. A contingency discharge of treated seawater may occur if major subsea repair is required.

10.6.2 Impact Assessment

Potential impacts to marine fauna via:

- Changes to the water quality through nutrient enrichment and increased biological oxygen demand;
- Impact to predator-prey dynamics.
- Changes in temperature, salinity, toxicity of water.

Table 10-22: Impact pathways for key environmental receptors associated with operational discharges

Activity	
Physical Environment	
Water Quality	Routine operational discharges (e.g., cooling water, treated sewage, greywater, desalination brine, bilge water, deck drainage and food waste) may result in localised, short-term changes to water quality in the immediate vicinity of discharge points. Cooling water discharges may also cause a localised and temporary increase in ambient seawater temperature and introduce low residual chlorination levels, which may result in minor short-term physiological or behavioural responses in nearby marine biota and highly localised effects on plankton. Treated oily water discharges may cause a localised reduction in water quality; however, treatment to applicable oil-in-water limits and rapid offshore dilution significantly reduce the potential for ecological

	effects. All discharges will comply with MARPOL and regulatory requirements, and are expected to rapidly dilute and disperse in offshore conditions. No long-term or broad-scale impacts to water quality are expected.
Sediment Quality	N/A
Air Quality	N/A
Ecological Environment	
Benthic Fauna	N/A
Coastal Habitats	N/A
Marine Mammals	Sensitive marine mammal species that may occur within the Development Area are likely to be in low numbers and infrequent. Minor, localised changes in water quality may occur near discharge points. These changes are temporary and within regulatory limits, and are not expected to affect mammal health, behaviour or habitat use. Operational discharges are expected to remain highly localised with rapid dilution in offshore waters. Any interaction with marine mammals would likely be brief and of insufficient duration or concentration to cause toxic effects. Temporary behavioural responses such as short-term avoidance or attraction may occur, but no prolonged disturbance is expected. Contingency treated seawater discharges would expose fauna only to low chemical concentrations for short durations in a limited area near the release point.
Marine Reptiles	Available tracking data indicates some turtle migration pathways may overlap parts of the Development Area, however no significant biological areas are known to occur as discussed in Section 10345021.0.10344960. Minor, localised changes in water quality may occur near discharge points. These changes are temporary and within regulatory limits, and are not expected to affect reptile health, behaviour or habitat use. Cooling water and treated oily water discharges are expected to rapidly disperse offshore and are not anticipated to create sustained conditions that would disturb marine reptile presence or movement patterns. Operational discharges are expected to remain highly localised with rapid dilution, and any interaction with marine reptiles would likely be brief and insufficient to cause toxic effects. Temporary behavioural responses such as avoidance may occur, but no prolonged disturbance is expected. Due to the transient nature of individuals, the absence of any marine turtle BIAs in the area, and the limited spatial extent of impacts, population-level effects are not expected on marine turtles. Sea snakes may occur within the Development Area, although densities are expected to be low and dominated by pelagic or transient individuals. Minor, localised changes in water quality may occur near discharge points, but these are temporary, within regulatory limits, and are not expected to affect sea snake health or behaviour. Operational discharges will rapidly disperse in the water column and are unlikely to create conditions that would alter sea snake presence, foraging or movement patterns. Given the absence of critical habitat and the transient nature of individuals, population-level impacts on sea snakes are not expected.
Fish, Sharks and Rays	Minor, localised changes in water quality may occur near discharge points. These changes are temporary and within regulatory limits, and are not expected to affect fish health, behaviour or habitat use. Fish, sharks and rays present within the Development Area are likely to be transient, and any contact with discharge plumes would likely be short duration and insufficient to cause toxic effects. Some species may be temporarily attracted or avoid discharge areas, including attraction of fish to macerated food waste discharges, though these events would be isolated and not expected to result in lasting behavioural change. Contingency treated seawater discharges would only expose fauna to low chemical concentrations for short durations within a small area near the release point.
Birds	N/A
Fisheries	There is the potential for three types of tuna fisheries in the region however these are Australian based and unlikely to occur in Timorese waters, there are currently no commercial fisheries operating in the Development Area. Therefore, there are likely to be no impacts on commercial fisheries. Illegal fishers may be present and this is addressed in Section 11.3.

Socioeconomic and Cultural	
Livelihoods and economy	N/A
Cultural heritage	
Archaeological and Historical	

Consequence Assessment

Table 10-23: Consequence assessment of operational discharges for each project phase

Activity	Consequence Ranking
Surveys	2 – Minor: Minor effect – recovery in weeks to months
Drilling	2 – Minor: Minor effect – recovery in weeks to months
Installation and commissioning	2 – Minor: Minor effect – recovery in weeks to months
Operations	2 – Minor: Minor effect – recovery in weeks to months

10.6.3 Mitigation and management

Controls considered and adopted for the activity are summarised in Section 9.4.

10.6.4 ALARP Assessment

Alternatives to the development are considered in Section 8.

Additional controls considered are provided in Table 10-24.

Table 10-24: ALARP assessment of additional controls

Activity	Additional Control	Reject Reasoning
Surveys Drilling Installation and commissioning Operations	Wastes stored onboard and transferred to shore for onshore treatment and disposal	Costs associated with this would be disproportionate to the environmental benefit gained given the rapid dilution in offshore water and low potential impact from discharges. In addition, transfers increase the risks of spills/ leaks and safety risks to personnel during transfer operations.

Operational discharges have been reduced to ALARP through treatment and discharge controls consistent with MARPOL requirements, including use of oily water separation and monitoring equipment, treatment of sewage prior to discharge, management of garbage and food waste in accordance with applicable requirements, containment and treatment of contaminated drainage, approval and control of chemicals planned for discharge.

Additional controls that were either not technically feasible, or grossly disproportionate for this type of activity were rejected. In the instance of rejected controls, the additional effort would not result in significant reductions in risk levels. With implementation of the existing management measures, it is considered the risk associated with this planned impact are reduced to ALARP as per the criteria in Section 9.

10.7 Drilling Discharges

10.7.1 Description of Hazard

The KTJ Project comprises three subsea production wells (two in the Kuda Tasi field, one in the Jahal field). The wells will be drilled using a floating MODU. The two Kuda Tasi production wells will be drilled from a common drill centre (with the two wellhead surface locations separated by ~40 m), and the Jahal well is located approximately 7.5 km WSW of the KT wells location. Hence, there are two locations at which drill cuttings and drilling fluids will be discharged.

Each well is expected to take approximately 50-55 days to drill. Drilling activities generate drill cuttings, require cementing of the casing, and require the use of a range of fluids. Throughout the drilling program several different fluids are to be run through the closed circulation system including, but not limited to, drilling fluids WBM, NWBM (non water-based mud such as SBM, if used), sea water, and kill-weight brine.

Routine drilling discharges will include:

- Drill cuttings
- Drilling fluids (direct to seabed, retained on cuttings and bulk discharge of mud pits [WBMs only])

Non-routine drilling discharges may include drill cuttings and fluids generated due to respud or side tracking.

Drill Cuttings and Drilling Fluids

The primary discharges used as the basis of the impact assessment for the KTJ Project are as follows:

- Drill cuttings: drilling generates drill cuttings due to the breakup of solid material from within the borehole. The resultant drill cuttings are basically rock particles of various shapes, with sizes typically ranging from very fine to very coarse.
- Drilling fluids: serve many purposes including maintaining borehole stability and hydrostatic pressure, reducing friction and cleaning/ cooling of the drill bit, in addition to acting as a medium to carry cuttings from the well bore and return them to the surface at seabed or on the MODU. There are two main types of drilling fluids as follows:

- WBMs - consists mainly of fresh water or seawater with the addition of chemical and mineral additives to aid in its function. Drilling additives typically used may include chlorides (e.g. sodium, potassium), bentonite (clay), cellulose polymers, guar gum, barite or calcium carbonate. These additives are either completely inert in the marine environment, naturally occurring benign materials, or readily biodegradable organic polymers with a very fast rate of biodegradation in the marine environment. Bentonite and guar gum are listed as 'E' category fluids under the OCNS and is included on the Oslo Paris (OSPAR) Commission PLONOR (chemicals that 'pose little or no risk to the environment') list (OSPAR Commission, 2025). WBMs can be discharged to sea as fluids retained on cuttings and as bulk discharge from mud pits.
- NWBMs - refers to drill fluids that are hydrocarbon rather than water-based fluid. NWBM may contain a range of synthetic hydrocarbons, such as paraffins and olefins; however, such additives are designed to be low in toxicity and biodegradable, as well as not being readily bioavailable or likely to bioaccumulate, particularly in deeper water areas. No bulk discharge of NWBMs will occur offshore, only NWBMs retained on cuttings can be discharged from the MODU. If a NWBM system is required to drill a well section, the cuttings from the NWBM drilling fluid system will pass through the SCE (Solids Control Equipment; centrifuge and dryers) to reduce the average residual oil on cuttings (OOC). It is noted that microbial biodegradation can result in oxygen reduction within sediments; however, Nedwed et al. (2006) found that depth is an important factor for residual concentrations of NWBF once they reach the seabed, suggesting that loss of base fluid during settling acted to significantly reduce chemical effects from discharges. It is also noted that NWBM cuttings tend to clump and settle to the seabed rapidly adding to the cuttings pile in proximity to the well site.

Drill cuttings and unrecoverable WBMs are discharged at the seabed at each well site for the top-hole sections, which are drilled riserless (i.e. no closed loop with the MODU). This results in a localised area of sediment deposition (known as a cuttings pile) around and in proximity to the well site influenced by prevailing seabed currents.

Once the top-hole sections are complete, installation of the riser and BOP provides a conduit back to the MODU, forming a closed circulating system. The bottom hole sections will be drilled with a marine riser in place that enables cuttings and drilling fluids to be circulated back to the MODU, where the cuttings are separated from the drilling fluids by the solids control equipment (SCE) and typically re-used in the closed loop system between the well bore and the MODU. The cuttings (with adhered residual fluids) are, in typical circumstances, discharged below the water line, with their fate and dispersion determined by cuttings particle size and the density of the unrecoverable fluids. In contrast the fluids are recirculated into the fluid system where there are a number of mud pits (tanks) on the MODU that provide a capacity to mix, maintain and store fluids required for drilling activities. The mud pits form part of the drilling fluid circulating system and may be discharged at the end of specific well sections, where there is a requirement to change the drilling fluid system or the drilling fluid cannot be re-used (due to deterioration/contamination). Bulk discharge of this type is only permitted for WBMs.

The estimated generation of well cuttings and disposal points for the Kuda Tasi and Jahal wells is summarised in Table 4-2.

Subsea – Displacement, Completion and Wellbore Cleanout Fluids

Completion fluids are usually brines (i.e. a mixture of seawater or formation water) with additives that can include:

- Chlorides (often sodium, potassium or calcium)
- Bromides

- Hydrate inhibitor (MEG)
- Biocide
- Oxygen scavenger.

They are designed to have the proper density and flow characteristics to be compatible with the reservoir formation. Completion fluids are used to run well completions, and during wellbore clean up and flowback during drilling.

Wellbore and casing clean-up are required at various stages of the drilling operations to ensure the contents of the well are free of contaminants before the next stage of drilling. A chemical wellbore cleanout fluid train may be used to remove residual fluids (including NWBM, if used) from the wellbore. The wellbore cleanout fluid is usually brine (similar to completion fluid) that can include several chemicals, such as biocide and surfactant. During the clean-up process, fluids are circulated back to the MODU.

Cleanout fluids and completion brine will be captured and stored on the MODU and discharged if oil concentration is less than 1% by volume or returned to shore if discharge requirements cannot be met. Discharge volume is estimated to be ~400 m³.

Contingent Drilling Activities

Respud

It is unlikely that a well would be required to respud. If required, the most likely scenario is that the decision to respud is made during drilling of the top hole section of a well; therefore, the incremental increase in cuttings and fluids discharges is associated with the repeat drilling of the same top hole sections for the respudded well with the same

associated discharges. A respud once drilling of the bottom hole sections has commenced is far less likely, given the time and effort already committed to the well. However, if this was to occur, the associated discharges would also be a repeat of the discharges as per Table 4-2 to re-drill the same sections of the respudded well.

Sidetrack

Should the drill string become stuck in hole and efforts to free it are unsuccessful, it may be necessary to use either a shaped explosive charge or a specialised mechanical cutter to separate drill pipe above the stuck pipe. After recovering remaining drill pipe above the stuck pipe, a contingency, which will be considered in the event of loss of the drill string, will be to run back in hole to a planned depth and kick off a side track and use directional drilling techniques to continue drilling to target. There is no additional risk to the environment in a contingency side track.

There may also be a requirement for a geological sidetrack. This may occur in the instance where the drilled reservoir result is not as prognosed, and it is determined that a different reservoir location would be more favourable to production and ultimate oil recovery. Should a sidetrack be required, it will result in an increase in the volume of cuttings generated and a potential increase in the use of NWBM. Additional drill cuttings volume is estimated to be ~120 m³, and fluid volume ~2000 m³.

Well Annular Fluids

Well annular fluids refer to the fluids that remain in the wellbore, or annular spaces between the casing. It may consist of weighted drilling fluid and cement-contaminated mud, seawater, barite, cement polymer, and may include small amounts of hydrocarbon.

If a well is underperforming, or surveillance indicates debris is contained within the well, the contents of the wellbore may be flowed to a MODU. This displaces the well fluids (i.e. suspension/completion fluids). These are discharged overboard, as potential gas content makes it too dangerous to personnel to filter or treat them.

In the event a wellhead is removed due to the requirement to respud, small volumes (~1.5 m^3) of fluid exchange between the annular spaces and the ocean may occur. The exchange will not be instantaneous as the annular spaces are small and the fluids are typically heavier than seawater. In the unlikely event routine wellhead removal techniques are unsuccessful, this fluid exchange is expected to occur over time following sufficient corrosion of the wellhead.

The small volumes and non-instantaneous nature of the release of the well annular fluids is expected to result in rapid dilution to a no-effect concentration within metres of the release location.

10.7.2 Impact Assessment

Routine and non-routine drilling-related discharges may result in the following impacts:

- Change in water quality
- Change in seabed sediment quality
- Change in seabed habitat
- Injury/mortality to marine fauna (benthic communities).

For each KT well, the upper hole sections well be drilled riserless (or 'open hole'), with cuttings and muds discharged at the seabed, whereas the lower hole sections will be drilled after the riser has been installed, with cuttings/muds returned to the drilling rig and discharged just below the sea surface. For each KT well, ~516 m^3 of cuttings will be discharged at the seabed, versus ~59 m^3 at the sea surface; and for the Jahal well, ~440 m^3 of cuttings will be discharged at the seabed, versus ~40 m^3 at the sea surface (refer Table 4-2).

Drill Cuttings and Retained Fluids

Drill cuttings and retained drilling fluid discharges are expected to increase turbidity and TSS levels above ambient concentrations above the seabed (top-hole well sections) or in the upper surface layers (bottom-hole well sections with discharge below the water line from the MODU). Drill cuttings discharge will be generally intermittent and of short duration (over a total period of about 55 days per well) during the drilling of a well.

Top-hole well section drill cuttings and drilling fluids (WBM) will be discharged at the seabed. The coarser material (drill cuttings) will deposit on the seabed and the finer sediment material (the WBM) will cause localised elevated total suspended solids (TSS) in the water column above the seabed surrounding the well. This reduction in water quality will be temporary (limited to the operational discharges during drilling) and subject to rapid dispersion and dilution by prevailing seabed currents.

During bottom-hole well sections, when drill cuttings with retained drilling fluids (WBM or NWBM) are discharged below the water line (from the MODU), the larger particles, representing about 90% of the mass of the solids, form a plume that drops out of suspension in the water column rapidly and, deposits on the seabed. About 10% of the mass of the solids (the fines predominately composed of drilling fluid) form a plume in the upper surface layer (depending on the depth of discharge from the MODU) that will be transported by prevailing currents away from the MODU and is diluted rapidly in the receiving waters (Neff, 2005, 2010). There is a large body of knowledge indicating a discharge of cuttings with adhered fluids diluting rapidly. These studies have found that within 100 m of the discharge point, a drilling cuttings and fluid plume released at the surface will have diluted by a factor of at least 10,000. Further to that, Neff (2005) states that in well mixed oceans waters, the plume is diluted by more than 100-fold within 10 m of the discharge site.

Dispersion of the cuttings plume is influenced by a number of factors: particle sized distribution (PSD) of the cuttings and fluids, operational discharge events and rates and metocean conditions such as ocean current speed. The case studies described in Neff (2005) used WBMs and surface current speeds of 0.15–0.3 m/s. As currents in the KTJ Development Area are ~0.4 m/s at the surface, and WBMs (bulk discharge) will contribute the largest input to elevated TSS/turbidity during drilling discharges, the dispersion extent as determined by Neff (2005) is considered representative for the KTJ drilling program.

Using the widely-accepted dilution factor of 10,000 (Neff, 2005), cuttings (and adhered fluids) are expected to reach 100 mg/L TSS within 100 m of the MODU. Using a conservative ocean current speed of 0.1 m/s (which is well below average current speeds in the KTJ Development Area), these discharges are expected to disperse to 100 mg/L within ~16 minutes.

Water Quality and Planktonic Communities

Given the generally low concentration of TSS outside the immediate vicinity of the discharge point, due to rapid dispersion of sediment and the short period of intermittent discharge, the plume is not expected to have more than a very highly localised reduction in water quality and area of potential ecological impact. It is not predicted to impact productivity of the water column.

The combination of low toxicity and rapid dilution of unrecoverable NWBMs discharged in association with drill cuttings are of little risk of direct toxicity to water-column biota (Neff et al., 2000).

Injury/mortality to planktonic species may occur due to a change in water quality following discharges of drill cuttings and fluids. Impacts to these organisms can be as a product of both physical and chemical alterations of water quality, predominantly in the water column.

As outlined above, using the widely-accepted dilution factor of 10,000 (Neff, 2005), cuttings (and adhered fluids) are expected to reach 100 mg/L TSS within 100 m of the MODU over a period of ~16 minutes. Minimal impact to plankton (phytoplankton, zooplankton and meroplankton (larvae of invertebrates and fish) is therefore expected from the discharge of drill cuttings. Neff (2010) explains that the lack of toxicity and low bioaccumulation potential of the drilling muds means that the effects of the discharges are highly localised and are not expected to spread through the food web (of which planktonic species are the basis).

Due to the low levels of planktonic productivity in the offshore waters of the KTJ Development Area, plankton populations on a regional scale are not expected to be affected by drilling operations. In addition, due to the open nature of the marine environment of the KTJ Development Area and associated environmental conditions (i.e. windy, strong currents, etc.), the content and dispersive nature of drilling muds within the marine environment and the high population replenishment of these organisms, it is expected that impacts to plankton species will be limited to within tens of metres of the discharge point and return to previous conditions within a relatively short period of time. On this basis, the impacts to plankton from routine and non-routine discharges during drilling activities are determined to be slight.

Sediment Quality and Benthic Communities

Accumulation of drill cuttings on the seabed causes changes in the physical properties of the seabed sediment such as the PSD, the introduction of contaminants (metals such as barium) from retained drilling fluids (WBM), introduction of forms of synthetic hydrocarbons (from retained NWBM on cuttings) and associated ecological effects.

The discharge of drill cuttings and unrecoverable fluids at the seabed during riserless top hole drilling results in a localised area of sediment deposition (known as a cuttings pile) surrounding the well site. The cuttings pile distribution may reflect prevailing seabed currents and spread predominately downstream of the well site but overall extent from the well site is typically tens of metres. The dimensions of the cuttings pile depend on several factors, including volume (~516 m^3 of top-hole cuttings per KT well; ~440 m^3 of top-hole cuttings for the Jahal well; Table 4-2) and composition of cuttings, and oceanographic conditions at the discharge location. The top-hole well section drill cuttings and retained drilling fluids (WBM) to seabed have the greatest impact to sediment quality and modification of the habitat in proximity to the well, as the solids tend to clump and settle rapidly around the discharge point (Neff, 2010).

Base fluids for NWBM will be assessed in accordance with the Offshore Chemical Notification Scheme (OCNS) and the Chemical Hazard and Risk Management (CHARM) methodology will be applied for hazard identification. NWBM base fluids are designed to be biodegradable in offshore marine sediments. Biodegradation can result in a low oxygen (anoxic) environment resulting in changes in benthic community structure. Species sensitive to anoxic environments are eliminated and replaced by tolerant and opportunistic species, resulting in decreased species diversity, but the number of individuals often increases (Neff et al., 2000). NWBMs are designed to be low in toxicity and are not readily bioavailable to benthic fauna due to their physical/chemical properties. Nedwed et al. (2006) found that depth is an important factor for concentrations of NWBM on cuttings, where cuttings which had a great distance to reach the seabed (950 m) had significantly lower concentrations, suggesting that loss of base fluid during settling acted to significantly reduce chemical effects from discharges. The study concluded that NWBM discharged in deep water posed very limited environmental impacts (from analysis of difference in benthic fauna between pre- and post-drilling samples, Nedwed et al., 2006). This discharge is expected to dilute rapidly, with a potential impact to the environment considered to be a local, temporary decrease in water quality (as discussed above).

Benthic organisms below the cuttings pile will be buried and smothered; however, the cuttings piles are expected to be recolonised over time. Ecological impacts to benthic biota are predicted when sediment deposition is equal to or greater than 6.5 mm in thickness (IOGP, 2016). This amount of sediment deposition from top hole and bottom hole cuttings is expected to be confined to within a few hundred metres around the well location, although this depends on the nature of the cuttings, the water depth and currents of the receiving environment (IOGP, 2016). A conservative radius of 500 m representing a zone of potential ecological impact has been applied to the KT wells location and the Jahal well location for this impact assessment. Mobile benthic fauna, such as demersal fish, may be temporarily displaced from areas where cuttings discharges accumulate. Furthermore, ecological impacts are not expected for mobile benthic fauna such as crabs and shrimps or pelagic and demersal fish, given their mobility (IOGP, 2016).

Balcom *et al*., (2012) concluded that impacts associated with discharging cuttings and base fluids (including NWBMs) are minimal, with impacts highly localised to the area of the discharge deposition on the seabed. Changes to benthic communities are normally not severe. Organic enrichment can occur, leading to anoxic conditions in the surface sediments and a loss of infauna species that have a low tolerance to low oxygen concentrations, and to a lesser extent chemical toxicity near the well location. These impacts are highly localised with short-term recovery that may include changes in community composition with the replacement of infauna species that are hypoxia-tolerant (IOGP, 2016). Recovery of affected benthic infauna, epifauna and demersal communities is expected to occur, given the short duration of sediment deposition and the widely represented benthic and demersal community composition. The zone of potential ecological impact for the two KT wells is conservatively estimated to be <1.5 km^2, and for the Jahal well <1.0 km^2. Thus, the total area of potential ecological impact for the three wells is conservatively estimated to be <2.5 km^2.

Low levels of sediment deposition away from the immediate area of the well site would represent a thin layer of settled drill cuttings and drilling fluids, which will likely be naturally reworked into surface sediment layers through bioturbation (US Environmental Protection Agency, 2000). Metals such as barium from the drilling fluid additives are used as a tracer of dispersion and are typically detected beyond the zone of ecological impact but as discussed for sediment quality (above), the insoluble mineralised salts (the source of barium) have low bioavailability to benthic biota.

Drilling Fluids (Bulk Discharge)

WBM may be bulk discharged at the end of specific well sections, as described above, where there is a requirement to change the drilling fluid system or the drilling fluid cannot be re-used (due to deterioration/contamination). A small quantity of WBM and NWBM residue (<1%) may also be discharged at the sea surface while cleaning the mud pits, typically at the conclusion of drilling activities or when changing between mud types.

Discharge of WBM will result in a buoyant plume of fine materials that will rapidly dilute and decrease in turbidity levels immediately away from the discharge point. WBM samples collected by Jones et al. (2021) from the mud pits just before discharge during the Greater Western Flank-2 drilling campaign (on the North West Shelf off Western Australia) were ~90% silt sized (<62.5 µm) with a mean diameter of 12 µm (gel-polymer) and 33 µm (KCl-polymer). Total suspended solid (TSS) levels in the gel-polymer mud and KCl-polymer mud were 257 g/L and 245 g/L respectively. Jones et al. (2021) used an ROV to observe mud pit discharges and reported the discharge to exit the discharge outlet as a jet of material in a distinctive cloud-like plume descending rapidly to the seabed and growing in diameter with increasing depth.

The subsea plume can be expected to disperse over a wide area (up to several kilometres), with no discernible sediment deposition on the seabed and no physical or biological impacts, particularly given the water depth of the well locations (400-440 m). Impacts beyond the 500 m zone of ecological impact for each well as described for drill cuttings and retained fluids discharge is not expected.

Subsea – Displacement, Completion and Well-bore Cleanout Fluids

Discharges such as displacement, completion and wellbore cleanout fluids are typically inert and of low-toxicity. These fluids are mostly brine, with a small proportion of chemical additives such as surfactants, biocide, corrosion inhibitor, oxygen scavenger, MEG and guar gum. The volume of one wellbore and subsequent discharge volume would be ~400 m^3. Any change to water quality is expected to be localised and temporary. As this is an intermittent batch discharge, any change in water quality will be short term as discharges are discrete and of short duration. Rapid dilution due to prevailing ocean currents in the open water environment would lead to any changes in water quality such as low toxicity contaminants being temporary (only for the duration of the discharge) and reducing water quality within a short distance of the discharge location.

Cumulative Impacts

The two Kuda Tasi wells will be drilled from a common drill centre (with the two wellhead surface locations separated by ~40 m), and the Jahal well is located approximately 7.5 km WSW of the KT wells location. Accordingly, there is no likelihood of cumulative impacts from the discharge of drill cuttings/muds from the KT wells and the Jahal well, given the separation distance between the discharge points. With regards to the potential for cumulative impacts resulting from discharge of drill cuttings/muds from the two KT wells, there are a number of factors that indicate cumulative impacts are highly unlikely to occur—namely, the water depth at the discharge location (~425 m), the volume of cuttings discharged at the sea surface versus at the seabed, and the use of WBM to drill the top-hole sections.

Adaptive Management

Secondary data used to inform the description of the existing environment of the KTJ Project Development Area (refer Section 6) indicates that the soft sediments at 400-440 m water depths are likely to have benthic habitats/communities representative of the epibenthic macrofaunal communities and infauna found across soft sediments in similar water depths in the Timor Sea—i.e., epibenthic fauna dominated by hermit crabs, echinoderms and demersal fishes; and low abundance, low diversity benthic infauna dominated by polychaetes and crustaceans. There are no indications that any hard substrates and associated epibenthic faunal communities (e.g., deep sea corals and sponges) occur at the KTJ Project location. Hence, with regards to potential impacts to benthic habitats/communities from the discharge of drill cuttings and drilling muds, it is highly likely that no sensitive receptors occur within the potential footprint of drill cuttings dispersion and settlement on the seabed.

If the Environmental Baseline Survey (EBS) finds sensitive benthic habitats/communities within the KTJ Project Development Area, Finder commits to revising this EIS in accordance with the Adaptive Management Approach for baseline data collection. Additionally, Finder commits to undertaking drill cuttings dispersion modelling based on final confirmed well locations, drilling fluid system, fluid and cuttings volumes, discharge depth and rates. The Drilling EMP will be revised to reflect the results of this drill cuttings dispersion modelling, and management measures that will be implemented to eliminate or reduce potential impacts to benthic habitats/communities.

Summary

Impacts associated with routine and non-routine drilling discharges will be largely limited to an area surrounding the well locations, which are in 400-440 m water depth, in the offshore, open water environment and >165 km from the nearest coastline. The low sensitivity of the benthic communities/habitats within and in the vicinity of the KTJ Development Area, combined with the low toxicity of WBMs and residual NWBMs, no bulk discharges of NWBM and the highly localised nature and scale of predicted physical impacts to seabed biota, affirm that any predicted impact is considered likely but of a minor environmental consequence.

Table 10-25: Impact pathways for key environmental receptors associated with drilling discharges

<table>
<tr><th>Activity</th><th>Drilling Discharges</th></tr>
<tr><td colspan="2">Physical Environment</td></tr>
<tr><td>Water Quality</td><td>Localised and temporary decline in water quality within a few tens metres of the well locations. Highly localised and slight impacts on planktonic communities.</td></tr>
<tr><td>Sediment Quality</td><td>Highly localised and temporary decline in sediment quality in the area immediately surrounding the well locations.</td></tr>
<tr><td>Air Quality</td><td>Not applicable</td></tr>
<tr><td colspan="2">Ecological Environment</td></tr>
<tr><td>Benthic Fauna</td><td>Highly likely that no sensitive receptors occur within the potential footprint of drill cuttings dispersion and settlement on the seabed.</td></tr>
<tr><td>Coastal Habitats</td><td>Not applicable</td></tr>
<tr><td>Marine Mammals</td><td rowspan="3">Sensitive marine mammals, marine reptiles, and fish, shark and ray species that may occur within the Development Area are expected to be infrequent and present only in low numbers. Large numbers of pelagic marine fauna species are unlikely to be impacted as the KTJ Development Area does not contain any significant feeding, breeding or aggregation areas for marine fauna. Therefore, marine fauna within the area are likely to be relatively limited in number, transient and well represented throughout the region. If contact with the plume resulting from surface disposal of drill cuttings and fluids does occur with any marine fauna, it will be for a short duration due to the rapid dispersion of the plume and the transient movement of marine fauna, such that exposure time may not be of sufficient duration to cause any toxic effects.</td></tr>
<tr><td>Marine Reptiles</td></tr>
<tr><td>Fish, Sharks and Rays</td></tr>
<tr><td>Birds</td><td>Not applicable</td></tr>
<tr><td>Fisheries</td><td>There is the potential for three types of tuna fisheries in the region however these are Australian based and unlikely to occur in Timorese waters, there are currently no</td></tr>
</table>

	commercial fisheries operating in the Development Area. Therefore, there are likely to be no impacts on commercial fisheries. Illegal fishers may be present and this is addressed in Section 11.3.
Socio-economic and Cultural	
Livelihoods and economy	Not applicable
Cultural heritage	
Archaeological and Historical	

Consequence Assessment

Table 10-26: Consequence assessment of drilling discharges

Activity	Consequence Ranking
Drilling	2 – Minor effect – recovery in weeks to months

10.7.3 Mitigation and Management

Controls considered and adopted for the activity are summarised in Section 9.4.

10.7.4 ALARP Assessment

Alternatives to the development are considered in Section 8.

Additional controls considered are provided in Table 10-27.

Table 10-27: ALARP assessment of additional controls

Activity	Additional Control	Reject Reasoning
Drilling	Collection of cuttings returns with residual WBM for onshore treatment/disposal (i.e. no offshore discharge)	Drilling discharges are unavoidable for this activity. > Onshore disposal was assessed but found impractical due to: >Higher fuel use and emissions from transport. >Increased safety risks to workers during handling/loading. >Added pressure on road transport and landfills. >High additional cost (~$3M AUD). Offshore discharge: >Has low toxicity and only short-term, localised seabed impacts. >Allows natural recolonisation of benthic biota after drilling. >Poses no added safety risks to personnel. >Impacts are short-term, recoverable, and negligible. Offshore disposal is therefore considered the most practical and lowest-risk option.
	Extended cuttings dump chute to below sea surface	Releases drilled solids (cuttings) deeper in the water column, thereby potentially reducing spatial extent and turbidity plume. The use of a chute does not materially change the environmental outcomes given that cuttings either fall vertically into the sea and thereafter through the water column or vertically through a cuttings chute and

		thereafter through the water column; a chute does not reduce the volume of cuttings discharged. A chute system introduces higher costs and operational risk. Significant cost associated with engineering, fabricating and/or installing chute. Potential delays if chute becomes blocked. Higher operational risk. Increased depth of concentrated cuttings deposition may inhibit infauna recovery at seabed. Given the low environmental impact of the cuttings discharged (due to the chemicals selected) and the short duration of discharge in an area that is not identified as significant habitat for marine fauna, the additional cost is considered disproportionate to the environmental benefit.
	Riserless mud recovery (RMR)	The use of RMR system to bring the WBM drilling fluids back to the MODU for removal may reduce impacts from smothering and sediment quality reduction. However, RMR increases the suspended sediment in the water column as the cuttings are subsequently discharged from the MODU. Cost associated with changes to equipment and change to the well design. RMR equipment requires additional space on the MODU and additional POB. RMR introduces additional operational/maintenance and risk and additional running time. There is also more opportunity for equipment failure. To reduce this possibility, additional inventory of spare parts is required to be on board as well as additional maintenance requirements and competency skills in personnel. Considering the negligible consequence to the marine environment from WBM fluids discharge on cuttings at the seabed, any negligible environmental benefits gained from the implementation RMR are considered disproportionate to the costs and risks associated with RMR system installation and use. The additional RMR management costs and drilling downtime risks are considered disproportionately high to the low environmental benefits. Cost outweighs the benefit.

Risks associated with drilling discharges have been reduced to ALARP through implementation of robust controls. All chemicals proposed for discharge are managed under the Chemical Register, approved by ANP, and selected to favour less hazardous alternatives. Cuttings management systems are in place to minimise overboard discharges and maximise reuse wherever possible. Inventories are kept to a minimum, with chemicals stored and handled in accordance with best practice. Strict adherence to the Drilling Fluids Management Plan and operational controls, ensures effective risk management.

Additional controls that were either not technically feasible, or grossly disproportionate for this type of activity were rejected. In the instance of rejected controls, the additional effort would not result in significant reductions in risk levels. With implementation of the existing management measures, it is considered the risk associated with this planned impact are reduced to ALARP as per the criteria in Section 9.

10.8 Produced Water

10.8.1 Description of Hazard

Produced water (PW) will be discharged overboard from the FPSO over the life of the field, after treatment to meet required discharge standards. Oil-water separation systems, probably with a hydrocyclone, will be used to treat PW prior to discharge. A small number of chemicals is added to the production process for purposes such as increasing and/or decreasing emulsification, inhibiting scale formation, reducing corrosion and preventing growth of bacteria. These production chemicals are to varying extents and are ultimately discharged with the PW. Discharged PW will contain also dissolved compounds from the geological formation, such as organic acids, low molecular weight hydrocarbons and salts, and finely dispersed oils.

At the current stage of project definition, PW, treatment performance and final handling arrangements (including reinjection and/or discharge) are not yet confirmed.

10.8.2 Impact Assessment

The following is a high-level assessment of the potential impacts of PW discharge from the FPSO, based on information presented in the Offshore Project Proposal (OPP) for the Barossa Area Development (ConocoPhillips 2018). Given that PW discharge modelling has not been undertaken to date, this impact assessment is also based on a number of conservative assumptions. Detailed PW modelling and impact assessment will be undertaken once final production forecasts and facility design parameters are confirmed and will be documented in the Operations EMP prior to production commencement.

Once PW is discharged to sea, it is subject to dilution, dispersion and physical, chemical and biological degradation. The discharge of PW is expected to result in a localised and temporary increase in water temperature (within a few metres horizontally of the release location, depending on discharge depth) and decline in water quality associated with the constituents within the PW plume (e.g. mixture of hydrocarbons, dissolved inorganic salts, metals and process chemicals) in the upper water column (within approximately 10-20 m below the sea surface).

The PW discharge is expected to be low salinity (~15 ppt) and warmer than receiving waters and will therefore rise to the surface. Mixing and dilution will be facilitated by the release point being below the surface. Further mixing and dilutions will occur due to surface currents, winds and wave action.

The risks from PW generally diminish significantly within short distances from the discharge due to rapid dilution. Considering this, potential toxicological impacts are not predicted to be observed more than tens of metres beyond the discharge point. For comparison, assessment of PW discharge from the Sunrise Gas Project (approximately 250 km ENE of the KTJ Development Area) concluded that impacts associated with chemical toxicity from the PW stream would not be experienced further than a radial distance of 15 m and at a depth of 3.3 m below the point of PW discharge (Office of Environment and Heritage 2003).

Hydrocarbons

The potential impacts and risks associated with the discharge of PW are determined by the fate of the constituents released to the marine environment. Residual amounts of dissolved hydrocarbon compounds that remain in the PW stream following treatment may include benzene, toluene and xylenes (BTEX), PAHs and phenols. BTEX are generally the most abundant hydrocarbons in PW, however they are also highly volatile and are therefore lost rapidly during treatment of PW and mixing with the receiving waters (IOGP 2005; Neff et al.

2011; Ekins *et al.* 2007). BTEX also biodegrades rapidly in the marine environment and is not known to accumulate to significant concentrations within marine organisms (IOGP 2005). BTEX are toxic to marine fauna as they have potential to alter the permeability of cell membranes, particularly in the gills of fish, and can cause developmental defects in marine biota fauna (Fucik et al. 1994; National Research Council 2003). However, given the rapid loss of BTEX components, exposure to marine fauna is extremely low (IOGP 2005).

PAHs are less volatile than BTEX, relatively insoluble and can accumulate in the marine environment (IOGP 2005; Ekins *et al*. 2005). PAHs can be broadly divided into two types; those of low molecular weight and those of high molecular weight. PAHs dissolved in PW are predominantly low molecular weight and, while moderately toxic, they are not mutagenic nor carcinogenic (Neff 2002; IOGP 2005). Higher molecular weight PAHs are rarely detected in treated PW as, due to their low aqueous solubility, they are associated primarily with dispersed oil droplets which are removed during treatment by the PW treatment system (Neff et al. 2011). PAHs are generally removed from the water column through volatilisation to the atmosphere upon reaching the sea surface, particularly the lower molecular weight fractions (Schmeichel 2017). PAHs can also degrade in the water column with half-lives ranging from less than a day to several months, with the more abundant and lower molecular weight compounds being more degradable (OGP 2002, cited in Ekins *et al*. 2005).

As outlined above, PAHs are toxic to marine fauna as they can affect reproductive and biological functions. In addition, higher molecular weight PAHs can be also be carcinogenic (Schmeichel 2017). Lower molecular weight PAHs are less toxic as their ability to accumulate in the tissue of marine fauna is lower when compared to higher molecular weight PAHs (IOGP 2005). However, higher molecular PAHs generally have low availability to marine organisms as they tend to remain associated with oil droplets and sorb tightly to particulates; though, this allows them to remain in marine sediments for months to years where they can affect benthic fauna (Schmeichel 2017). In well-mixed offshore waters, such as those in the KTJ Development Area, elevated concentrations of higher molecular PAHs in sediments have been observed to be limited to within several hundred metres from a high-volume PW discharge location (Neff et al. 2011). Given this, the potential for environmental impact associated with accumulation of PAHs in sediments is considered to be very low. Phenols may also be dissolved in the PW stream; however, they are highly volatile and rapidly biodegraded by micro-organisms in seawater, and therefore pose a low risk to marine fauna (IOGP 2005).

Metals

The various trace metals that may be present in low concentrations in the PW stream are generally in a low oxidative state and on release to the marine environment rapidly oxidise and precipitate into solid forms. Marine fauna have the ability to regulate the availability of many trace metals, with few trace metals shown to accumulate significantly (IOGP 2005). While concentrations of trace metals in PW can be significantly greater than those in the marine environment, they are rapidly reduced through dilution and mixing processes, and other physicochemical reactions to levels that pose a low risk to the receiving environment (IOGP 2005).

Mercury is a key metal of concern and may occur in low concentrations in the PW discharged. Mercury is expected to be mainly in the form of liquid elemental mercury, with production of some mercury sulphide likely. Liquid elemental mercury is relatively unreactive and insoluble in water (Neff 2002; Boszke *et al*. 2002). Of the different forms of mercury, methyl-mercury is of greatest concern as it is readily bioavailable, has potential to bioaccumulate and can cause toxicological effects at very low doses. While methyl-mercury is not expected to be present in the reservoir, as the presence of this form of mercury in natural gas and natural gas liquids is uncommon (Row & Humphrys 2011; Carnell & Row 2014), it has been Risher 2003). conservatively assumed for the purposes of this assessment that trace amounts may be present within the PW stream. Methylation of elemental mercury can also occur in the marine environment by microorganisms (However, the formation of methyl-mercury mainly occurs in anaerobic conditions and is enhanced in low pH (i.e. acidic) waters (Risher

2003; Boszke *et al*. 2002); which are not characteristic of the conditions in the KTJ Development Area (refer Section 6.1.8). Considering this, and based on the conservative assumption that methyl-mercury is present within the reservoir (which is highly unlikely), it is possible that there may be a slight accumulation of mercury in marine sediments within the vicinity of the PW discharge (within hundreds of metres). When taking into account the low sensitivity and widely represented nature of the benthic communities in the KTJ Development Area, the ecological risk of slight increases of mercury in the sediments is expected to be low.

Process Chemicals

Trace levels of process chemicals may be present in the PW. Some of the process chemicals will be in concentrations below that which are toxic to marine fauna, such as scale inhibitors, while others may be at concentrations that have potential to cause impact or contribute to the aquatic toxicity of the PW, such as corrosion inhibitors and biocides (Neff 2002). The ecotoxicological impacts of process chemicals in PW discharges was investigated in a study by Henderson *et al.* (1999). The study tested 11 commonly used process chemicals (including biocides, corrosion inhibitors and demulsifiers) for their acute toxicity to marine bacterium, both directly in aqueous preparations and following their partitioning between oil and water phases. The chemicals selected represented a range of toxicities as per the OCNS ranking system. With regard to the relevance of the oil and water phases, the toxic components of the process chemicals have different affinities to these phases. For example, the toxic components of biocides partition into the water phase of the PW discharge, corrosion inhibitors partition primarily into the water phase while demulsifiers partition into the oil phase (Schmeichel 2017).

The Henderson *et al*. (1999) study observed that for the majority of the process chemicals tested, the toxicity of the water phase to the test organism following partitioning against the oil phase, was not significantly altered by the presence of process chemicals when used in their normal operational dosage concentrations. However, the study also stated that, should the chemicals be used in high concentrations, they may increase the toxicity of the PW as higher concentrations could increase the partitioning of the oil phase components into the water phase (Henderson *et al.* 1999). A toxicological review of this study by Schmeichel (2017) notes that the study concluded that process chemicals make a small contribution to the overall acute toxicity profile of PW discharges and even chemicals which are classified as highly toxic, may not actually present an acute toxicity risk at dosages representing normal operating conditions. Considering the observations by Henderson *et al*. (1999) and Schmeichel (2017), and that concentrations of the process chemicals expected to be used for the KTJ Project will align with normal operational dosages, it is considered that ecological risk associated with trace levels of process chemicals in the PW discharge stream will be low.

The accumulation of PW chemical constituents in the water column and benthic sediments is influenced by the volume/concentration in PW discharges and subsequent rate of dilution, the ability of the constituents to be taken up by sediments, the area of the seabed that is contacted and re-suspension, bioturbation and microbial decay in the water column and on the seabed. Results from monitoring programs have generally shown that natural dispersion processes control the concentrations of toxic metals in the water column and sediments slightly above natural background concentrations (Neff et al. 2011).

Summary

Considering that the KTJ Development Area is located in open, offshore waters, which are subject to large-scale currents and mixing from the influence of the Indonesian Throughflow (ITF) (refer Section 6.1.8), the elevated water temperatures and concentrations of the constituents within the PW plume are expected to rapidly dilute and reach levels below those which may cause harm to marine species. A PW plume such as that expected within the KTJ Development Area will be very well mixed and have little interaction with the seabed and sediments in any elevated concentrations. Consequently, impacts are expected to be relatively localised (i.e.

limited to deep offshore waters), with the PW plume not expected to impact any environmental values/sensitivities.

Table 10-28: Impact pathways for key environmental receptors associated with produced water

Activity	Discharge of Produced Water
Physical Environment	
Water Quality	Localised and temporary decline in water quality within a few hundred metres of the FPSO facility. Potential toxicological impacts are not predicted to be observed more than tens of metres beyond the discharge point.
Sediment Quality	Localised and temporary decline in sediment quality in the area immediately surrounding the FPSO facility.
Air Quality	N/A
Ecological Environment	
Benthic Fauna	The potential for impact associated with the bioaccumulation of PW constituents in benthic sediments is considered low and limited to a potential localised effect on a limited number of benthic fauna species immediately surrounding the FPSO facility.
Coastal Habitats	N/A
Marine Mammals	Sensitive marine mammals, marine reptiles, and fish, shark and ray species that may occur within the Development Area are expected to be infrequent and present only in low numbers. Large numbers of pelagic marine fauna species are unlikely to be impacted as the KTJ Development Area does not contain any significant feeding, breeding or aggregation areas for marine fauna. Therefore, marine fauna within the area are likely to be relatively limited in number, transient and well represented throughout the region. If contact with the plume does occur with any marine fauna, it will be for a short duration due to the rapid dispersion of the plume and the transient movement of marine fauna, such that exposure time may not be of sufficient duration to cause any toxic effects.
Marine Reptiles	
Fish, Sharks and Rays	
Birds	N/A
Fisheries	There is the potential for three types of tuna fisheries in the region however these are Australian based and unlikely to occur in Timorese waters, there are currently no commercial fisheries operating in the Development Area. Therefore, there are likely to be no impacts on commercial fisheries. Illegal fishers may be present and this is addressed in Section 11.3.
Socio-economic and Cultural	
Livelihoods and economy	N/A
Cultural heritage	
Archaeological & Historical	

Consequence Assessment

Table 10-29: Consequence assessment of produced water

Activity	Consequence Ranking
Discharge of Produced Water	2 – Minor effect – recovery in weeks to months

10.8.3 Mitigation and Management

Controls for PW have not yet been confirmed but will be provided in the Operations EMP. During operations, verification monitoring of hydrocarbon concentrations of the PW discharge stream will be undertaken prior to discharge. The results will be reviewed to confirm compliance with the management controls presented in the Operations EMP.

10.8.4 ALARP Assessment

Alternatives to the development are considered in Section 8.

Additional controls for PW have not yet been considered due to the maturity of the project.

11. UNPLANNED EVENTS

11.1 Marine Pest Introduction

11.1.1 Description of Hazard

Introduced Marine Species (IMS) are marine plants, animals and algae that have been introduced into a region that is beyond their natural range but have the ability to survive, and possibly thrive. The majority of climatically compatible IMS to the NWS are found in south-east Asian countries. IMS can be introduced into the Development Area and surrounds by vessels carrying IMS on external biological fouling, internal systems (sea chests, seawater systems etc.), on marine equipment (including ROVs), or through ballast water exchange. Artificial, disturbed and/or polluted habitats in tropical regions are susceptible to introductions meaning that ports are often areas of higher IMS risk, and where IMS transfer onto operational vessels and through ballast water, and then potentially translocated to the Development Area (Neil et al. 2005). Ballast water is responsible for up to 30% of all IMS incursions into Australian waters however, research indicates that biofouling (the accumulation of aquatic micro-organisms, algae, plants and animals on vessel hulls and submerged surfaces) has been responsible for more foreign marine introductions than ballast water (DAWR 2017).

Some IMS pose a significant risk to environmental values, biodiversity, ecosystem health, human health, fisheries, aquaculture, shipping, ports and tourism (Wells et al. 2009). IMSs can cause a variety of adverse effects in a receiving environment, including:

- Over-predation of native flora and fauna;
- Out-competing of native flora and fauna for food;
- Human illness through released toxins;
- Depletion of viable fishing areas and aquaculture stock;
- Reduction of coastal aesthetics; and
- Damage to marine and industrial equipment and infrastructure.

Species of concern vary from one region to another depending on various environmental factors for survival such as water temperature, salinity, nutrient levels and habitat type. However, once established, eradication of IMS populations is difficult, limiting management options to ongoing control or impact minimisation. Case studies in Australia indicate that from detection to eradication can take approximately four weeks (dependent on the environmental conditions and species; Bax 1999). For this reason, increased management requirements have been implemented in recent years by Australian Commonwealth and State regulatory agencies, and the International Maritime Organisation (IMO) Ballast Water Management Convention. Timor Leste as a member of implements the IMO Biofouling Guidelines (2023). Under the Australian National Biofouling Management Guidance for the Petroleum Production and Exploration Industry (2009), a risk assessment approach is recommended to manage biofouling. This risk assessment methodology has been adopted for this project. All vessels are subject to some level of biofouling. Biofouling can be found:

- On vessel hulls
- On external niche areas,
- In internal niches,
- On equipment routinely immersed in water, and
- In ballast water exchange.

Organisms attach to the vessel hull, particularly in areas where organisms can find a good attachment surface (e.g. seams, strainers and unpainted surfaces) or where turbulence is lowest (e.g. niches and sea chests).

Commercial vessels typically maintain cleaning and anti-fouling coatings to reduce the build-up of fouling organisms.

The potential biofouling risk presented by the vessels will relate to the location/s of the operations it has been undertaking, the length of time spent at these location/s, and whether the vessel has undergone hull inspections, cleaning and application of new anti-foulant coating prior to returning to operate in Timor waters.

11.1.2 Impact Assessment

IMS may potentially be introduced throughout the Development Lifespan:

- Potential for vessels to transfer IMS from international waters into the Development Area through ballast water or from vessel hulls from survey vessels.
- Potential for drilling activities to transfer IMS into the Development Area.
- Potential to transfer IMS into the Development Area through ballast water or from vessel hulls from OSVs and other operational equipment e.g. ROVs.
- Potential to transfer IMS into the Development Area through ballast water or from vessel hulls from OSVs and other operational and installation equipment e.g. submerged cables and infrastructure.
- Potential for drilling activities to transfer IMS into the Development Area.
- Potential to transfer IMS into the Development Area through ballast water or from vessel hulls from OSVs and other operational equipment e.g. ROVs.
- Potential for IMS translocation during decommissioning

The introduction of IMS can potentially result in localised impacts on native marine fauna and flora, including:

- Competition, predation or displacement of native species;
- Alteration of natural ecological processes;
- Introduction of pathogens with the potential to impact human and/or ecological health;
- Reduction and/or competition with commercial fish and aquaculture species.

As further discussed in Table 11-1.

Table 11-1: Impact pathways for key environmental receptors associated with marine pest introduction

Activity	
Physical Environment	
Water Quality	N/A
Sediment Quality	N/A
Air Quality	N/A
Ecological Environment	
Benthic Fauna	Ballast water discharge and contaminated ships and equipment may have the potential to introduce IMS. There is the potential that any IMS entering the Development Area would establish on the natural benthic habitat (macroalgal habitat). However, invasive marine species vary from one region to another and depend on various environmental factors for survival such as water temperature, salinity, nutrient levels and habitat type. Given the depth of the area (400 m), and the lack of diversity on the seabed and limited epifauna and in fauna, it is unlikely to provide ideal habitat for MIS establishment however, this cannot be ruled out.
Coastal Habitats	N/A
Marine Mammals Marine Reptiles Fish, Sharks and Rays	IMS are likely to have little or no natural competition or predation, thus potentially outcompeting native species for food or space, preying on native species or changing the nature of the environment. For example, Australia has over 250 established marine pests, and it is estimated that approximately one in six IMS becomes pests (DoE 2015). In the event that a marine pest is

	introduced into the Development Area, there is the potential for pests to become established resulting in a localised but medium-term impacts to the area. Impacts to pelagic fish are not predicted, given the fish are mobile. The Development Area does not contain any known critical areas (i.e. feeding, breeding) or highly significant habitat (i.e. coral reef, seagrass) for fish. Larger fauna is unlikely to be significantly affected by a change in the physical environment due to the introduction of IMS as they are transient species (marine mammals, marine reptiles) and the prey availability in the area is not high enough to support critical habitat to these species, hence the low numbers found. The lack of critical areas (coral reefs and filter feeders) in the area of the well location further reduces the potential for IMS establishment and subsequent competition with local fauna.
Birds	N/A
Fisheries	IMS have the potential to outcompete and displace native species which may in turn affect the local marine ecosystem, and potentially fisheries operating in the area affected. There is the potential for three types of tuna fisheries in the region however these are Australian based and unlikely to occur in Timorese waters, there are currently no commercial fisheries operating in the Development Area. Therefore, there are likely to be no impacts on commercial fisheries. Illegal fishers may be present and this is addressed in Section 11.3.
Socioeconomic and Cultural	
Livelihoods and economy	TBC post consultation period
Cultural heritage	
Archaeological and Historical	

Consequence Assessment

Table 11-2: Consequence assessment of marine pest introduction for each project phase

Activity	Consequence Ranking	Likelihood	Ranking
Surveys	4 – Major	2	Medium
Drilling	4 – Major	3	Medium
Installation and commissioning	4 – Major	3	Medium
Operations	4 – Major	2	Medium

11.1.3 Mitigation and management

Controls considered and adopted for the activity are summarised in Section 9.4.

11.1.4 ALARP Assessment

Alternatives to the development are considered in Section 8.

Additional controls considered are provided in Table 11-3.

Table 11-3: ALARP assessment of additional controls

Activity	Additional Control	Reject Reasoning
Surveys Drilling Installation and commissioning Operations	Support vessels to be sourced from Australian waters only	Wherever possible, domestic vessels will be sourced, but this may not always be feasible. Delays to activities can result from non-availability of suitable vessels if only drawn from local waters. Regardless, all vessels are subject to IMP risk assessment and must manage their ballast water and biofouling in accordance with regulatory requirements. Minimal benefit gained given the implemented controls ensure only low IMP risk vessel are contracted.

	Application of new anti-foulant coating to vessels prior to contract commencement	Substantial additional cost, potential delay to commencement of activity. Little benefit given the requirement to rank as low risk using the IMP risk assessment. Anti-fouling coating on the in-water surfaces of vessels, and the chemical dosing of sea chests (marine growth prevention system) will occur. Anti-fouling coatings containing TBT are not an option as these biocides are prohibited from use globally.
	Use an alternative ballast system to avoid uptake or discharge of water (zero discharge)	Vessels suitable for the activity may not have options for alternative ballast system, therefore would require modification at significant cost, ballast water exchange is required for stability on the vessels.
	Follow-up marine pest inspection around 75 days after arrival if the vessel is still in Timorese waters	The objective is to ensure that vessels (including MODU and FPSO) engaged in the activity are free of IMPs at the time of mobilisation. Accordingly, the residual risk of IMP is considered low due to inspection and cleaning controls and the need for any follow-up inspections of vessels 75 days after arrival is negated. In the event that any invasive marine pests entered the Development Area(s) the nearest habitat is the FPSO/ vessel hull or the benthic habitat (soft sediments at the seabed). The depth of the Development Area, open ocean conditions and lack of available light at this depth provides a very hostile/ different environment to that within sheltered port and shallow coastal areas which have historically been colonised by IMPs.

The risk of introducing invasive marine species (IMS) has been reduced to ALARP by implementing legislative controls as outlined in Section 9.4. These measures include rigorous vessel inspections and cleaning prior to mobilisation (where applicable), adherence to approved anti-fouling practices excluding prohibited biocides, and compliance with ballast water management regulations. The application of current IMP risk assessment criteria ensures that the likelihood of IMS introduction is minimised to the lowest practicable level consistent with regulatory requirements.

Additional controls that were either not technically feasible, or grossly disproportionate for this type of activity were rejected. In the instance of rejected controls, the additional effort would not result in significant reductions in risk levels. With implementation of the existing management measures, it is considered the risk associated with this unplanned impact are reduced to ALARP as per the criteria in Section 9.

11.2 Interaction with fauna

11.2.1 Description of Hazard

The Development will result in the physical presence of facilities/infrastructure and equipment in the water column, on the sea surface and on the seabed. However, once installed the physical presence of subsea infrastructure, anchors, FPSO, etc, is not likely to cause a barrier to movement. The risk of collision by birds is low due to the low height of the FPSO and lighting and will result in birds avoiding the infrastructure and thus changing behaviour, but not significantly enough to impact on migration flyways (Masden et al., 2010). Similarly, the subsea infrastructure is not likely to impact on the migration route of cetaceans such as the pygmy blue whale. Post-construction, these structures can act as artificial reef structures causing the recolonisation of benthic habitat, and which may attract concentrated fish populations (Macreadie et al., 2011; Ajemian et al., 2015), though this usually occurs in shallower warmer waters close to reefs that can act as sources for fish and is not typical in very deep waters such as those in the Development Area.

During the Development, use of FPSO, MODU, support vessels, and helicopters has the potential to result in direct and indirect impacts to fauna through disturbance or collision with larger marine fauna (including cetaceans, whale sharks, birds and turtles). Vessel speed is a key factor in increasing the chance and severity of vessel strikes. Nearly 90% of vessel strikes where a whale was severely hurt or killed have been recorded when the vessel was travelling above 14 knots and was more serious in collisions with larger vessels considered greater than 80 m Olson et al. (2021). Throughout the Development, a variety of vessels could be used that differ in size, speed, and operating procedures. Table 11-4 shows the range in size of typical vessels operating throughout the Development lifespan.

Table 11-4: Typical vessels and sizes operating throughout the Development

Activity	Vessel Size	Speed
Surveys (geotechnical and environmental baseline sampling)	- Uncrewed vessel controlled remotely (smaller than crewed) - Environmental baseline survey vessel, length 35 m, max speed 22 knots. - Geophysical survey vessel approx. 65 m length. - Geotechnical survey vessels approx. 100 m length.	Maximum speed 22 knots however, control measures implemented will reduce speed to 8 knots when within 300 m of cetaceans adhering to national guidelines.
Drilling	The Hakuryu-5 106m long Rig tenders typically operating with vessel size 50–100 m.	Stationary 0.1 knots. Typically steaming at 11 knots (McCauley, 1998).
Installation and commissioning, drilling, and operations	The *Petrojarl I* is 215 m length Rig tenders typically operating with vessel size 50–100 m. Other larger vessels used for installation, decommissioning, ≥ 100 - <200 m (Class 4), and ≥200 m (Class 5). Shuttle oil tanker Helicopters Bell 212 and Sikorsky-61.	Stationary 0.1 knots. Typically steaming at 11 knots (McCauley, 1998). Typically 12-16 knots.

11.2.2 Impact Assessment

Section 6.3.4 identifies the potential sensitive receptors of conservation importance that may occur in the Development Area year-round. There are also seasonal periods during which vessel interaction with sensitive marine fauna are more likely e.g. during the whale shark and pygmy blue whale migration.

The main risk from vessel collisions are species that swim slowly, and spend considerable time at the surface either resting, foraging, sleeping, or mating which may make them more vulnerable to a vessel strike. Species that have low noise awareness (e.g. blue whales) or find it difficult to identify the direction of vessel noise (e.g. turtles) will reduce the ability for individuals to avoid vessel strikes. Marine fauna like turtles, cetaceans and whale sharks that are present in surface waters for feeding and breathing are more susceptible to vessel strike due to their proximity to the vessel (hull, propeller or equipment) and their limited ability to avoid vessels

(Pilcher, 2022). Whale sharks may be behaviourally vulnerable to boat strike. They spend a significant amount of time feeding in surface waters (DEH 2005; Norman 1999) and scars have been observed on several whale sharks that have likely been caused by boat collision (DEH 2005). There have also been several reports of whale sharks being struck by bows of larger ships in other regions where whale sharks occur (Norman 1999). Fast moving species of fish such as the Great white shark are less likely to be impacted by vessel collisions (Olsen et al. 2021).

Seabirds have the potential to collide with helicopter blades in flight. PSC 19-11 occurs within the East Asian–Australasian, and the West Pacific migratory bird flyways which are a major migration route through which migratory waterbirds traverse annually. There are no nearby seabird breeding islands, and no exposed land within PSC19-11 that could offer nesting or resting sites. Therefore, bird presence in the area is expected to be limited to migrating and/or foraging pelagic seabirds. Sound emitted from helicopter operations is typically below 500 Hz, localised and short in duration. Sound pressure in the water directly below a helicopter is greatest at the sea surface but diminishes quickly with depth. However, the noise at the sea surface can disturb marine fauna.

Table 11-5: Impact pathways for key environmental receptors associated with interaction with fauna

<table>
<tr><th colspan="2">Activity</th></tr>
<tr><td colspan="2">Physical Environment</td></tr>
<tr><td>Water Quality</td><td>N/A</td></tr>
<tr><td>Sediment Quality</td><td>N/A</td></tr>
<tr><td>Air Quality</td><td>N/A</td></tr>
<tr><td colspan="2">Ecological Environment</td></tr>
<tr><td>Benthic Fauna</td><td>Once operational there will be low interaction with benthic fauna that may result from other activities discussed in previous chapters e.g. seabed disturbance.</td></tr>
<tr><td>Coastal Habitats</td><td>N/A</td></tr>
<tr><td>Marine Mammals</td><td rowspan="3">The underwater infrastructure is not likely to impact on the migration route of cetaceans or whale sharks. The use of FPSO, support vessels, and helicopters has the potential to result in direct and indirect impacts to fauna through disturbance or collision with larger marine fauna (including cetaceans, whale sharks, birds and turtles) and potential vessel collision.</td></tr>
<tr><td>Marine Reptiles</td></tr>
<tr><td>Fish, Sharks and Rays</td></tr>
<tr><td>Birds</td><td>The risk of collision by birds is low due to the low height of infrastructure and lighting and will result in birds avoiding the infrastructure and thus changing behaviour, but not significantly enough to impact on migration routes.</td></tr>
<tr><td>Fisheries</td><td>There is the potential for three types of tuna fisheries in the region however these are Australian based and unlikely to occur in Timorese waters, there are currently no commercial fisheries operating in the Development Area. Therefore, there are likely to be no impacts on commercial fisheries.
Illegal fishers may be present and this is addressed in Section 11.3.</td></tr>
<tr><td colspan="2">Socioeconomic and Cultural</td></tr>
<tr><td>Livelihoods and economy</td><td rowspan="3">N/A</td></tr>
<tr><td>Cultural heritage</td></tr>
<tr><td>Archaeological and Historical</td></tr>
</table>

As discussed above the vessels supporting and operating throughout the duration of the Development may disturb sensitive species such as the whale sharks, turtles and cetaceans through accidental collisions. Impacts on marine fauna that could potentially occur throughout the Development include:

Direct impacts

- Mortality/injury from vessel collision,

- Mortality/injury from helicopter strike on seabirds,
- Behavioural changes/avoidance in marine fauna.

Indirect impacts

- Disruption of behaviour (e.g. feeding, nursing, mating, migrating),
- Displacement from important habitat areas (e.g. resting, feeding, breeding and calving areas),
- Long term stress,
- Reduced breeding success.

Applying a precautionary approach to minimise disturbance to whales, dolphins and other marine megafauna as recommended by the Guidelines for Interactions with Cetaceans in Timor-Leste, and the Australian National Guidelines for Whale and Dolphin Watching, (2017) would reduce the likelihood of a collisions and disturbance occurring.

Consequence Assessment

Table 11-6: Consequence assessment of interaction with fauna for each project phase

Activity	Consequence Ranking	Likelihood	Ranking
Surveys	2 - Minor	2	Low
Drilling	2 - Minor	2	Low
Installation and commissioning	2 - Minor	2	Low
Operations	2 - Minor	2	Low

11.2.3 Mitigation and management

Controls considered and adopted for the activity are summarised in Section 9.4.

11.2.4 ALARP Assessment

Alternatives to the development are considered in Section 8.

Additional controls considered are provided in Table 11-7.

Table 11-7: ALARP assessment of additional controls

Activity	Additional Control	Reject Reasoning
Surveys Drilling Installation and commissioning Operations	Removal of vessels	Vessel presence is required during the activity and there are no practicable alternatives. The potential for interaction between support vessels and fauna cannot be eliminated, however the risk is low given the low volume of vessel activity, short duration and speed limits.
	Reduce or remove vessel use during key sensitive periods	Reducing or removing vessel activities during known migration periods of marine fauna is not a viable option as these activities are necessary for the safe and efficient operation. Given the low vessel speeds, the risk to marine fauna is considered very low and no additional controls are required.
	Use of marine fauna observers on all vessels to identify fauna close to vessels	Vessel Masters will complete an environmental induction which includes the applicable requirements or speed limits and avoiding fauna. The introduction of a specialist marine fauna observer is unlikely to increase detection and the additional cost is considered grossly disproportionate given the low vessel speeds and low potential for impacts on marine fauna.

The use of support vessels in the field is necessary for the safe and efficient operation of the production facilities. Without vessels providing support for activities via replenishment of materials and subsea inspections, the risk of equipment failure leading to a safety or environmental incident is increased. Therefore, elimination of subsea equipment inspection activities or supply transfer to eliminate the risk of marine fauna collision is not considered. In the event that vessels come in close proximity to EPBC Act–listed marine fauna, such as whales and whale sharks, environmental performance standards have been implemented for limiting vessel operations, as well as for ensuring that the crew are aware through inductions of the risk posed by conducting the activity, in order to reduce the likelihood of a marine fauna collision to ALARP.

Additional controls that were either not technically feasible, or grossly disproportionate for this type of activity were rejected. In the instance of rejected controls, the additional effort would not result in significant reductions in risk levels. With implementation of the existing management measures, it is considered the risk associated with this unplanned impact are reduced to ALARP as per the criteria in Section 9.

11.3 Interaction (unplanned) with others (IUU and FADS)

11.3.1 Description of Hazard

Throughout the development, the physical presence of project vessels, the MODU, the FPSO and associated subsea infrastructure may result in interaction with other marine users and disrupt fishing activity, including Illegal, Unreported and Unregulated (IUU) fishing and the deployment of fish aggregating devices (FADs). The movement of support vessels and helicopters as well as the presence of PSZ around the FPSO, MODU and subsea infrastructure in the Development Area may physically interact with or disrupt other illegal users of the sea.

IUU fishing activities and the deployment of FADs frequently occur in the Timor Sea and may also occur in the Development Area. FADs are typically deployed in nearshore waters, most commonly within approximately 3 km of the mainland (Tilley et al 2019) and only rarely beyond 5 km offshore. The Development Area is located approximately 147 km offshore from the Timor-Leste coastline and therefore the use of fish aggregating devices is not anticipated within the Development Area.

Potential interactions primarily relate to vessel movements and transit routes, temporary exclusion zones, and the presence of subsea infrastructure that may lead to interactions and potentially collisions between offshore support vessels and IUU fishermen. A 500 m Petroleum Safety Zone (PSZ) will be established around the MODU, FPSO and subsea infrastructure will minimise the risk of collision with illegal fishing vessels.

Project infrastructure and increased vessel presence as a result of the project may:

- Increase visibility of the area to fishing operators
- Create perceived aggregation of fish or habitat value
- Result in opportunistic fishing activity, including IUU fishing

In remote areas such as the KTJ project, this may increase the likelihood of unauthorised fishing interactions, particularly when enforcement presence is limited. Recently (April 2026) an Indonesian-flagged fishing vessel operating illegal within Timor-Leste's EEZ was seized by Timor-Leste authorities with 9 tons of illegal catch on board. A lack of resources to patrol the country's waters, combined with limited monitoring of vessel activity means that IUU can occur.

11.3.2 Impact Assessment

Direct impacts associated with the activity include the potential for vessel collision between project-related ships and small fishing vessels that may be operating illegally within the area. A collision event could result in injury to personnel, damage to vessels and equipment, or localised environmental impacts associated with fuel or cargo release.

Indirect impacts may include the potential for an increase in illegal fishing activity if offshore infrastructure or vessel presence is perceived to create fish aggregation effects. Structures and operational discharges can attract marine species and may inadvertently create areas of enhanced fishing opportunity. This perception could encourage unauthorised fishing vessels to enter the area more frequently, increasing safety risks, the potential for vessel interactions, and pressure on local marine resources.

Table 11-8: Impact pathways for key environmental receptors associated with interaction with unplanned others (IUU and FADS)

Activity	
Physical Environment	
Water Quality	N/A
Sediment Quality	
Air Quality	
Ecological Environment	
Benthic Fauna	N/A
Coastal Habitats	
Marine Mammals	
Marine Reptiles	
Fish, Sharks and Rays	
Birds	
Fisheries	There is the potential for three types of tuna fisheries in the region however these are Australian based and unlikely to occur in Timorese waters, there are currently no commercial fisheries operating in the Development Area. Therefore, there are likely to be no impacts on commercial fisheries. Illegal fishers may be present. The presence of the MODU, FPSO, support vessels and the 500 m Petroleum Safety Zone (PSZ) may disrupt illegal fishing vessels by: • Indirect increase in fishing activity if aggregation is perceived • Potential risk of ship collision with other small fishing vessels that are illegally in the area • potential snagging or damage to fishing gear if the PSZ is breached by illegal fishers
Socioeconomic and Cultural	
Livelihoods and economy	Overall, due to the deepwater location, limited spatial footprint, and absence of overlapping uses, impacts to socio-economic values are expected to be negligible to none. HOLD for consultation outcomes
Cultural heritage	
Archaeological and Historical	

Consequence Assessment

Table 11-9: Summary of disturbance from interaction with unplanned others (IUU and FADS)

Activity	Likelihood	Consequence	Risk ranking
Surveys	2. Minor	2	Low
Drilling	2. Minor	2	Low
Installation and Commissioning	2. Minor	2	Low
Operations	2. Minor	2	Low

11.3.3 Mitigation and Management

Controls considered and adopted for the activity are summarised in Section 9.4.

11.3.4 ALARP Assessment

No additional controls were considered and rejected for this activity.

Interaction with others has been managed to ALARP by minimising the infrastructure footprint, and using common drill centres and shared corridors where feasible. Through communication with other users and engaging in public consultation, potential impacts should be reduced.

With implementation of the existing management measures, it is considered the risk associated with this planned impact are reduced to ALARP as per the criteria in Section 9.

11.4 Unplanned release of solids

11.4.1 Description of Hazard

Non-hydrocarbon solid wastes including paper, plastics e.g. hard hats, and packaging, and hazardous solid wastes such as batteries, fluorescent tubes, medical wastes and aerosol cans may be released unintentionally to the marine environment. The unplanned (accidental) release of solid waste (non-hydrocarbon solids) into the marine environment has the potential to occur during and/or from the following activities:

- MODU/ vessel operations;
- Overfull and/or uncovered bins,
- Incorrectly disposed items,
- Spills during transfer of waste between vessels and MODU.
- Human error - dropped object overboard;
- Accidental discharge of dry bulk; and/ or
- Accidental discharge of waste.

11.4.2 Impact Assessment

Non-hazardous solid wastes such as plastics have the potential to harm marine fauna through entanglement or ingestion. Marine turtles and seabirds are particularly at risk from entanglement. Marine turtles may mistake plastics for food; once ingested, plastics can damage internal tissues and inhibit physiological processes, which can both result in fatality.

Release of hazardous solid wastes may result in the pollution of the immediate receiving environment, leading to detrimental health impacts to marine flora and fauna, resulting in potential loss of benthic habitats and invertebrate communities within the impact zone. Physiological damage can be through ingestion or absorption may occur to individual fish, cetaceans, marine reptiles or seabirds.

Table 11-10: Impact pathways for key environmental receptors associated with unplanned release of solids

Activity	Impact Assessment
Physical Environment	
Water Quality	Any accidental solid waste is likely to be on a small scale and localised to the vicinity of the Development Area and not likely to impact on the overall water quality of the Timor Sea.
Sediment Quality	Dropped objects during bulk transfer have the potential to damage benthic habitats on the seabed beneath the MODU/FPSO/OSV. Given the seabed surrounding the area is predominantly flat and featureless (characterised by soft clays with silty/sandy sediments), and the extent of the area affected is minimal, the risk of impact is considered low. Any

	accidental solid waste is likely to be on a small scale and localised to the vicinity of the Development Area and is not likely to impact on the overall sediment quality.
Air Quality	N/A
Ecological Environment	
Benthic Fauna	In the event of a lost equipment/dropped object, it is only expected to result in localised damage to the seabed. Any localised disturbance to benthic organisms is not expected to have a significant impact to the benthic habitat or fish feeding on the benthos in the immediate vicinity. The extent of the seabed damage will be limited to the size of the dropped object and given the size of standard materials lifted overboard, any impact is expected to be very small. Any impact to seabed through dropped objects would result in a negligible reduction in habitat area/function impacted and the consequence was assessed as Slight- with recovery in days to weeks
Coastal Habitats	The Development is in deep waters (>400m), and is not near any coastal habitat. Any accidental debris dropped into the sea may potentially float on currents to coastlines however, this is likely to be on a minor scale given the total amount that could be accidentally released into the water.
Marine Mammals Marine Reptiles Fish, Sharks and Rays Birds	In the event of a non-hydrocarbon release (solids), the quantities would be limited. Ingestion of solid wastes in small quantities or entanglement could occur. Any impacts would be restricted to a small number of individuals in close proximity to the release, if any. As such, there is the potential for impacts to a small proportion of individual species only. However, this is not likely to affect critical lifecycle activity for cetaceans, marine turtles or fish on a population level. The limited quantities associated with this event indicate that even in a worst-case release of solid waste, fatalities would be limited to individuals and is not expected to result in a decrease of the local population size for any of the species identified.
Fisheries	There is the potential for three types of tuna fisheries in the region however these are Australian based and unlikely to occur in Timorese waters, there are currently no commercial fisheries operating in the Development Area. Therefore, there are likely to be no impacts on commercial fisheries. Illegal fishers may be present and this is addressed in Section 11.3.
Socioeconomic and Cultural	
Livelihoods and economy Cultural heritage Archaeological and Historical	N/A

Consequence Assessment

Table 11-11: Consequence assessment of unplanned release of solids for each project phase

Activity	Consequence Ranking	Likelihood	Ranking
Survey - Unplanned release of solids (small objects)	1. Slight	4	Medium
Survey - Unplanned release of solids (large objects)	2. Minor	2	Low
Drilling - Unplanned release of solids (small objects)	1. Slight	4	Medium
Drilling - Unplanned release of solids (large objects)	2. Minor	2	Low
Installation and Commissioning - Unplanned release of solids (small objects)	1. Slight	4	Medium
Installation and Commissioning - Unplanned release of solids (large objects)	2. Minor	2	Low

Operations - Unplanned release of solids (small objects)	1. Slight	4	Medium
Operations - Unplanned release of solids (large objects)	2. Minor	2	Low

11.4.3 Mitigation and management

Controls considered and adopted for the activity are summarised in Section 9.4

11.4.4 ALARP Assessment

Alternatives to the development are considered in Section 8.

Additional controls considered are provided in Table 11-14.

Table 11-12: ALARP assessment of additional controls

Activity	Additional Control	Reject Reasoning
Surveys Drilling Installation and commissioning Operations	Eliminate any lifting in the Development Area	Not feasible to eliminate lifting in the field.
	Only undertake lifting during daylight hours	Reducing the lifting window would have consequences on the schedule time and cost as the activity length could potentially double in time.

The use of support vessels in the field is necessary for the safe and efficient operation of the production facilities. Without vessels providing support for activities via replenishment of materials and subsea inspections, the risk of equipment failure leading to a safety or environmental incident is increased. Therefore, elimination of supply transfer to eliminate the risk of dropped objects is not considered. Decreasing the frequency of supply and maintenance activities will require larger supply transfers and increases in the duration and complexity of maintenance activities. This frequency of material supplies and subsea inspections is considered ALARP, based on the safe operation and maintenance requirements of the FPSO and development activities or during drilling.

Additional controls that were either not technically feasible, or grossly disproportionate for this type of activity were rejected. In the instance of rejected controls, the additional effort would not result in significant reductions in risk levels. With implementation of the existing management measures, it is considered the risk associated with this unplanned impact are reduced to ALARP as per the criteria in Section 9.

11.5 Unplanned release of (non-hydrocarbon) liquids

11.5.1 Description of Hazard

There may be accidental releases/ discharges to the marine environment of a variety of potentially hazardous materials and chemicals (liquid) which are stored and utilised or produced on vessels.

Liquid waste products (non-hydrocarbon) may potentially be released accidentally into the marine environment during and/or from the following activities:

- MODU/ vessel operations;
- Brine, muds and base fluids – overflow of tanks;
- Mechanical failure of equipment;
- Dropped objects;
- Vessel collision; and/or
- Structural failure

Accidental leaks could potentially occur from any of the wide range of equipment on a drill rig. The types of fluids range from lubricating fluids to hydraulic, fuel and cooling fluids. The leaks considered will come from a failure of a mechanical component, fitting or hose. Any leaks from inboard fittings and connections would be contained within bunded areas, which drain to a sump through the closed drain system. Any spill to deck will be cleaned up using absorbents. Spills to ocean are considered very unlikely, and if they were to occur would be of minimal quantities subject to rapid dilution and therefore the effects would be highly localised and temporary.

Supplies are routinely transferred from OSVs to the drill rig and FPSO, including bulk quantities of liquids and powders pumped through hoses, as well as packaged products transferred in certified containers by cranes. Releases can occur through the venting of small quantities of powders e.g. cement during transfers, failure of hoses or equipment, or dropping of items through operator error or mechanical failure. Standard operating procedures are in place to control all transfers. The extent of any impact associated with releases during transfers will depend on the nature of the material spilled and the quantities involved. In the event of a spill, impacts will be localised and temporary and the quantities involved will be minimised through measures such as dry-break couplings for hoses and the prompt shutting off of pumps in the event of a problem.

11.5.2 Impact Assessment

The maximum volume of non-hydrocarbon liquid that may be released during routine operations is likely to be small and realistically limited to the volume of individual containers (e.g. IBCs/ drums etc.) stored on deck (1 m^3). However, it is credible that a hose could part when loading/offloading brine or mud – then the discharge would be approximately 2.5 m^3. Dilution from most discharges at sea is rapid with 1 in 1,000 dilution occurring within 30 minutes (Costello and Read 1994). It is expected that in the event that spill is not contained on deck, the spill would rapidly disperse and evaporate.

Direct impacts

- Localised and temporary reduction in water quality associated with increased turbidity, water temperature, oil-in-water or salinity leading to impacts to marine fauna
- Disturbance and/or direct loss of habitat
- Reduction in water quality
- Reduction in sediment quality

Indirect impact

- Ingestion or physical contact with chemical compounds within the water column or sediment
- Accumulation and biomagnification of chemicals within the food chain

Table 11-13: Impact pathways for key environmental receptors associated with unplanned release of (non-hydrocarbon) liquids

Activity	
Physical Environment	
Water Quality	Marine receptors can be impacted from non-hydrocarbon liquid releases from direct contact with the release (toxicity) or a reduction in water quality (e.g. reduced dissolved oxygen concentrations). The susceptibility of marine receptors to non-hydrocarbon releases will be dependent on the nature of the liquid released, toxicity and other chemical properties such as biodegradation and bioaccumulation potential. The exposure duration is also a consideration in resultant acute and chronic toxicity effects. The extent of potential impact associated with this hazard is confined to the Development Area. Rapid dispersion and dilution is expected in the highly dynamic (GHD 2018) receiving

	environment and a liquid release would have short dispersion duration and a small extent of exposure at concentrations that may result in toxic effects. As such acute toxicity in the water column is not expected and the worst-case impact is expected to be short term behavioural impact to fauna. As, in the event an accidental discharge, the consequence is considered to be slight. It is expected that there would be an impact to individual(s) with no decrease in the population size at either a local or regional scale. Impacts to water quality were considered slight with effects unlikely to be discernible or measurable.
Sediment Quality	Given that acute toxicity in the water column is not expected the impact on sediment quality is considered slight.
Air Quality	N/A
Ecological Environment	
Benthic Fauna	Physical environment and habitats can be impacted as a result of smothering (from an accidental spill of mud pits). However, as a result of currents, dilution is expected. While unplanned liquid discharges may cause short term reductions in the change in water quality, these spikes are expected to occur for very short durations and as such any affects to benthic habitats are expected to be temporary as the most common benthic habitat is rubble and algae, which would recover quickly if impacted.
Coastal Habitats	The Development is in deep waters (>400 m), and is not near any coastal habitat. Any accidental debris dropped into the sea may potentially float on currents to coastlines however, this is likely to be on a minor scale given the total amount that could be accidentally released into the water.
Marine Mammals Marine Reptiles Fish, Sharks and Rays Birds	Liquid discharges may cause minor short-term water quality perturbations and as a result a possible alteration to marine fauna behaviour such as fish at surface, marine turtles, sea snakes, mammals and seabirds. Operational discharges in the same release location may result in temporary water quality perturbations and alteration to marine fauna behaviour. Sensitive receptors that may be impacted include pelagic fish and sharks at surface, marine turtles and mammals, and seabirds. Given that the activity will be for a limited duration, in offshore waters, impacts will be limited to short-term with recovery measures in days to weeks and potential disturbance to fish and seabirds. Planned operational discharges are therefore not expected to significantly impact marine fauna within the receiving environment nor compromise the objectives of Recovery Plans for threatened and migratory marine fauna. As such the worst-case consequence ranking for unplanned non-hydrocarbon releases given was slight due to the potential disturbance to fauna.
Fisheries	The water quality could potentially be impacted by the accidental release of liquid waste. However, acute toxicity in the water column is not expected and the worst-case impact is expected to be short term. There is the potential for three types of tuna fisheries in the region however these are Australian based and unlikely to occur in Timorese waters, there are currently no commercial fisheries operating in the Development Area. Therefore, there are likely to be no impacts on commercial fisheries. Illegal fishers may be present and this is addressed in Section 11.3.
Socioeconomic and Cultural	
Livelihoods and economy Cultural heritage Archaeological and Historical	N/A

Consequence Assessment

Table 11-14: Consequence assessment of unplanned release of (non-hydrocarbon) liquids for each project phase

Activity	Consequence Ranking	Likelihood	Ranking
Survey	1. Slight	3	Low
Drilling	1. Slight	3	Low
Installation and Commissioning	1. Slight	3	Low
Operations	1. Slight	3	Low

11.5.3 Mitigation and management

Controls considered and adopted for the activity are summarised in Section 9.4.

11.5.4 ALARP Assessment

Alternatives to the development are considered in Section 8.

Additional controls considered are provided in Table 11-15.

Table 11-15: ALARP assessment of additional controls

Activity	Additional Control	Reject Reasoning
Surveys Drilling Installation and commissioning Operations	No transfers to occur during activity	This would require vessels to return to port to gather supplies taking additional time and cost disproportionate to the low environmental risk of a spill during the activity. FPSO and MODU cannot leave location mid activity.

The use of support vessels in the field is necessary for the safe and efficient operation of the production facilities. Without vessels providing support for activities via replenishment of materials and subsea inspections, the risk of equipment failure leading to a safety or environmental incident is increased. Therefore, elimination of supply transfer to eliminate the risk of spills not considered. A thorough set of control measures has been proposed to ensure the risks of minor hazardous liquid spills and leaks occurring and subsequent impacts are minimised. The resulting impacts to marine fauna that could potentially result from a spill of this size would be minor, with impacts restricted to a small number of individuals within a localised area.

Additional controls that were either not technically feasible, or grossly disproportionate for this type of activity were rejected. In the instance of rejected controls, the additional effort would not result in significant reductions in risk levels. With implementation of the existing management measures, it is considered the risk associated with this unplanned impact are reduced to ALARP as per the criteria in Section 9.

11.6 Unplanned release of hydrocarbons

A number of unplanned events may occur during the KTJ development, resulting in the potential release of hydrocarbons (light crude and diesel) to the marine environment. Spill scenarios were identified prior to undertaking the ENVID and spill modelling has been undertaken for the activity (RPS, 2026) to support this submission.

To determine the maximum worst-case credible spill volumes for each identified spill scenario, Finder has considered the AMSA (2015) guideline: Technical guideline for preparing contingency plans for marine and coastal facilities and NOPSEMA Bulletin #1 Oil Spill modelling (April 2019). Finder Energy considers that in adopting the AMSA guideline, the estimated spill volumes are appropriately conservative given that for the scenarios presented, there are multiple barriers/controls in place; meaning the total volumes evaluated are much greater than would most likely be released in the event of a spill.

11.6.1 Hydrocarbon Characteristics

MDO (marine diesel oil)

MDO has an API of 27.5 and a density of 890 kg/m^3 (at 15ºC) with a viscosity value (14.0 cP) classifying it as a Group I (non-persistent) oil. About 4.0% of the oil mass should evaporate within the first 12 hours (BP < 180°C); a further 32.0 % should evaporate within the first 24 hours (180°C < BP < 265°C); and a further 54.0% should evaporate over several days (265°C < BP < 380°C). Approximately 10.0% of the oil is shown to be persistent.

Light crude

Light crude has an API of 52.1 and a density of 771 kg/m^3 (at 15ºC) with a viscosity value (1.5 cP) classifying it as a Group I (non-persistent) oil. About 64.3% of the oil mass should evaporate within the first 12 hours (BP < 180°C); a further 20.6 % should evaporate within the first 24 hours (180°C < BP < 265°C); and a further 15.0% should evaporate over several days (265°C < BP < 380°C). Approximately 0.1% of the oil is shown to be persistent.

11.6.2 Spill scenario selection

From the scenarios listed in Table 11-16, stochastic modelling was used to determine the greatest extent for exposure from each fraction of hydrocarbon (surface, shoreline, dissolved and entrained) to form the conservative combined environment that may be affected, termed the EMBA, for all seasons for the largest volumes for each of the different hydrocarbon types.

The EMBA represents the greatest possible extent of each hydrocarbon fraction, has been used to determine all the relevant environmental receptors. For the purposes of hydrocarbon impact assessment, thresholds are applied, as defined in NOPSEMA bulletin #1, to indicate the receptors that could be affected rather than just contacted (See Section 11.6.4 for more details).

Table 11-16: Credible hydrocarbon spill scenarios

Aspect	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Scenario Description	Loss of well control (LOWC)	Subsea pipeline rupture	FPSO cargo tank rupture due to external impact (vessel collision)	Release of marine diesel from vessel activities in the Development Area (vessel collision)
Location Name	KT4 Wellhead	FPSO	FPSO	FPSO
Geographic Location	10° 32' 03.6901" S; 126° 10' 27.4217" E	10° 33' 07.4962" S , 126° 09' 48.9410" E		
Periods to analyse	Summer (Nov - Apr) Winter (May - Oct)			
Simulation Length	90 days	30 days	30 days	30 days
Oil Type	Light, non-persistent crude (comparable to a condensate) - Kuda Tasi assay			Marine Diesel Oil
Release Depth	425m	400m	Surface	Surface
Total Release Volume	2,137,583 bbls	5000 bbl	45,000 bbl	$700 m^3$
Release Duration	90 days	6 hours	6 hours	6 hours

11.6.3 Oil Spill Modelling Overview

The Spill Impact MAPping model system (SIMAP) (French et al., 1999) has been applied to simulate the physical fates and biological effects of unplanned release of hydrocarbons (diesel and light crude) in 3-dimensional space to predict real-time spill simulation, contingency planning, and ecological risk assessments. The modelling study was carried out in stages. Firstly, a 10-year wind and current dataset (2010–2019) that includes the combined influence of large-scale ocean and tidal currents was prepared. Secondly, the currents, local winds and the oil characteristics were used as inputs in the three-dimensional oil spill model (SIMAP) to simulate the drift, spread, weathering and fate of the spilled oil.

SIMAP includes algorithms to account for both physical transport and weathering processes French et al., (1999) and French-McCay (2004). The latter are important for accounting for the partitioning of the spilled mass over time between the water surface (surface slick), water column (entrained oil and dissolved compounds), atmosphere (evaporated compounds) and land (stranded oil). These algorithms account for the specific oil type being considered. Input specifications for oil types include density, viscosity, pour-point, distillation curve (volume of oil distilled off versus temperature) and the aromatic/aliphatic component ratios within given boiling point ranges. The model calculates a distribution of the oil by mass into the following components:

- Surface-bound or floating oil;
- Entrained oil (non-dissolved oil droplets that are physically entrained by wave action);
- Dissolved hydrocarbons (principally the aromatic and short-chained aliphatic compounds);
- Evaporated hydrocarbons;
- Sedimented oil; and
- Decayed hydrocarbons

One hundred spill simulations were modelled per season for the scenario. Each simulation had the same spill information (spill volume, duration and composition of hydrocarbons) however they each used different start times to ensure a range of wind and current conditions were assessed. Once all 200 simulations were run for the scenario, the results were analysed on seasonal basis to assess the risk to the surrounding waters, shorelines and sensitive receptors based on the thresholds outlined in the NOPSEMA Oil Spill Modelling Bulletin (NOPSEMA, 2019).

The modelling results are presented using several metrics (NOPSEMA, 2018), noting that some metrics may be reported as zero, including:

- **Ecological EMBAs** – An amalgamation of areas where floating oil, entrained oil, dissolved hydrocarbons, or shoreline accumulation exceed predefined impact thresholds.
- **Probability of oil accumulating on a shoreline receptor** – The proportion of replicate simulations that resulted in oil accumulating above given concentration thresholds within the receptor bounds (i.e. any shoreline section within the receptor area).
- **Probability of oil arriving at sensitive receptors** – the proportion of replicate simulations that resulted in instantaneous exceedance of a given concentration threshold within the receptor bounds (i.e. any location within the receptor area).
- **Minimum time to receptor before shoreline oil accumulation** – The shortest elapsed time before a given accumulation was calculated for any shoreline cell within the receptor bounds in any replicate simulation. The elapsed times are calculated from the start of the model simulation.
- **Minimum time before oil arriving at sensitive receptors** – The shortest elapsed time before an instantaneous exceedance of a given concentration threshold for any cell within the receptor bounds. The elapsed times are calculated from the start of the model simulation.

- **Maximum accumulated oil concentration on shoreline** - The highest accumulated concentration of oil calculated for any shoreline cell within the receptor bounds over any entire replicate simulation.
- **Maximum concentration of oil** – The highest instantaneous concentration of floating oil, entrained oil, or dissolved hydrocarbons calculated in any replicate simulation for any grid cell within the receptor bounds.
- **Maximum residence time** – The longest continuous duration above a given concentration calculated for any grid cell within the receptor bounds.

11.6.4 Hydrocarbon Thresholds and EMBA definition

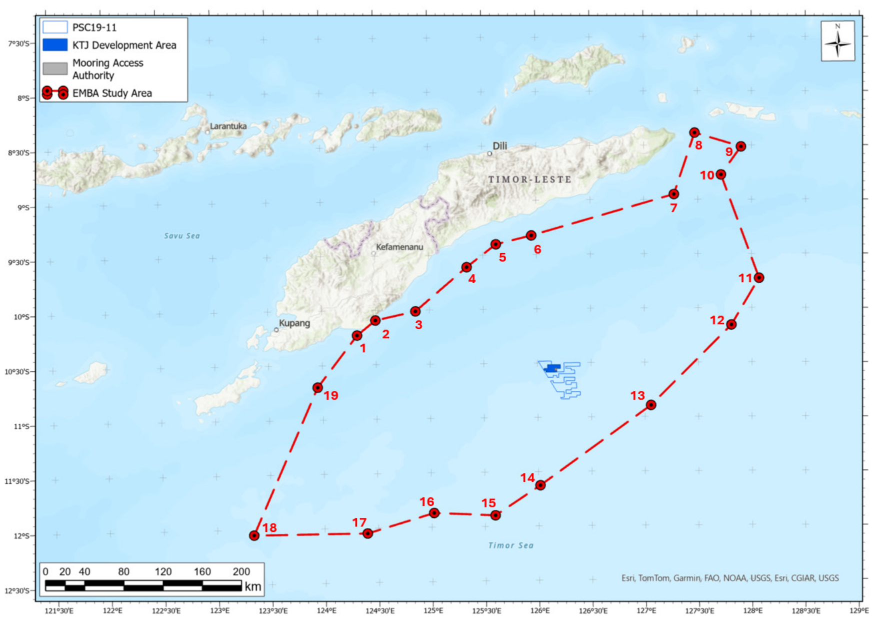
To assess environmental effects from an unplanned hydrocarbon release, four separate hydrocarbon components that pose differing environmental risks were evaluated.

- Surface hydrocarbons – hydrocarbons that are 'on' the water surface;
- Entrained hydrocarbons – hydrocarbon that is entrained 'in' the water;
- Dissolved hydrocarbons – the dissolved component of hydrocarbon 'in' the water; and
- Shoreline accumulation – hydrocarbons that accumulate along shorelines.

Threshold concentrations for each of the hydrocarbon phases were developed and applied to the modelling outputs to define the EMBA for each phase. A receptor was considered 'affected' by one of the phases as soon as the threshold for the phase at that location was exceeded (i.e. instantaneous impact approach).

The four spill scenarios (Table 11-16) were modelled and overlaid on top of each other to form the overall EMBA to ensure a conservative approach to impact assessment has been applied. The EMBA (Figure 11-1) is denoted by the hydrocarbon exposure thresholds to indicate all receptors that may be ecologically affected by hydrocarbons of any phase from any scenario and is based on scientific knowledge to determine the potential for impact.

The rationale for the selection of the thresholds is described below and a summary of the threshold values applied to the EMBA is provided in Table 11-17.



#	Longitude (dms)	Latitude (dms)
1	124°19'48"E	10°13'35"S
2	124°30'7"E	10°5'25"S
3	124°52'29"E	10°0'41"S
4	125°21'19"E	9°36'36"S
5	125°37'39"E	9°24'7"S
6	125°57'27"E	9°19'23"S
7	127°17'1"E	8°57'1"S
8	127°28'38"E	8°23'2"S
9	127°54'26"E	8°30'47"S
10	127°43'15"E	8°46'16"S
11	128°4'20"E	9°43'29"S
12	127°48'51"E	10°9'17"S
13	127°3'41"E	10°53'35"S
14	126°1'19"E	11°37'28"S
15	125°35'56"E	11°53'49"S
16	125°1'31"E	11°52'5"S
17	124°24'6"E	12°2'51"S
18	123°20'26"E	12°2'51"S
19	123°57'26"E	10°41'59"S

Area_km2
101175.255928

Figure 11-1: EMBA for the KTJ Development

The EMBAs are derived from the seasonal stochastic modelling results (i.e. results from all replicates), hence each describes a substantially larger area than would be affected during any single spill event. The modelling does not take into consideration any of the spill prevention, mitigation and response capabilities that Finder

Energy propose to have in place during the campaign to reduce volumes and/or prevent hydrocarbons from reaching sensitive areas.

The SIMAP modelling applied Ecological Thresholds based on the Bonn Agreement Oil Appearance Code (2019), the NOPSEMA Oil Spill Modelling Bulletin (2019), and NOPSEMA Oil Spill Modelling information paper (2025) which are summarised in Table 11-17.

Table 11-17: Thresholds Applied for the EMBA

Hydrocarbon Phase	Threshold used to determine the EMBA
Floating oil	10 g/m^2
Shoreline oil accumulation	100 g/m^2
Entrained oil	100 ppb
Dissolved hydrocarbons	50 ppb

Surface Oil exposure threshold

Floating oil concentrations are relevant to assessing risks to emergent reefs, littoral vegetation, shoreline habitats, and wildlife on the water surface, such as marine mammals, reptiles, and birds.

Ecological impacts have been estimated to begin occurring at concentrations around 10 g/m^2, which corresponds to a film thickness of approximately 10 µm (0.01 mm). Oil at this thickness, described as a metallic sheen, has been observed to fatally affect some bird species by oil adhesion to feathers, leading to secondary effects such as hypothermia (French et al., 1996; French-McCay, 2009; Bonn Agreement, 2009). Concentrations above this level also represent the lower actionable threshold where containment, recovery, and dispersant treatment may be considered (AMSA, 2015).

Surface oil concentrations of 25 g/m^2 or greater are harmful to all birds landing on the oil film due to contamination of feathers, which impairs temperature regulation and leads to ingestion of oil during preening (Scholten et al., 1996; Koops et al., 2004). This concentration is similarly described as a metallic sheen (Bonn Agreement, 2009). For this study, an upper threshold of 50 g/m^2 and above was set following NOPSEMA (2019).

The threshold selected for the EMBA definition is therefore 10g/m^2.

Entrained oil exposure threshold

Entrained oil is oil that is dispersed within the water column as oil droplets. As such, insoluble compounds in oil cannot be absorbed from the water column by aquatic organisms, hence are not bioavailable through absorption of compounds from the water. Exposure to these compounds would require routes of uptake other than absorption of soluble compounds. The route of exposure of organisms to whole oil alone include direct contact with tissues of organisms and uptake of oil by direct consumption, with potential for biomagnification through the food chain (NRC, 2005). For oil spills released at surface, entrained oil is created in the top few meters of the water column through mixing of surface oil by wave action. For oil spills released subsea (e.g. pipelines leaks, well blowouts) entrained oil may be distributed deeper within the water column.

The concentrations of entrained droplets output by SIMAP represent hydrocarbons that are not bioavailable. The soluble and semi-soluble fractions dissolve from the droplets over time, and a potential effects analysis based on the dissolved hydrocarbons characterizes their risk. The 10 ppb threshold represents the very lowest concentration and corresponds generally with the lowest trigger levels for chronic exposure for entrained hydrocarbons in the ANZECC & ARMCANZ (2000) water quality guidelines. Due to the requirement for relatively long exposure times (> 24 hours) for these concentrations to be significant, they are likely to be more meaningful for juvenile fish, larvae and planktonic organisms that might be entrained (or otherwise moving) within the entrained plumes, or when entrained hydrocarbons adhere to organisms or trapped against a shoreline for periods of several days or more.

This exposure zone is not considered to be of significant biological impact and is therefore outside the adverse exposure zone. This exposure zone represents the area contacted by the spill. This area does not define the area of influence as it is considered that the environment will not be affected by the entrained hydrocarbon at this level. On that basis, the 100 ppb entrained oil threshold has been selected to define the EMBA for this study.

A threshold of 100 ppb were applied over a 1-hour time exposure, to cover the range of thresholds outlined in ANZECC & ARMCANZ (2000) water quality guidelines, the incremental change for greater potential effect and is per NOPSEMA (2019).

A complicating factor that should be considered when assessing the consequence of dissolved and entrained oil distributions is that there will be some areas where both physically entrained oil droplets and dissolved hydrocarbons co-exist. Higher concentrations of each will tend to occur close to the source where sea conditions can force mixing of relatively unweathered oil into the water column, resulting in more rapid dissolution of soluble compounds.

The threshold selected for the EMBA definition is therefore 100ppb.

Dissolved hydrocarbons exposure threshold

Laboratory studies have shown that dissolved hydrocarbons exert most of the toxic effects of oil on aquatic biota (Carls et al., 2008; Nordtug et al., 2011; Redman, 2015). The mode of action is a narcotic effect, which is positively related to the concentration of soluble hydrocarbons in the body tissues of organisms (French-McCay, 2002). Dissolved hydrocarbons are taken up by organisms directly from the water column by absorption through external surfaces and gills, as well as through the digestive tract. Thus, soluble hydrocarbons are termed “bioavailable”.

Hydrocarbon compounds vary in water-solubility and the toxicity exerted by individual compounds is inversely related to solubility, however bioavailability will be modified by the volatility of individual compounds (Nirmalakhandan and Speece, 1988; Blum and Speece, 1990; McCarty, 1986; McCarty et al., 1992a; 1992b; McCarty and Mackay, 1993; Verhaar et al., 1992; 1999; Swartz et al., 1995; French-McCay, 2002; McGrath & Di Toro, 2009). Of the soluble compounds, the greatest contributor to toxicity for water-column and benthic organisms are the lower-molecular-weight aromatic compounds, which are both volatile and soluble in water. Although they are not the most water-soluble hydrocarbons within most oil types, the polynuclear aromatic hydrocarbons (PAHs) containing 2 – 3 aromatic ring structures typically exert the largest narcotic effects because they are semi-soluble and not highly volatile, so they persist in the environment long enough for significant accumulation to occur (Anderson et al., 1974; 1987; Neff and Anderson, 1981; Malins and Hodgins, 1981; McAuliffe, 1987; NRC, 2003). The monoaromatic hydrocarbons (MAHs), including the BTEX compounds (benzene, toluene, ethylbenzene, and xylenes), and the soluble alkanes (straight chain hydrocarbons) also contribute to toxicity, but these compounds are highly volatile, so that their contribution will be low when oil is exposed to evaporation and higher when oil is discharged at depth where volatilisation does not occur (French-McCay, 2002).

French-McCay (2002) reviewed available toxicity data, where marine biota was exposed to dissolved hydrocarbons prepared from oil mixtures, finding that 95% of species and life stages exhibited 50% population mortality (LC50) between 6 and 400 ppb total PAH concentration after 96 hrs exposure, with an average of 50 ppb. On this basis, the 50 ppb dissolved aromatic hydrocarbon threshold has been selected to define the EMBA for this study.

The threshold selected for the EMBA definition is therefore 50ppb.

Shoreline oil exposure threshold

Shoreline types vary widely (e.g., cliffs, rocky beaches, sandy beaches, mudflats, and mangroves) and therefore influencing the volume and thickness of oil that can remain stranded before the shoreline reaches saturation. Sandy beaches e.g. (Timor) allow oil to percolate through the sand, increasing their capacity to retain oil over tidal cycles and wave actions compared to equivalent open water areas. Consequently, oil thickness onshore can increase over time. This study assumes a sandy beach shoreline as the default type for modelling, as it represents the highest carrying capacity among open/exposed shoreline types.

A concentration threshold of 10 g/m^2 has been used in previous risk assessments (French-McCay et al., 2005a; 2005b) to identify potential socio-economic impacts, such as temporary closures of adjacent fisheries or the need for clean-up along beaches and man-made structures (e.g., breakwaters, jetties, marinas). This concentration roughly corresponds to two teaspoons of hydrocarbon per square meter of shoreline and is visually described as a stain or film. This threshold defines the lower boundary for potential impact areas. French et al. (1996) and French-McCay (2009) identifies a concentration of approximately 100 g/m^2 or above as potentially harmful to shorebirds and wildlife such as fur-bearing aquatic mammals and marine reptiles, based on documented sub-lethal and lethal effects. This threshold has been widely used in environmental risk assessments (French-McCay, 2003; 2004; 2011; 2012; NOAA, 2013) and recommended by AMSA's foreshore assessment guide as the minimum level where natural coastal processes alone can adequately remediate the contamination without inhibiting recovery (AMSA, 2015). Lin & Mendelssohn (1996), indicate that hydrocarbon loadings exceeding 1,000 g/m^2 during growing seasons can significantly harm marsh vegetation. Similar impact thresholds have been found for mangrove ecosystems (Grant et al., 1993; Suprayogi & Murray, 1999). This concentration marks the upper boundary threshold considered for ecological impact assessment.

The threshold selected for the EMBA definition is therefore 10g/m^2.

11.6.5 Hydrocarbon spill impacts

When liquid hydrocarbons enter the marine environmental there will be immediate physical and chemical changes such as entrainment, dissolution, emulsification, evaporation and decay; that that occur dependent on the chemical properties of the hydrocarbon and the physical environment. Entrainment is the physical process where globules of oil are transported from the sea surface into the water column by wind and wave-induced turbulence or be generated subsea by a pressurised discharge at depth. Small droplets spread and diffuse into the water column, while larger ones rise rapidly back to the surface (Delvigne & Sweeney, 1988; Delvigne, 1991). Dissolution is the process by which soluble hydrocarbons enter the water from a surface slick or from entrained droplets. The lower molecular weight hydrocarbons tend to be both more volatile and more soluble than those of higher molecular weight. The formation of water-in-oil emulsions, which is termed ‘emulsification’, depends on oil composition and sea state. Emulsified oil can contain as much as 80% water in the form of micrometre-sized droplets dispersed within a continuous phase of oil (Daling & Brandvik, 1991; Bobra, 1991; Daling et al., 1997; Fingas, 1995, 1997).

Entrainment, dissolution and emulsification rates are correlated to wave energy, which is accounted for by estimating wave heights from the sustained wind speed, direction and fetch (i.e. distance downwind from land barriers) at different locations in the domain. Dissolution rates are dependent upon the proportion of soluble, short-chained hydrocarbon compounds, and the surface area at the oil/water interface of slicks. Dissolution rates are also strongly affected by the level of turbulence.

Evaporation can result in the transfer of large proportions of spilled oil from the sea surface to the atmosphere, depending on the type of oil, and the prevailing sea temperatures, wind and current speeds, the surface area of the slick and entrained droplets that are exposed to the atmosphere as well as the state of weathering of the oil.

Decay (degradation) of hydrocarbons may occur as the result of photolysis, which is a chemical process energised by ultraviolet light from the sun, and by biological breakdown, termed biodegradation.

Hydrocarbons usually comprise hundreds of mainly carbon based chemical structures. The relative balance of the constituent substances influences both their chemical and physical properties when mixed with water, which in turn affect their potential or environmental impact on marine biota.

The maximum worst-case credible scenario was used to determine the nature and scale of impacts to sensitive receptors. The environmental consequences of a loss of hydrocarbons are highly variable, dependent on the characteristics of the hydrocarbon released, the dynamics of the receiving environment and the proximity of the release point to sensitive environmental receptors. They include:

- Reduction in water quality;
- Direct/indirect toxic or physiological effects on marine biota, including corals;
- Direct/indirect loss/disturbance to marine mammals, marine reptiles, birds, fish (including sharks/rays);
- Hydrocarbon/chemical contact with shoals/banks, reefs and islands at concentrations that result in adverse impacts;
- Direct/indirect loss/disturbance of significant habitat;
- Disturbance of non-conservation significant populations/communities;
- Disturbance of conservation significant individuals (e.g. change in fauna behaviour/movement, or injury/mortality); and
- Socio-economic, human health impacts and reputational damage.

The determination of biologically meaningful impact levels is complex since the degree of impact will depend on the sensitivity of the biota contacted, the duration of the contact (exposure) and the toxicity of the hydrocarbon mixture making the contact. The toxicity of a hydrocarbon will change over time, due to weathering processes altering the composition of the hydrocarbon.

Hydrocarbon Impact Pathways

Key potential impacts to sensitive receptors present within the EMBA are described below.

Sea birds

Large oil spills and disasters can result in high mortalities of seabirds (Piatt & Ford, 1996; Munilla et al., 2011; Fraser et al., 2022). Oil spills can have a variety of effects including direct suffocation, fouling of the plumage, ingestion of oil, effects on reproduction and physical disturbance (Pavlov et al., 2023). Many of the species that occur offshore are migratory, surface-feeding or plunge-diving pelagic birds, so that oil slicks would potentially interfere with feeding and increase exposure risk. Preening to remove oil would also expose the birds to direct ingestion of oil (Swan et al., 1994). Given the open oceanic location of the Development, remote from any land mass, the number of seabirds likely to be exposed in the event of an oil spill is expected to be low.

Marine mammals

Marine mammals can be exposed to oil and related compounds through surface slicks when breathing or resting at the air/sea interface (Trustees 2016) and through interaction with subsurface plumes during dives and foraging events. Oil compounds can be taken up through the skin, breathed into the lungs, or ingested with prey (Schwacke et al. 2013; Helm et al., 2014; Neff, 2002). Long-term offshore monitoring of the accidental oil spill of the Deep-Water Horizon suggests ongoing declines in marine mammal presence, which may be related to reduced reproductive success as observed in nearshore proxies. Oceanic species were most heavily and directly impacted by this spill (Frasier, 2020). Some whales, particularly those with coastal migration and reproduction, display strong site fidelity to specific resting, breeding and feeding habitats, as well as to their migratory paths. Pygmy blue whales are known to migrate through the EMBA. Oil in biologically important habitats may disrupt natural behaviours, displace animals, reduce foraging or reproductive success rates and increase mortality.

Sea turtles

Potential direct impacts to sea turtles from an oil spill differ depending on the life stage, but all stages are vulnerable to acute toxicity from volatile contaminants, exposure through inhalation and ingestion, physical impairment from heavy oiling, and a variety of physiological impacts of exposure (Frasier, 2020). Studies showed that sea turtles are unlikely to detect oil and showed no avoidance behaviour (Lutcavage et al. 1995; Odell and MacMurray 1986). Sea turtles are continuously exposed by resurfacing to breathe (Milton et al. 2003), and pelagic juveniles are susceptible to floating tar accumulations in ocean convergence zones due to indiscriminate feeding patterns (Witherington 2002; Lutcavage et al. 1997). Studies indicate that sea turtles were directly exposed to unprecedented amounts of oil and dispersants during the accidental spill of the Deep-Water Horizon resulting in likely acute and chronic population-level impacts (Frasier, 2020).

Fish, sharks and rays

Fish are impacted by oil spills in a number of ways, such as increased mortality (Fodrie et al., 2014), sublethal damage to fish eggs and larvae, such as morphological deformities, reduced feeding and growth rates, increased vulnerability to predators and starvation (Hicken et al., 2011), habitat degradation, loss of egg hatching ability, fouling of gill structures, impaired reproduction, growth, development, feeding, and respiration (Blackburn et al., 2014). It has been shown that fish populations are vulnerable to significant oil spills (Fodrie et al., 2014), and are most susceptible in the early stages, such as eggs and larvae (Bellas et al., 2013; Kawade, 2025).

Fish and sharks most likely to be exposed to entrained and dissolved hydrocarbons are pelagic free-swimming fish and sharks as they dwell in the surface layers of the water column. Some shark species, such as the whale shark, tend to feed close to the surface and may be exposed to the presence of entrained hydrocarbons. Whale sharks are known to routinely move between surface and to depths of >30 m, and in offshore regions can spend most of their time near the seafloor (DSEWPaC 2012). Demersal fish within the in-water Hydrocarbon Area are not expected to be impacted given the presence of in-water hydrocarbons is predicted in the surface layers (<20 m depth) only. Pelagic free- swimming fish and sharks exposed to entrained hydrocarbons within the surface layers are unlikely to suffer long-term damage from oil spill exposure because in-water hydrocarbons are typically insufficient to cause harm (ITOPF 2011). Pelagic species are also generally highly mobile and as such are not likely to suffer extended exposure (e.g. >40–96 hours) at concentrations that would lead to chronic effects due to their patterns of movement, therefore fish and shark kills as a result of a spill in open water are unlikely. The larval stages of fish species are more likely to be susceptible. however, in comparison to predation and natural loss, any impacts would be over a small proportion of the marine environment in which they may occur and any measurable impact at the population level is likely to be low. In addition, fish mortality from oil spills is rarely reported and it is unlikely that significant population level impacts will occur (ref). Consequently, the spill is only expected to cause a very localised disruption of behaviours/ecosystem.

Coastal habitats

Entrained and shoreline hydrocarbons may smother seagrass beds, mangroves, sandy beaches, corals, macroalgae, etc, in shallow intertidal areas. Intertidal seagrass communities would theoretically be the most susceptible because the leaves and rhizomes may both be affected. When seagrass leaves are exposed to oil, sub-lethal quantities of the soluble fraction can be incorporated into the tissue, causing a reduction in tolerance to other stress factors (Zieman et al., 1984). The toxic components of petroleum oils are thought to be the PAH, which are lipophilic and therefore able to pass through lipid membranes and tend to accumulate in the thylakoid membranes of chloroplasts (Ren et al., 1994).

Macroalgae

Macroalgae in intertidal areas have the potential to be exposed to in-water and shoreline hydrocarbons. Residues may be left in the area as the tide ebbs, but will be flushed with each flood tide. Studies have shown that macroalgae appear to recover rapidly from oiling, irrespective of the degree of impact and level of oiling. This is attributed to the fact that most of the new algae growth is produced near the base of the plant while distal parts (which would be exposed to the oil contamination) are continually lost (Connell and Miller, 1981).

Fisheries

There is anecdotal evidence of observed impacts resulting to fisheries catch and aquaculture from a previous oil spill incident – Montara recorded in 2009 (Spies et al. 2017; Shin et al., 2024). There is the potential for three types of tuna fisheries in the region however these are Australian based and unlikely to occur in Timorese waters, there are currently no commercial fisheries operating in the Development Area. Therefore, there are likely to be no impacts on commercial fisheries.

Illegal fishers may be present and this is addressed in Section 11.3.

11.7 Unplanned Release of marine diesel oil

11.7.1 Description of Hazard

This section considers three spill scenarios resulting in the release of marine diesel to the marine environment:

- Release of marine diesel may occur from a support vessel fuel tank rupture due to collision. The maximum worst-case credible spill volume of diesel has been calculated as 700 m3 based on the largest single fuel tank volume;
- Due to a refuelling event (5 m^3); or
- Due to poor handling and storage of hydrocarbons, equipment failure, refuelling of machinery from day tank (500 L).

Modelling was completed for the worst-case spill scenario only and it is recognised that the majority of vessels will have much smaller tank sizes than that modelled.

Modelling of this scenario is described in Section 11.6.3, the results are presented in Table 11-18.

Table 11-18: Modelling results from diesel spill of 700m^3

Scenario description	Surface release of MDO due to a vessel collision
Spill volume	700 m^3
Oil type	MDO
Release depth	Surface
Release duration	6 hours

Simulation length		30 days
Floating Oil	Maximum distances from the release location for floating oil.	Floating oil concentrations ≥10 g/m^2 were observed to up to 115.9 km away
	Highest probability of floating oil arriving at a receptor at, or above, 10 g/m^2	Big Bank Shoals 8% probability Karmt Shoal 4% probabilityNo other receptors contacted at this threshold above 1% probability
	Quickest time before floating oil arriving at a receptor at, or above, 10 g/m^2	Big bank Shoals 8.75 hrs Karmt shoal 12.25 hrs No other receptors contacted at this threshold
Shoreline Oil Accumulation	Probability of oil accumulation on **any** shoreline at, or above, 100 g/m^2	No shoreline accumulation above the 100g/m^2 threshold
	Absolute minimum time for oil to accumulate on **any** shoreline at, or above, 100 g/m^2	
	Maximum volume of oil accumulation on **any** shoreline from a single spill simulation at, or above, 100 g/m^2	
	Highest probability of oil accumulation for a specific shoreline receptor at, or above, 100 g/m^2	
	Maximum volume of oil accumulation from a single spill simulation for a specific shoreline receptor at, or above, 100 g/m^2	
Entrained Oil	Maximum distances from the release location to each entrained oil thresholds.	Entrained oil concentrations ≥100 ppb were observed up to 218.8 km from the release location
	Highest probability of entrained oil arrival at a receptor at, or above, 100 ppb	Highest probability of entrained oil at, or above, 100 ppb was 33.5% at Karmt shoal and 21.5% at Big Bank shoal.
	Quickest time before entrained oil arrival at a receptor at, or above, 100 ppb	Minimum time to contact for Big Bank shoals is 45.2 hours and Karmt Shoal 39.8 hours.
Dissolved Hydrocarbons	Maximum distances from the release location to e50 ppb.	Dissolved hydrocarbon concentrations ≥50 ppb were observed up to 7.1 km from the release location.
	Highest probability of dissolved hydrocarbon arrival at a receptor at, or above, 50 ppb	No contact above 50 ppb
	Quickest time before dissolved hydrocarbon arrival at a receptor at, or above, 50 ppb	No contact above 50 ppb

11.7.2 Impact Assessment

Release of diesel may occur from vessel collision within the Development Area. The worst-case diesel spill scenario is due to collision of a vessel with a third-party vessel resulting in damage to a fuel oil tank and diesel released to the ocean. The maximum worst-case credible spill volume of diesel has been calculated as 700 m^3

based on the largest fuel oil tank on the proposed vessels, though it is considered more likely that smaller vessels would be used. Details on impact to receptors within the EMBA are described in 11.6.5.

The modelling results indicate that oil would remain in open waters and entrained oil could reach shoals in the regions such as Big Bank and Karmt Shoals. Therefore affected receptors would include pelagic species (marine mammals, fish, sharks, rays, marine reptiles and birds) and open water. There is no shoreline accumulation or floating oil predicted to reach shorelines, therefore coastal habitats and important areas such as turtle and seabird nesting beaches are not predicted to be impacted by a diesel spill; though the distance that the entrained oil covers overlaps coastal waters of Timor and Indonesia.

Consequence Assessment

Table 11-19: Consequence assessment of unplanned release of hydrocarbons (diesel) from vessel collision for each project phase

Activity	Consequence Ranking	Likelihood	Ranking
Survey	2. Minor	2	Low
Drilling	2. Minor	2	Low
Installation and Commissioning	2. Minor	2	Low
Operations	2. Minor	2	Low

11.7.3 Mitigation and Management

Controls considered and adopted for the activity are summarised in Section 9.4.

11.7.4 ALARP Assessment

Alternatives to the development are considered in Section 8.

Additional controls considered are provided in Table 11-20.

Table 11-20: ALARP assessment of additional controls

Activity	Additional Control	Reject Reasoning
Surveys Drilling Installation and commissioning Operations	Require all support vessels involved in the activity to be double hulled.	Large costs associated with vessel selection and by having an activity schedule determined by vessel availability considered grossly disproportionate compared to low risk of a vessel collision and low risk of a large diesel spill.
	Use alternative energy sources	The use of diesel for fuel for vessels and machinery cannot be eliminated, vessels and machinery are required for the operations and diesel is therefore required. Other energy sources are not readily available to power all equipment and vessels.
	Substitute diesel for another hydrocarbon type	Machinery and engines are designed for using diesel as the fuel oil which reduces the potential impact from an unplanned release to as low as possible. As no other hydrocarbon has been identified that is more environmentally friendly that could still fulfil the equipment requirements, no engineering controls have been identified.

Vessel activities are required to support the activity and cannot be eliminated. The use of marine diesel for the activity is necessary as the main fuel supply on vessels and the MODU. Vessel presence is implicit in the activity to transfer supplies/equipment, offload equipment and waste, perform inspection and maintenance.

Therefore, the risk of a marine diesel release cannot be completely eliminated from the activity. The use of marine diesel by support vessels is standard industry practice. Marine diesel is considered a more environmentally friendly fuel than heavier fuel oils such as Heavy Fuel Oil (HFO) or Intermediate Fuel Oil (IFO) which have a greater persistence in the marine environment should a spill occur.

In addition the use of fuel gas on the FPSO where feasible reduces the requirement for the use of diesel to power the FPSO.

Procedures provide controls, such as speed restrictions will reduce the risk of collision during the activity. Communication is established between the MODU, FPSO and support vessels before they enter the PSZ to ensure proposed activities are safe to proceed and to reduce the potential for vessel collision during simultaneous operations.

Additional controls that were either not technically feasible, or grossly disproportionate for this type of activity were rejected. In the instance of rejected controls, the additional effort would not result in significant reductions in risk levels. With implementation of the existing management measures, it is considered the risk associated with this planned impact are reduced to ALARP as per the criteria in Section 9.

11.8 Unplanned release of hydrocarbons (light crude) from a Loss of Well Control

11.8.1 Description of Hazard

A loss of well control during drilling activities may occur as a result of failure or degradation of primary and secondary well barriers, failure of safety-critical downhole or subsea equipment, or damage to subsea well infrastructure. Potential initiating events may include unexpected formation pressures, equipment malfunction, human error, or external mechanical impacts resulting in an uncontrolled release of hydrocarbons from the reservoir to the marine environment. Depending on the nature of the failure, hydrocarbons may be released subsea or at the surface until effective source control measures are implemented and well integrity is restored.

A release during offtake bunkering could also be considered credible, but would be a much smaller volume and was not modelled as the more conservative scenario is described. The hose is 360 m long in 34 sections with a diameter of 16 inches, therefore a full volume is assumed to be ~47m^3.

Modelling of this scenario is described in Section 11.6.3, the results are presented in Table 11-24. The modelling considers the worst-case credible discharge associated with a sustained loss of well control during drilling activities, including the behaviour and fate of released hydrocarbons under a range of metocean conditions representative of the activity area.

Table 11-21: Modelling results of a loss of well control

Scenario description		Loss of well control at KT4 Wellhead
Spill volume		2,137,583 bbl
Oil type		Kuda Tasi light crude
Release depth		425 m
Release duration		90 days
Simulation length		104 days
Floating Oil	Maximum distances from the release location for floating oil.	Floating oil concentrations ≥10 g/m^2 were observed to up to 22.4 km away

	Highest probability of floating oil arriving at a receptor at, or above, 10 g/m^2	Big bank Shoals 4.53% probability No other receptors contacted at this threshold above 1% probability
	Quickest time before floating oil arriving at a receptor at, or above, 10 g/m^2	Big bank Shoals 1 d 23 hrs No other receptors contacted at this threshold
Shoreline Oil Accumulation	Probability of oil accumulation on **any** shoreline at, or above, 100 g/m^2	No shoreline accumulation above the 100g/m^2 threshold
	Absolute minimum time for oil to accumulate on **any** shoreline at, or above, 100 g/m^2	
	Maximum volume of oil accumulation on **any** shoreline from a single spill simulation at, or above, 100 g/m^2	
	Highest probability of oil accumulation for a specific shoreline receptor at, or above, 100 g/m^2	
	Maximum volume of oil accumulation from a single spill simulation for a specific shoreline receptor at, or above, 100 g/m^2	
Entrained Oil	Maximum distances from the release location to each entrained oil thresholds.	Entrained oil concentrations ≥100 ppb were observed up to 319.7 km from the release location.
	Highest probability of entrained oil arrival at a receptor at, or above, 100 ppb	Highest probability of entrained oil at, or above, 100 ppb was 99.5% Big Bank shoal, and 89.4 at Karmt shoal. Other shoals predicted to receive entrained oil at less than 30% (Echo Shoal), 19% (Dillon shoal) and 1% (Jabiru shoal).
	Quickest time before entrained oil arrival at a receptor at, or above, 100 ppb	Minimum time to contact for Big Bank shoals is 10.5 hours and Karmt Shoal 21.3 hours. Other shoals predicted to receive entrained oil at less than 1d19hrs (Echo Shoal), 3d 1 hr(Dillon shoal) and 25d17hr (Jabiru shoal).
Dissolved Hydrocarbons	Maximum distances from the release location to 50 ppb.	Dissolved hydrocarbon concentrations ≥50 ppb were observed up to 183.9 km away from the release location
	Highest probability of dissolved hydrocarbon arrival at a receptor at, or above, 50 ppb	Highest probability of dissolved oil at, or above, the 50 ppb was 100% Big Bank shoal, and 99.5 at Karmt shoal. Other shoals predicted to receive floating oil at less than 34% (Echo Shoal) and <15% (Dillon shoal)
	Quickest time before dissolved hydrocarbon arrival at a receptor at, or above, 50 ppb	Minimum time to contact for Big Bank shoals is 18.5 hours and Karmt Shoal 1d8hr hours. Other shoals predicted to receive entrained oil at less than 3d2hrs (Echo Shoal), 11d3hr (Dillon shoal).

11.8.2 Impact Assessment

In the worst-case credible loss of well control scenario, substantial quantities of Kuda Tasi light crude oil (maximum estimated release volume of approximately 2,137,583 bbl) could be discharged to the marine environment prior to successful well intervention and re-establishment of well control. The release may result in surface slick formation, entrainment and dispersion within the water column, and potential shoreline interaction or exposure of environmentally sensitive receptors, depending on prevailing environmental conditions and response effectiveness. The duration and extent of impacts would be influenced by factors including release rate, response timing, weather and oceanographic conditions, and the success of intervention measures such as activation of the blowout preventer, subsea intervention, capping and relief well operations. Details on impact to receptors within the EMBA are described in 11.6.5.

The modelling results indicate that oil would remain in open waters with entrained and dissolved oil reaching shoals in the region including Big Bank, Karmt, Echo, Dillon and Jabiru. Therefore, affected receptors would include pelagic species (marine mammals, fish, sharks, rays, marine reptiles and birds) and open water. There is no shoreline accumulation or floating oil predicted to reach shorelines, therefore coastal habitats and important areas such as turtle and seabird nesting beaches are not predicted to be impacted by a light crude spill.

13.1.3. Consequence assessment

Table 11-22: Consequence assessment of unplanned release of hydrocarbons (light crude) - LOWC during drilling

Activity	Consequence Ranking	Likelihood	Ranking
Survey	N/a	N/a	N/a
Drilling	4. Major	3	Medium
Installation and Commissioning	N/a	N/a	N/a
Operations	N/a	N/a	N/a

11.8.3 Mitigation and Management

Controls considered and adopted for the activity are summarised in Section 9.4.

11.8.4 ALARP Assessment

Alternatives to the development are considered in Section 8.

Additional controls considered are provided in Table 11-20.

Table 11-23: ALARP assessment of additional controls

Activity	Additional Control	Reject Reasoning
Drilling	Standby MODU available in-field during drilling operations instead of having to source and deploy at the time of loss of containment	A MODU on standby close to the well location for the duration of the drilling campaign in readiness to drill a relief well may reduce the time to drill a relief well. However, the MODU would be required to be on standby 24/7 over the entire activity duration. This is not considered feasible. The additional MODU would introduce additional impacts (e.g. light, noise, atmospheric emissions and operational discharges) and risks. The costs, safety concerns and complexity of having a MODU and maintaining this arrangement for the duration of the activity is

		grossly disproportionate to the environmental benefit gained.
	Drilling of a simultaneous relief well in parallel with the primary well	Simultaneous drilling of a relief well could reduce the duration of an uncontrolled well event. However, undertaking parallel drilling operations would substantially increase operational complexity, vessel traffic, seabed disturbance, personnel exposure and overall environmental footprint for the entirety of the campaign. The likelihood of requiring a relief well is already considered extremely low due to existing preventative barriers and well control measures. The environmental and safety impacts, operational risks and costs associated with drilling a parallel relief well are grossly disproportionate to the incremental reduction in environmental risk.
	Installation of additional independent blowout preventer (BOP) systems beyond regulatory and design requirements	Additional redundant BOP systems beyond the installed primary and secondary well control barriers may marginally reduce the likelihood of loss of containment. However, the drilling program already incorporates industry-standard well integrity measures, verified BOP testing, redundancy within the installed system and compliance with recognised international standards. Additional independent systems would significantly increase equipment handling, maintenance requirements, deck loading, operational complexity and safety exposure during installation and operation. The incremental risk reduction is negligible compared with the increased operational burden and impacts, and is therefore considered grossly disproportionate.

Loss of well control cannot be completely eliminated from offshore drilling activities, as drilling into hydrocarbon-bearing formations inherently involves the management of subsurface pressures and fluids. However, the drilling program has been specifically designed to minimise the likelihood of a loss of well control through the implementation of multiple independent preventative and mitigative barriers consistent with recognised international industry standards and good oilfield practice.

The well design incorporates verified primary and secondary well barriers, including casing and cement programs designed to isolate formations and maintain well integrity throughout the activity. Drilling fluid properties are continuously monitored and managed to maintain appropriate hydrostatic pressure and prevent uncontrolled influx of formation fluids into the wellbore. Real-time monitoring of well parameters enables early detection of abnormal conditions, with established response procedures in place to manage any indications of influx or pressure anomalies.

The MODU is equipped with a blowout preventer (BOP) system designed, tested and maintained in accordance with regulatory requirements and recognised standards to provide a secondary barrier in the event primary well control is compromised. Routine inspection, testing and maintenance of well control equipment will be undertaken throughout the drilling campaign to verify functionality and integrity.

Operational controls, including detailed drilling procedures, permit-to-work systems, management of change processes, competency and training requirements, and well control drills, reduce the likelihood of human or system failure contributing to a loss of well control event. Independent well examination and technical review processes have also been applied during well planning and design to verify that risks have been appropriately identified and managed.

Additional controls that were either not technically feasible, or grossly disproportionate for this type of activity were rejected. In the instance of rejected controls, the additional effort would not result in significant reductions in risk levels. With implementation of the existing management measures, it is considered the risk associated with this planned impact are reduced to ALARP as per the criteria in Section 9.

11.9 Unplanned release of hydrocarbons (light crude) – FPSO vessel collision

11.9.1 Description of Hazard

A vessel collision with the FPSO could potentially occur during offshore operations, resulting in structural damage to hydrocarbon containment systems and a subsequent release of Kuda Tasi crude oil to the marine environment. Potential collision scenarios may involve support vessels, shuttle tankers or third-party marine traffic and could arise due to navigational error, mechanical failure, adverse weather conditions, loss of propulsion or failures in communication or simultaneous operations management. A significant collision has the potential to damage cargo tanks, offloading systems, risers or associated process infrastructure, resulting in an uncontrolled release of hydrocarbons at the sea surface.

This scenario is considered credible only following FPSO hook-up, commissioning and commencement of hydrocarbon production, when hydrocarbons are present within the FPSO storage and processing systems. Existing engineered and operational controls, including marine exclusion zones, vessel management procedures, navigational aids, communication protocols and simultaneous operations controls, are implemented to minimise the likelihood of vessel collision events occurring.

Modelling of this scenario is described in Section 11.6.3, the results are presented in Table 11-24

Table 11-24: Modelling results of a loss of light crude due to a vessel collision with the FPSO

Scenario description		Surface release of light crude from FPSO
Spill volume		45,000 bbl
Oil type		Kuda Tasi light crude
Release depth		Surface
Release duration		6 hours
Simulation length		30 days
Floating Oil	Maximum distances from the release location for floating oil.	Floating oil concentrations ≥10 g/m^2 were observed to up to 62.8 km away
	Highest probability of floating oil arriving at a receptor at, or above, 10 g/m^2	Big bank Shoals 6.5% probability Karmt Shoal 2.5% probability No other receptors contacted at this threshold above 1% probability
	Quickest time before floating oil arriving at a receptor at, or above, 10 g/m^2	Big bank Shoals 8.25 hrs Karmt Shoal 12 hrs No other receptors contacted at this threshold
Shoreline Oil Accumulation	Probability of oil accumulation on **any** shoreline at, or above, 100 g/m^2	No shoreline accumulation above the 100g/m^2 threshold
	Absolute minimum time for oil to accumulate on **any** shoreline at, or above, 100 g/m^2	
	Maximum volume of oil accumulation on **any** shoreline from a single spill simulation at, or above, 100 g/m^2	

	Highest probability of oil accumulation for a specific shoreline receptor at, or above, 100 g/m^2	
	Maximum volume of oil accumulation from a single spill simulation for a specific shoreline receptor at, or above, 100 g/m^2	
Entrained Oil	Maximum distances from the release location to each entrained oil thresholds.	Entrained oil concentrations ≥100 ppb were observed up to 345.6 km from the release location.
	Highest probability of entrained oil arrival at a receptor at, or above, 100 ppb	Highest probability of entrained oil at, or above 100 ppb was 23.5% Big Bank shoal, and 31.5 at Karmt shoal. Other shoals predicted to receive floating oil at less than 5% (Echo Shoal), 8% (Dillon shoal) and 1.5% (Barton shoal).
	Quickest time before entrained oil arrival at a receptor at, or above, 100 ppb	Minimum time to contact for Big Bank shoals is 6.75 hours and Karmt Shoal 17.25 hours. Other shoals predicted to receive entrained oil at less than 1d17hrs (Echo Shoal), 2d12hrs (Dillon shoal) and 7d6hrs (Barton shoal).
Dissolved Hydrocarbons	Maximum distances from the release location to 50 ppb.	Dissolved hydrocarbon concentrations ≥50 ppb were observed up to 79 km away from the release location
	Highest probability of dissolved hydrocarbon arrival at a receptor at, or above, 50 ppb	Highest probability of dissolved oil at, or above, the 50 ppb was 17% Big Bank shoal, and 16.5 at Karmt shoal. No other receptors were contacted.
	Quickest time before dissolved hydrocarbon arrival at a receptor at, or above, 50 ppb	Minimum time to contact for Big Bank shoals is 8.25 hours and Karmt Shoal 19 hrs. Other shoals predicted to receive entrained oil at less than 3d2hrs (Echo Shoal), 11d3hr (Dillon shoal).

11.9.2 Impact Assessment

In the worst-case credible vessel collision scenario, large quantities of hydrocarbon (maximum estimated release volume of approximately 45,000 bbl of Kuda Tasi light crude oil) could be discharged to the marine environment over a period of approximately six hours, assuming no successful intervention or isolation of the release source during that time. The release may result in the formation of a surface oil slick with the potential to spread over a large area depending on prevailing metocean conditions, potentially exposing marine environmental and socioeconomic receptors to hydrocarbon impacts.

The modelling results indicate that oil would remain in open waters with entrained and dissolved oil reaching shoals in the region including Big Bank, Karmt, Echo, Dillon and Barton. Therefore, affected receptors would include pelagic species (marine mammals, fish, sharks, rays, marine reptiles and birds) and open water. There is no shoreline accumulation or floating oil predicted to reach shorelines, therefore coastal habitats and important areas such as turtle and seabird nesting beaches are not predicted to be impacted by a light crude spill. Though the distance that the entrained oil covers overlaps coastal waters of Timor and Indonesia.

11.9.3 Consequence assessment

Table 11-25: Consequence assessment of unplanned release of hydrocarbons (light crude) – from a flowline rupture

Activity	Consequence Ranking	Likelihood	Ranking
Survey	N/a	N/a	N/a
Drilling	N/a	N/a	N/a
Installation and Commissioning	N/a	N/a	N/a
Operations (Offtake tank rupture (FPSO cargo tank rupture -)	4 Major	2	Medium
Operations (Release during offtake bunkering)	1 Slight	3	Low

11.9.4 Mitigation and Management

Controls considered and adopted for the activity are summarised in Section 9.4.

11.9.5 ALARP Assessment

Alternatives to the development are considered in Section 8.

Additional controls considered are provided in Table 11-26.

Table 11-26: ALARP assessment of additional controls

Activity	Additional Control	Reject Reasoning
Operations	Dedicated standby escort vessel permanently stationed adjacent to the FPSO to intercept all approaching vessels	A permanently stationed escort vessel may marginally reduce the likelihood of vessel collision with the FPSO by providing additional monitoring and interception capability for approaching marine traffic. However, the activity already incorporates established marine controls including a Petroleum Safety Zone (PSZ), navigational lighting and marking and communication protocols Maintaining a dedicated standby escort vessel for the full operational period would introduce additional vessel traffic, atmospheric emissions, underwater noise, fuel consumption and operational risks. The incremental reduction in collision risk is considered limited relative to the additional environmental impacts, safety exposure and operational costs, and is therefore considered grossly disproportionate to the environmental benefit gained.
	Permanent shutdown of hydrocarbon transfer and processing systems during all vessel approaches within the PSZ	Temporarily shutting down hydrocarbon processing and transfer operations during all vessel approaches may reduce the potential consequences of a vessel collision event. However, vessel movements within the PSZ are routine and managed under existing procedures, communication protocols and marine management controls designed to minimise collision risk. Frequent shutdown and restart of processing systems would introduce additional operational complexity, process safety risks, flaring, atmospheric emissions and potential equipment reliability issues. The marginal reduction in environmental risk is not considered sufficient to justify the increased operational and safety impacts associated with repeated production interruptions.
	Installation of additional external impact protection structures around the FPSO hull and offloading systems beyond design requirements	Additional external collision protection structures may provide some increased physical protection to FPSO hydrocarbon containment systems in the event of a vessel collision. However, the FPSO design already incorporates structural integrity requirements, marine exclusion

		arrangements and collision risk controls consistent with recognised international standards and classification society requirements. Retrofitting or expanding impact protection structures would significantly increase engineering complexity, vessel installation activities, maintenance requirements and offshore safety exposure. The incremental reduction in collision consequence is considered negligible when compared with the additional environmental, safety and economic impacts, and is therefore considered grossly disproportionate.

A vessel collision with the FPSO cannot be completely eliminated during offshore production activities, as marine traffic associated with support operations, offloading activities and third-party vessel movements is inherent to offshore petroleum operations. However, the FPSO operations have been specifically designed and managed to minimise the likelihood of vessel collision and any subsequent loss of hydrocarbon containment through the implementation of multiple engineered and procedural controls consistent with recognised international industry standards and good marine practice.

The FPSO will be located within a designated Petroleum Safety Zone (PSZ) and supported by navigational controls including navigational lighting and marking, radar aand continuous communication protocols with nearby vessels. Vessel movements within and around the field are managed through established marine coordination procedures, vessel approach requirements, exclusion zones and permit-to-work systems to minimise the likelihood of collision events.

Operational controls including competency and training requirements for marine personnel, vessel assurance processes, bridge management procedures, adverse weather operating limits and emergency response arrangements further reduce the likelihood of human error or equipment failure contributing to a collision event. Support vessels and offloading tankers are required to comply with defined approach procedures and communication protocols prior to undertaking operations in proximity to the FPSO.

Additional controls that were either not technically feasible, or grossly disproportionate for this type of activity were rejected. In the instance of rejected controls, the additional effort would not result in significant reductions in risk levels. With implementation of the existing management measures, it is considered the risk associated with this planned impact are reduced to ALARP as per the criteria in Section 9.

11.10 Unplanned release of hydrocarbons (light crude) – flowline rupture

11.10.1 Description of Hazard

A rupture of the subsea flowline could potentially occur as a result of internal or external impacts to the infrastructure, including dropped objects during offshore operations, corrosion, material failure, excessive fatigue, or mechanical damage from subsea intervention activities or third-party interactions. Such an event could result in a loss of containment of Kuda Tasi light crude from the subsea production system to the marine environment. In the worst-case credible flowline rupture scenario, approximately 5,000 bbl of light crude may be released subsea prior to isolation and shutdown of the affected system.

This scenario is considered credible only following FPSO hook-up, commissioning and commencement of hydrocarbon production, when hydrocarbons are present within the subsea flowline system and operating under pressure. Existing engineered and operational controls are implemented to minimise the likelihood of flowline failure and loss of containment. These include flowline design and material selection in accordance with recognised international standards, corrosion protection systems, inspection and maintenance programs, pressure monitoring, leak detection capability, and isolation systems designed to rapidly shut in the affected section in the event of an anomaly.

Modelling of this scenario is described in Section 11.6.3, the results are presented in Table 11-27.

Table 11-27: Modelling results of a loss of light crude due to a flowline rupture

Scenario description		Subsea release of light crude from flowline rupture
Spill volume		5,000 bbl
Oil type		Kuda Tasi light crude
Release depth		Subsea
Release duration		6 hours
Simulation length		30 days
Floating Oil	Maximum distances from the release location for floating oil.	Floating oil concentrations ≥10 g/m^2 were observed to up to 3.6 km away
	Highest probability of floating oil arriving at a receptor at, or above, 10 g/m^2	No receptors contacted above the threshold
	Quickest time before floating oil arriving at a receptor at, or above, 10 g/m^2	No receptors contacted above the threshold
Shoreline Oil Accumulation	Probability of oil accumulation on **any** shoreline at, or above, 100 g/m^2	No shoreline accumulation above the 100g/m^2 threshold
	Absolute minimum time for oil to accumulate on **any** shoreline at, or above, 100 g/m^2	
	Maximum volume of oil accumulation on **any** shoreline from a single spill simulation at, or above, 100 g/m^2	
	Highest probability of oil accumulation for a specific shoreline receptor at, or above, 100 g/m^2	
	Maximum volume of oil accumulation from a single spill simulation for a specific shoreline receptor at, or above, 100 g/m^2	
Entrained Oil	Maximum distances from the release location to each entrained oil thresholds.	Entrained oil concentrations ≥100 ppb were observed up to 48.9 km from the release location.
	Highest probability of entrained oil arrival at a receptor at, or above, 100 ppb	No receptors contacted above the threshold
	Quickest time before entrained oil arrival at a receptor at, or above, 100 ppb	No receptors contacted above the threshold
Dissolved Hydrocarbons	Maximum distances from the release location to 50 ppb.	Dissolved hydrocarbon concentrations ≥50 ppb were observed up to 14.2 km away from the release location
	Highest probability of dissolved hydrocarbon arrival at a receptor at, or above, 50 ppb	No receptors contacted above the threshold
	Quickest time before dissolved hydrocarbon arrival at a receptor at, or above, 50 ppb	No receptors contacted above the threshold

11.10.2 Impact Assessment

In the worst-case credible flowline rupture scenario, large quantities of hydrocarbon (maximum estimated release volume of approximately 5,000 bbl of Kuda Tasi light crude oil) could be discharged to the marine environment over a period of approximately six hours, assuming no successful intervention or isolation of the release source during that time. The release may result in the formation of entrained hydrocarbons subsea, potentially exposing marine environmental and socioeconomic receptors to hydrocarbon impacts.

The modelling results indicate that oil would remain in open waters with entrained and dissolved oil not reaching any defined receptor locations. Therefore, affected receptors would include pelagic species (marine mammals, fish, sharks, rays, marine reptiles and birds) and open water. There is no shoreline accumulation or floating oil predicted to reach shorelines, therefore coastal habitats and important areas such as turtle and seabird nesting beaches are not predicted to be impacted by a light crude spill.

13.1.3. Consequence assessment

Table 11-28: Consequence assessment of unplanned release of hydrocarbons (light crude) – from a vessel collision

Activity	Consequence Ranking	Likelihood	Ranking
Survey	N/a	N/a	N/a
Drilling	N/a	N/a	N/a
Installation and Commissioning	N/a	N/a	N/a
Operations	3 Local	2	Medium

11.10.3 Mitigation and Management

Controls considered and adopted for the activity are summarised in Section 9.4.

11.10.4 ALARP Assessment

Alternatives to the development are considered in Section ALTERNATIVES8.

Additional controls considered are provided in Table 11-29.

Table 11-29: ALARP assessment of additional controls

Activity	Additional Control	Reject Reasoning
Operations	Burial or trenching of the entire subsea flowline system along all sections of the route	Full burial or trenching of all subsea flowlines may provide additional protection from external impacts such as dropped objects or third-party interactions. However, the activity area has limited third-party seabed interaction and existing controls, including exclusion zones, dropped object prevention measures and subsea asset management systems, already minimise the likelihood of external impact damage. Full trenching or burial would substantially increase seabed disturbance, sediment mobilisation, installation duration, vessel activity and environmental impacts during construction. In addition, burial may not be technically feasible across all seabed conditions. The incremental reduction in risk is considered limited relative to the additional environmental and operational impacts.
	Continuous intervention vessel onsite for immediate subsea inspection and repair response	Maintaining a dedicated intervention vessel onsite throughout operations may marginally reduce response time in the event of a subsea flowline failure. However, existing leak detection, shutdown and isolation systems are designed to rapidly identify and isolate a loss of

		containment event to minimise release volumes. A permanently stationed intervention vessel would introduce additional vessel traffic, atmospheric emissions, underwater noise, operational discharges and marine safety risks for the duration of operations. The marginal reduction in environmental consequence is not considered sufficient to justify the increased environmental footprint, operational complexity and cost associated with continuous vessel presence.

A rupture of the subsea flowline cannot be completely eliminated during offshore production activities, as subsea hydrocarbon transport systems are inherently exposed to risks associated with operating pressures, material degradation and potential external impacts. However, the subsea production system has been specifically designed and managed to minimise the likelihood of flowline failure and any subsequent release of Kuda Tasi light crude through the implementation of multiple engineered and operational controls consistent with recognised international industry standards and good oilfield practice.

The subsea flowline system has been designed in accordance with recognised engineering and classification standards, incorporating appropriate material selection, corrosion allowances and pressure containment requirements to maintain integrity throughout the operational life of the field. Inspection, maintenance and integrity monitoring programs are undertaken throughout operations to identify anomalies or deterioration and verify continued system integrity.

Operational controls including pressure monitoring, leak detection systems, automatic shutdown and isolation functionality are implemented to enable rapid identification and isolation of any loss of containment event, thereby minimising potential release volumes. Dropped object prevention procedures, crane and lifting controls, vessel positioning requirements, exclusion zones and permit-to-work systems further reduce the likelihood of mechanical damage to subsea infrastructure from offshore activities..

Additional controls that were either not technically feasible, or grossly disproportionate for this type of activity were rejected. In the instance of rejected controls, the additional effort would not result in significant reductions in risk levels. With implementation of the existing management measures, it is considered the risk associated with this planned impact are reduced to ALARP as per the criteria in Section 9.

12. ENVIRONMENTAL MANAGEMENT PLAN

12.1 Overview

The KTJ Project Development is a phased project, with timing and progression dependent on the outcomes of technical studies, regulatory approvals, and internal investment decision gates . As such, it was agreed with ANP in a meeting on 9 December 2025 and through a subsequent formal letter to ANP, that Regulatory Approvals documents – including all EMPs would also be submitted to ANP for approval in a phased manner that aligned with the project development

A phase-specific Environmental Management Plan (EMP) will be prepared for each stage of the KTJ Project (including drilling, construction and installation, operations and decommissioning), based on a consistent overarching framework aligned with Timor-Leste regulatory requirements and international offshore petroleum industry best practice. Each EMP will define the scope and objectives of the phase, describe the proposed activities, identify environmental, social and safety risks through a structured Environmental Risk Assessment (including ENVID workshops), and establish control measures to manage impacts to ALARP.

EMPs will also set out roles and responsibilities, monitoring and performance indicators, reporting and notification requirements, emergency preparedness and response arrangements, and stakeholder engagement and grievance mechanisms.

Finder Energy has already prepared an EMP for the first activity which is the geophysical and geotechnical (GPGT) surveys and this has already been submitted for assessment by ANP and accepted, and it is attached as Appendix B. This framework, demonstrated in the submitted KTJ GTGP EMP, ensures a systematic, transparent and auditable approach to environmental management across all project phases, with the level of detail in each EMP commensurate with the activity scope and design maturity at the time of submission.

The GTGP EMP provides an example of how Finder Energy and its contractors will comply with environmental laws and ensure that the activities do not cause long-term damage to the marine environment. It provides guidelines on safety measures, waste disposal, emergency preparedness, and community engagement.

The primary objectives of the EMP are as follows:

- To provide the necessary framework to effectively mitigate against environmental impacts during the activities;
- To provide the means to ascertain the effectiveness of environmental protection / conservation measures identified in the EIS study, which will form the basis for additional / modified provisions to meet the stipulated limits where these are expected; and
- To provide guidance for environmental management so that the work is carried out in accordance with legislative requirements and in meeting the overall environmental objectives of the Project.
- Ensures that activities follow environmental laws.
- Reduces harm to marine life and natural habitats.
- Keeps workers and nearby communities safe.
- Establishes a plan for responding to emergencies such as oil spills.
- Helps monitor and report environmental impacts.

By following strict environmental laws, using advanced technology, and having a clear emergency response plan, the project aims to minimize negative effects on the environment.

The GTGP and all future EMP's ensures that activities are carried out responsibly and provide environmental guidance so that the program is conducted in line with the environmental requirements and minimizes the impact to the environment. It will also identifies the roles and responsibilities of personnel and parties involved in the management of environmental aspects related to the activities. Through cooperation with local authorities and community engagement, the project can support sustainable energy exploration while protecting Timor-Leste's marine ecosystems for future generations.

13. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

13.1 Purpose of the Consultation

The purpose of the public consultation is to inform stakeholders about the proposed development activities, ensuring stakeholders receive sufficient information before the activities commence, addressing any questions or concerns they may have. This approach supports transparency and community engagement, by providing an inclusive forum in which local perspectives can be shared, concerns addressed, and stakeholders can contribute to the decision-making process. The Public consultation strategy is further detailed in Finder's Public Consultation Plan (PCP) that outlines the recommended approach for conducting stakeholder engagement and consultation throughout the lifecycle of the KTJ Project. The KTJ Project PCP, Revision 2 was approved by ANP on 17 March 2026.

13.2 Methodology and Approach

13.2.1 Identification of Stakeholders

Stakeholder identification considered those potentially affected by or proximate to each element of the activity being proposed, broadened to include those who may perceive they are affected, and document those with an interest in the activity. These and additional techniques used to identify stakeholders are outlined in the Finder Stakeholder Consultation Guidance (FDR-STE-GUI-0001).

Stakeholders included in the Public Consultation Process are detailed in Section 3.2. of the PCP.

13.2.2 Level of engagement

The following engagement activities (as detailed in the PCP) were undertaken as part of the public consultation for the Project EIS:

One-to-one consultations

One-to-one consultations were undertaken with the high priority stakeholders listed below:

Date	Time	Venue	Institution
7 April 2026	15:00 – Finish	Ministry of Tourism's Mandarin office	Ministry of Tourism and Environment – Department of Biodiversity, Department of Pollution Control & Department of Environment
9 April 2026	10:00 – Finish	APORTIL's office	Ministry of Transportation and Communication – APORTIL (Administrasaun Portuariu Timor-Leste / Timor-Leste Port Administration)
9 April 2026	15:00 – Finish	Finder Energy Dili Office	Ministry of Defence – National Maritime Authority (AMN)
10 April 2026	10:00 – Finish	Immigration Office	Ministry of Interior – Immigration Service
15 April 2026	09:00 – Finish	Ministry of Finance Tower	Ministry of Finance – Autoridade Aduaneira / Timor-Leste Custom Authority
17 April 2026	15:00 – Finish	DNQB Office	Ministry of Agriculture, Livestock, Fisheries & Forestry – National Directorate of Quarantine & Biosecurity
20 April 2026	09:00 – Finish	DNPAGR Office	Ministry of Agriculture, Livestock, Fisheries & Forestry – General Directorate of Fisheries, Aquaculture & Aquatic Resources Management

Further details of these consultations are provided in 13.4.1.

Public Consultation Notice

A Public Consultation Notice was published via ANP's website, Finder's website, and relevant communication channels, including social media platforms (such as LinkedIn, newspapers, radio and television, to inform stakeholders, as part of the Environmental Impact Assessment (EIA) process on the day of the EIS draft submission.

Through the Public Notice process, any interested person was given the opportunity to review the documentation and submit written comments either via email or in person at the offices of the Environmental Authority (ANP) and the Project Proponet (Finder).

The Public Notice was provided to ANP 2 weeks prior to publication to allow for review and feedback.

Public Meeting

Finder organised a one-day formal public meeting (town hall meeting, see Section 13.6.2) involving the identified stakeholders (Section 3.2 of PCP) to ensure awareness of the proposed activity and to present the draft EIS. The meeting included a presentation of the potential impacts of the proposed activity, as well as the proposed mitigation measures.

The purpose of the public consultation was to inform stakeholders about the proposed development activities, ensuring they received sufficient information and providing an opportunity to address any questions or concerns.

This approach supported transparency and community engagement by providing an inclusive forum in which local perspectives were shared, concerns were addressed, and stakeholders contributed to the decision-making process.

To facilitate focused discussion and maximise the quality of inputs received, interested parties and relevant stakeholders were grouped according to their interests and level of influence on the Project.

An agenda for the public meeting was prepared to ensure an effective Public Consultation (PC) process was implemented, enabling interactive and constructive discussions between participants and the project proponent.

Hard copies of relevant materials were made available in both English and Tetum to support informed and proactive engagement by participants during the meeting.

Preparation of presentation materials was provided to ANP 2 weeks prior to the meeting.

Communication methods

A range of communication methods may be used to exchange information during consultation, including:

- Written documentation or information provided in person or remotely, as appropriate, via post, email, website publication, advertising (via news or other media outlets) or social media;
- Verbal communication through telephone calls (either proactive or in response/follow up), targeted meetings, focus group workshops, information sessions; or
- On site and in person meetings and information sessions (including presentations or drop-in sessions).

All interactions with stakeholders are to be documented and, where appropriate, consultation records should be confirmed with the parties represented.

Opportunity to respond

For the Public Notice, a 60-day Public Comment period is a reasonable timeframe to enable broad participation and to maximise the inputs received.

In assessing consultative feedback, a number of judgements are required to be made, dependent on the nature of the response received:

- **No response:** Where a response has not been received from a stakeholder.
- **No issues:** Where a stakeholder has responded to consultative information and has no concerns or questions regarding the proposed activity, often this allows Finder to consider the consultative process for that stakeholder and activity to have been satisfactorily closed out.
- **Clarification:** Where a stakeholder seeks further information or clarification of the information received, this is an opportunity for Finder to confirm the stakeholder is aware of the information and can also be an opportunity to seek confirmation of acceptance of proposed activity and arrangements or if there are any issues that can be identified or may arise.
- **Objection:** Where a stakeholder raises an objection to a proposed activity, Finder must seek to understand the nature and basis of the objection and undertake reasonable engagement to consider the stakeholder's concerns.

13.3 Summary of Consultation (Public Meeting)

Date: 2 June 2026

Venue: Salaun Delta Nova, Delta 1, Comoro, Dili Timor Leste

Time: 0930 to Finish

Participants: Refer to Annex XX (Will be attached after public meeting)

HOLD: (Will be attached after public meeting)

13.4 Summary of Main Comments

HOLD: (Will be attached after public meeting)

13.4.1 One-to-One Consultations

HOLD

13.4.2 Public Meeting

The objective of the public consultation is to ensure transparency and responsibility in oil and gas exploration. Through the public consultation, everyone has the right to review and submit their concerns, if any regarding the KTJ Project. During the public consultation the following comments arose:

(Summary of comments, suggestions, etc. Will be added after public meeting)

HOLD: Through the public consultation, everyone has the right to review and submit their concerns, if any regarding the KTJ Project. During the public consultation the following comments arose.

13.5 Summary of Public Acceptance of the Project

HOLD – until after public meeting.

13.6 Photos for Public Consultation

13.6.1 One-on-One Consultation

Ministry of Defence – National Maritime Authority

Ministry of Interior – Immigration Service

Ministry of Finance – Autoridade Aduaneira / Timor-Leste Custom Authority

Ministry of Agriculture, Livestock, Fisheries & Forestry – National Directorate of Quarantine & Biosecurity


Ministry of Agriculture, Livestock, Fisheries & Forestry – General Directorate of Fisheries, Aquaculture & Aquatic Resources Management


Ministry of Transportation and Communication – APORTIL (Administrasaun Portuariu Timor-Leste / Timor-Leste Ports Administration)

Ministry of Tourism and Environment – Department of Biodiversity, Department of Pollution Control & Department of Environment

13.6.2 Town Hall Consultation

HOLD – until after public meeting.

13.7 Recommendations for Future Consultations

Consultation with identified stakeholders will persist throughout the entirety of the project, at each project stage e.g. drilling, subsea infrastructure installation, operations etc. and as appropriate, for a period of time after the cessation of the activity. Further details are provided in the Project Public Consultation Plan.

HOLD for any further consultation outcomes after public meeting and public comment period

14. DIFFICULTIES ENCOUNTERED

At the current stage of project maturity, no significant technical difficulties have been encountered; however, adverse weather conditions and other project-related scheduling constraints have delayed completion of the environmental baseline surveys. Finder continues to assess and pursue suitable alternatives to minimise further delays and enable the required work to be undertaken as soon as practicable.

Other challenges encountered during the assessment included understanding the regulatory requirements during the preparation of the Terms of Reference and EIS and sourcing primary and secondary data for the EIS.

15. EMERGENCY PREPAREDNESS

An emergency response framework will be maintained to address unforeseen incidents. Depending on the stage of the activity will depend on the level of preparedness required and this will be detailed in individual EMPs and an accompanying OPEP.

15.1.1 Potential Emergency Scenarios

- Minor fuel or oil spill
- Onboard fire
- 3rd party vessel collision

- Loss of hydrocarbons due to loss of FPSO, well or pipeline integrity
- Extreme weather or sudden deterioration of sea conditions
- Medical emergency.

15.1.2 Immediate Response Actions

Stop work and secure the source of the incident

- Activate onboard emergency procedures
- Deploy spill kits or firefighting equipment as appropriate
- Notify Vessel Master/FPSO OIM and Finder Project Manager or Finder COO immediately.

15.1.3 Responsible Person

- Primary: Vessel Master/OIM
- Secondary: Offshore Supervisor / HSE Representative
- Emergency Contact Numbers (to be provided to ANP upon contracting)

15.2 Oil Pollution Emergency Plan

An Oil Pollution Emergency Plan (OPEP) will be developed and implemented as part of the development and will be submitted with the next EMP (for drilling) to provide a comprehensive framework for preparedness, response and recovery in the event of a hydrocarbon spill associated with drilling, installation, commissioning, FPSO operations or supporting vessel activities. The OPEP will be developed in accordance with the requirements of ANP and international best practice including Australian guidance.

The OPEP will address credible spill scenarios relevant to the Project, including loss of containment from wells, subsea infrastructure, risers, flowlines, fuel transfers, marine diesel storage, vessel collision, tank overfill, cargo transfer operations and FPSO process systems. Spill response arrangements will be commensurate with the nature and scale of the identified oil pollution risks and will be supported by oil spill modelling undertaken for representative spill scenarios.

The OPEP will define the systems, equipment, personnel, procedures and organisational arrangements necessary to ensure a timely and effective response to an oil pollution incident. This is expected to include:

- incident notification and escalation procedures;
- emergency response management structures and responsibilities;
- source control arrangements;
- mobilisation of response personnel and equipment;
- spill trajectory forecasting and surveillance activities;
- protection priorities for environmentally sensitive receptors;
- waste management procedures;
- shoreline response arrangements where relevant;
- wildlife response considerations; and
- coordination arrangements with relevant government agencies and response organisations.

Given the Project's offshore deep-water location, primary response strategies are expected to focus on source control, monitor and evaluate, and protection of sensitive environmental receptors identified through spill risk assessment and modelling. Response strategies will be selected based on spill characteristics, prevailing environmental conditions and net environmental benefit considerations.

The OPEP will include arrangements to ensure response capability is maintained throughout the life of the Project, including personnel training, emergency exercises, equipment testing, contractor arrangements and periodic review of response procedures. The OPEP will be treated as a live operational document and updated as necessary to reflect changes in Project activities, environmental understanding, response capability or regulatory requirements.

16. MONITORING AND AUDITING

16.1 Proposed Future Monitoring Programs

The proposed Environmental Monitoring Plans (EMPs) (see Section 12) will include detailed environmental monitoring where required, and will be informed by baseline data collected as part of the EBS.

Environmental monitoring programs will be implemented throughout the drilling, installation, commissioning and operational phases of the Project to verify the effectiveness of environmental management measures, confirm compliance with regulatory requirements, and identify any unanticipated environmental effects requiring adaptive management. Monitoring programs will be developed and implemented in accordance with the requirements of the accepted EMPs, relevant approval conditions, and applicable industry standards and guidelines under the regulatory oversight of ANP.

The monitoring framework is expected to incorporate a combination of baseline surveys, operational monitoring, compliance verification, environmental performance monitoring and, where required, targeted investigative monitoring. The scope and frequency of monitoring will be commensurate with the nature, scale and environmental risk profile of each activity phase.

16.1.1 Seabed and Benthic Habitat Monitoring

Pre-installation seabed surveys will be undertaken to confirm existing seabed conditions within areas proposed for subsea infrastructure installation, anchoring, mooring systems, drilling infrastructure and pipeline or flowline placement. Surveys are expected to include geophysical and/or geotechnical investigations, seabed imagery and habitat characterisation sufficient to verify seabed conditions and identify any sensitive benthic features requiring avoidance or management as described in the EPBS SOW and the GPGT EMP.

Post-installation seabed monitoring may be undertaken to verify the extent of seabed disturbance associated with installation activities and to confirm that impacts remain consistent with those predicted in the environmental assessment. Monitoring may include remotely operated vehicle (ROV) inspections, seabed imagery, bathymetric surveys and infrastructure integrity inspections. In deep-water offshore environments, seabed conditions are generally stable and benthic recovery processes are expected to occur gradually over time with limited ongoing disturbance following installation activities.

Additional seabed inspections may also be conducted periodically during operations to support integrity management of subsea infrastructure, moorings, risers and pipelines, including verification of seabed stability and absence of unexpected scour or debris accumulation.

16.1.2 Produced Formation Water Monitoring

Produced formation water generated during hydrocarbon processing aboard the FPSO will be subject to continuous management and monitoring throughout operations. Produced water treatment systems will be designed to achieve applicable discharge performance criteria prior to any overboard discharge, including oil-in-water concentration limits and operational performance standards.

Monitoring is expected to include:

- continuous or routine monitoring of oil-in-water concentrations;
- monitoring of produced water discharge volumes and flow rates;
- periodic sampling and laboratory analysis of produced water quality parameters;
- monitoring of treatment system performance and efficiency;
- recording and reporting of discharge events and compliance exceedances; and
- inspection and maintenance of produced water treatment equipment.

Where required, operational and receiving environment monitoring programs may also be implemented to verify that produced water discharges are not resulting in unacceptable impacts to marine water quality or ecological receptors. Monitoring programs may be adaptively managed based on operational performance and monitoring outcomes.

16.1.3 Drilling Discharge and Well Operations Monitoring

During drilling activities, monitoring programs will be implemented to verify compliance with drilling fluid, cuttings discharge and chemical management requirements. This may include:

- monitoring of drilling fluid properties and discharge rates;
- verification of drilling chemical selection and usage;
- monitoring of synthetic-based mud retention on cuttings where applicable;
- recording of cuttings discharge volumes;
- well integrity and pressure monitoring; and
- inspection and auditing of waste handling and storage practices.

Operational monitoring will support confirmation that discharges and associated seabed deposition remain within predicted and acceptable impact footprints that will be defined in the drilling EMP.

16.1.4 Marine Fauna Observation and Interaction Monitoring

Marine fauna monitoring measures will be implemented during offshore activities to minimise risks to protected species including cetaceans, marine turtles, migratory seabirds and other EPBC Act listed species. Monitoring may include:

- recording and reporting of marine fauna interactions or sightings;
- implementation of vessel strike avoidance measures including speed limits;
- periodic review of operational activities in response to fauna observations or incident trends.

The monitoring approach will be consistent with recognised industry practice and applicable regulatory guidance for offshore petroleum activities.

16.1.5 Waste, Chemical and Spill Management Monitoring

Monitoring and inspection programs will be implemented to verify the appropriate storage, handling, transfer and disposal of wastes, fuels and chemicals throughout all project phases. This is expected to include:

- routine inspections of chemical and fuel storage systems;
- monitoring of hazardous and non-hazardous waste inventories;
- tracking and verification of waste disposal pathways;
- inspection of bunding and containment systems;
- spill response equipment inspections and testing; and
- environmental incident and near-miss reporting.

Operational monitoring will support ongoing compliance with MARPOL requirements, relevant legislation and EMP commitments.

16.1.6 Greenhouse Gas and Atmospheric Emissions Monitoring

Monitoring of atmospheric emissions associated with FPSO and vessel operations may include fuel consumption tracking, flaring records, greenhouse gas emissions estimation and maintenance of emissions-related equipment. Monitoring data may be used to support compliance reporting, emissions inventories and operational optimisation initiatives.

16.1.7 Integrity Inspection and Infrastructure Monitoring

Routine inspection and integrity monitoring programs will be undertaken throughout operations for subsea infrastructure, mooring systems, risers, pipelines and FPSO systems. These programs are intended to minimise the risk of loss of containment events and verify continued operational integrity.

Inspection methods may include ROV inspections, corrosion monitoring, pressure monitoring, leak detection systems, structural inspections and preventative maintenance programs.

16.2 Auditing

The monitoring and review of environmental performance of activities are achieved through daily reports which will be in accordance with JPDA Interim Guidelines, Guideline 5. Auditing will be compliant with the Operators Business Management System (BMS) and vessel Operating Management System (OMS).

Typical monitoring parameters will likely include:

- Environmental Training and Awareness
- Compliance with approved work procedures
- Waste segregation and storage compliance
- Adherence to vessel operational limits (weather and safety).
- Daily visual checks during operations (e.g. Equipment Maintenance and Leak Detection)
- Waste Management Compliance
- Chemical and Fuel Storage Conditions
- Marine and Water Protection
- Incident-based monitoring if abnormal events occur
- Presence of visible oil/fuel sheen
- Condition of spill response equipment

16.3 Reporting

Reporting during, and following, the individual activities will comply with Finder & ANP requirements and will be detailed in EMPs. Indicative reports may include:

- Daily field reports
- Survey reports
- Factual reports, presenting the outcomes of measurements and analyses

ANP will only be notified if:

- A reportable incident occurs

- Environmental harm or pollution is observed
- Authorities formally request information.

Table 16-1: Proposed records to be kept

Measurement	Frequency	Monitoring strategy	Record
Oily sludge is disposed of at shore	Weekly	Oily sludge is monitored as per MARPOL	Oil record book
Food waste from the FPSO and vessels will be recorded	Weekly	Putrescible waste as monitored per MARPOL	Garbage record book
Produced water OIW concentration and discharge volume	Every discharge	Monitoring designed to accommodate discharge operations	Daily report
Diesel consumption on the FPSO	Monthly	Review of consumption data to determine emissions and efficiency	Fuel and ullage records Daily reports
Diesel consumption on vessels	Post vessel charter	Review of consumption data to determine emissions and efficiency	Fuel records
Fugitive emissions on the FPSO	Annually	Fugitive emissions surveys are undertaken annually	Fugitive emissions survey
Volumes of the following waste types are recorded: General and putrescible waste Hazardous waste Timber/ wood Recyclables Cardboard/ paper Scrap metal Metal drums and containers Batteries (lead acid) Plastic drums and containers	Logged on facility when transferred via vessel to shore then to licensed waste facility. Vessel also records volumes on manifest	Invoicing process checks vessel manifest against waste disposal records of service provider, and evidence of disposal	Monthly waste reports Manifests are records of garbage wastes, recyclables and dangerous goods disposed.

17. CONCLUSION

The EIS evaluates the potential risks arising from the proposed KTJ development and outlines mitigation measures to address environmental, social, and economic impacts. Generally, the assessment has been conducted based on the known activities and predictions based on the proposed future development. The EIS is prepared in accordance with the Terms of Reference submitted by Finder and approved by ANP.

While certain aspects of the project may evolve over time, including the availability of additional baseline survey data and refinements arising through the progression of the activity, the assessment has adopted a conservative approach to ensure that potential impacts are appropriately characterised and managed. On this basis, the EIS is considered fit for purpose in supporting the current stage of project assessment. More detailed environmental management measures and operational controls will subsequently be developed and implemented through phase-specific EMPs prepared for the relevant stages of the activity.

The existing environment of the Development Area has been assessed using secondary data for marine water quality, ambient air, seabed sediment and marine microbiological data as EBS have not yet been completed. Following receipt of EBS data, the existing environment and impact assessment may be updated depending on the outcomes of the surveys to ensure impacts are assessed appropriately. Other areas of interest that are relevant to the proposed activities in the offshore environment include marine ecology, meteorological conditions, oceanography, bathymetry, fisheries and shipping activities.

Environmental impacts associated with the proposed development were assessed and the magnitude of impacts against the existing environment were discussed in Chapter 10 and 11.

The predicted consequences of planned project activities are generally slight to minor, with a limited number of locally confined impacts. Seabed and benthic habitat disturbance increases from slight during surveys to minor during drilling and operations, with the highest planned consequence ranking of local during installation and commissioning due to the duration of the impact (i.e for the life of operations). Overall, the planned events are expected to result predominantly in low-level, localised environmental consequences that can be managed through the proposed controls and mitigation measures.

Most identified unplanned events, including interaction with fauna, interaction with other users, release of large objects, non-hydrocarbon liquid releases, and diesel spills from vessel collision, are assessed as low risk during survey activities. The medium risk events are marine pest introduction and the unplanned release of small solid objects. Overall, the survey phase is characterised by generally low environmental risk, with medium risks limited to a small number of credible events that can be reduced through standard controls and management measures.

During drilling, medium risk ranking also applies to unplanned crude hydrocarbon release associated with a loss of well control (LOWC). Overall, drilling presents a broader range of potential unplanned events than the survey phase, but residual risks remain within low to medium levels following application of international best practice and industry standard mitigation and emergency response measures.

Overall, the installation and commissioning phase presents a similar residual risk profile to the survey phase, with risks largely low and only a limited number of medium-ranked events.

For operations, again the medium risk unplanned events include marine pest introduction, release of small solid objects, crude release from LOWC, crude release from FPSO cargo tank rupture, and crude release from flowline rupture. Overall, while operations involve a greater number of hydrocarbon-related unplanned events, the assessment indicates that residual risk remains within low to medium levels with the proposed safeguards, spill prevention, and response arrangements in place.

18. NON-TECHNICAL SUMMARY

18.1 Introduction

PSC-TL-SO-T 19-11 (PSC 19-11), located in the prolific Laminaria High oil province of the Bonaparte Basin offshore Timor-Leste, contains four discovered but undeveloped oil fields, including the fully appraised Kuda Tasi and Jahal fields. The Finder Timor-Leste B.V. and TIMOR GAP Joint Venture is progressing a fast-track subsea and FPSO-based development targeting Final Investment Decision (FID) in mid-2026 and first oil in late 2027. The Joint Venture has advanced key technical, commercial, and funding workstreams to support a safe, compliant, and economically robust development pathway.

The initial phase of the KTJ Development will comprise three subsea production wells drilled in approximately 400 m water depth. These wells will be tied back via subsea flowlines and umbilicals to the Petrojarl FPSO, which will be permanently moored on location using a turret mooring system. The FPSO will provide processing, storage, and offloading capability to enable early production while supporting future expansion opportunities within PSC 19-11.

Petroleum activities within PSC 19-11 are regulated under Decree Law 2019/25 – Transition of Petroleum Titles and Regulation of Petroleum Activities from the Joint Petroleum Development Area, supported by the Interim Administrative Guidelines for the JPDA, including Guideline #5: Environmental Impact Assessment of Petroleum Activities. In accordance with this framework, the KTJ Development has been identified as requiring a full Environmental Impact Assessment (EIA) to evaluate potential environmental and social impacts across drilling, construction, installation, commissioning, operation, and decommissioning phases.

The EIA defines the environmental and social baseline, identifies potential impacts, assesses their significance, and develops appropriate mitigation and management measures. The assessment will be supported by a comprehensive program of environmental baseline surveys (EBS), geotechnical and geophysical surveys (GPGT), and risk assessments, ensuring that the development is planned and executed in a manner consistent with Timor-Leste's environmental legislation and international best practice.

The KTJ Development represents a significant opportunity for Timor-Leste to advance offshore oil production, strengthen domestic petroleum capability, and contribute to national economic growth. The EIA and EIS will ensure that the project proceeds with a clear understanding of environmental sensitivities and with robust controls in place to avoid, minimise, or mitigate potential impacts throughout the project lifecycle.

18.2 Environmental Consideration

The EIA assesses potential risks, develops mitigation strategies, ensures compliance with environmental laws, and involves stakeholder engagement. It will guide the creation of future phased Environmental Management Plans (EMPs) and associated Monitoring Programs.

A comprehensive program of environmental baseline surveys (EBS), geotechnical and geophysical surveys (GPGT), and risk assessments will build on the information within this EIS, and will inform the subsequent development of project phased activities (drilling, construction, operations) Environment Management Plans (EMPs), and associated monitoring to avoid, mitigate, or offset potential environmental impacts identified during the EIA process.

Primary data collected during the EBS will cover physical, chemical and biological characteristics of both marine water and sediments. For chemical parameters the matrix provides threshold criteria based on default guideline values (DGVs) for toxicants in marine waters and sediments derived from the Australian and New Zealand Guidelines for Fresh & Marine Water.

Air quality impacts are expected to be minimal, as offshore drilling operations allow for the rapid dispersion of emissions. The project's remote offshore location also ensures that socio-economic activities such as fisheries and tourism will not face significant disruptions. While some environmental risks exist, they can be effectively managed through best industry practices and strict regulatory compliance.

18.3 Potential Environmental Impacts and Mitigation Measures

The KTJ Development has been designed to minimise environmental impacts through the adoption of lower-risk technologies, robust operational controls, and industry-standard environmental management practices. Water-based drilling fluids (WBM) will be used for all production wells, significantly reducing environmental risk compared to synthetic-based fluids. WBMs exhibit lower acute and chronic toxicity, higher biodegradability, and reduced persistence in the marine environment, while also producing cleaner drill cuttings that require less energy-intensive treatment. These characteristics help limit impacts to water quality and benthic habitats during drilling activities.

The project's gas handling strategy further reduces environmental emissions. The Kuda Tasi and Jahal reservoirs contain very light, low-GOR oil, resulting in only small volumes of associated gas. This gas will be used as a primary fuel source for the FPSO and subsea ESPs, reducing reliance on diesel and avoiding the need to burn produced crude oil for power generation. During the early high-production period, any surplus gas will be flared in accordance with established practices used in comparable Timor-Leste fields such as Kitan, Buffalo and Elang-Kakatua. Full details of produced volumes and flaring requirements will be provided in the Field Development Plan for regulatory review.

Routine project activities may cause localised seabed disturbance, including temporary placement of survey equipment, MODU anchoring, installation of subsea infrastructure, and inspection or maintenance works. These activities can result in short-term turbidity, sediment resuspension, and small-scale loss of benthic habitat. Disturbance footprints are minimised through careful planning, use of pre-approved infrastructure locations, and adherence to established procedures for MODU positioning, ROV deployment, and subsea installation.

Across all phases of the project, mitigation measures will be implemented to manage potential impacts to marine ecosystems. These include strict waste management procedures, MARPOL-compliant discharge controls, spill prevention systems, and comprehensive oil spill response arrangements. Noise and light emissions will be managed through vessel speed restrictions, equipment maintenance, and compliance with navigational lighting standards to reduce disturbance to marine fauna. Routine environmental monitoring and reporting will ensure that emissions, discharges, and seabed interactions remain within regulatory limits and that mitigation measures continue to be effective throughout drilling, installation, and operations.

18.4 Conclusion

The Petroleum Activities in PSC 19-11 represent a major step toward unlocking Timor-Leste's offshore energy potential. With strict environmental safeguards in place, the project aims to balance economic benefits with sustainable resource management.

Through careful planning, regulatory compliance, and responsible operational practices, the project seeks to ensure minimal environmental impact while contributing to Timor-Leste's long-term energy security and economic growth.

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Appendix A Environmental Baseline Surveys Scope of Work

Appendix B Geophysical and Geotechnical Survey EMP

Appendix C : Summary of Consultation

Appendix C1: Summary of One-to-one Consultation

Appendix C2: Summary of Public Meeting

Appendix C3: Summary of Public comments received

HOLD – for outcomes from consultation meetings

Appendix D : Summary of data utilised to inform EIA

Source list	Relevance to KTJ Field Development	Data taken from Source to support TOR and EIA
Link to PMST search tool: Protected Matters Search Tool: Interactive Map	• Provides a regulator-endorsed list of MNES (threatened, migratory and marine species) that *may* occur in the Development Area, giving a precautionary baseline for early-stage risk assessment. • Uses national datasets covering the Timor Sea region, so it reliably captures species relevant to nearby fields like Chuditch, Bayu-Undan and Kitan that are regionally relevant to the KTJ Field. • Serves as an appropriate interim sensitivity layer until site-specific EBS data are collected (opportunistic marine fauna sightings)	Data from PMST used to support TOR/EIS by identifying the protected species in KTJ Field
Link to IBAT: IBAT | Data	• Provides verified global biodiversity layers (KBAs, protected areas, threatened species) relevant to the wider Timor Sea and KTJ region. • Gives credible species-presence context for marine fauna likely to occur near KTJ before EBS data are available. • Acts as a robust interim sensitivity dataset, with EBS later refining these broad distributions.	Data from IBAT used to support TOR/EIS by identifying the sensitive habitats in KTJ Development Area
Link to AMSIS: Australian Marine Spatial Information System (AMSIS)	• Provides nationally consistent spatial layers (bathymetry, geomorphology, habitats, marine parks) covering the Timor Sea, giving reliable regional context for the KTJ Development Area. • Includes baseline environmental features relevant to drilling/GPGT planning (seabed type, depth, geomorphic units) even before site-specific EBS data exist. • Acts as a credible interim physical-environment dataset, with EBS later confirming fine-scale sediment and habitat conditions at KTJ.	Data from AMSIS is used to support TOR/EIS by identifying the cultural or regulatory constraints present KTJ Development Area.
RPS 2020 Metocean Drilling study Buffalo East 1	• Provides site-specific metocean conditions (waves, currents, winds) for a nearby Timor Sea drilling location, giving a strong analogue for expected physical conditions at KTJ. • Includes modelling outputs relevant to drilling and GPGT risk pathways (e.g., metocean loads, operational windows), making it suitable as interim physical-environment data.	FEED and FDP

	• Offers recent, high-quality regional data (2020) that can reliably inform early planning until KTJ-specific EBS metocean measurements are collected.	
RPS 2009 Metocean design criteria for Kitan field in Timor sea	• Provides metocean design criteria (waves, currents, winds) developed specifically for the Kitan field, which is geographically and oceanographically close to the KTJ Development Area. • Serves as a credible interim dataset until KTJ-specific EBS metocean measurements are collected, given its direct relevance to nearby Timor Sea conditions.	FEED and FDP
Zaunbrecher, M. & Reeks, K. (2008). Cyclone evacuation in the Timor Sea — a case study. APPEA Journal, 48(1), 43–52.	• Gives region-specific cyclone behaviour insights for the Timor Sea, helping characterise metocean risk conditions relevant to KTJ operations. • Provides real operational data and response patterns from a nearby offshore field, supporting interim understanding of extreme-weather exposure before KTJ-specific EBS work.	Weather conditions and FDP.
ADB. 2014b. State of the coral triangle: Timor-Leste. Mandaluyong City: Asian Development Bank.	• Provides regional coral reef condition and biodiversity context relevant to Timor Sea ecosystems near KTJ. • Offers baseline ecological patterns useful until KTJ-specific benthic EBS data are collected.	Ecological component discusses the marine fauna expected to be present in the KTJ Development Area
ADB (2021). Climate Risk Country Profile: Timor-Leste. Asian Development Bank. https://www.adb.org/sites/default/files/publication/751241/climate-risk-country-profile-timor-leste.pdf	• Gives recent climate and oceanographic risk trends (storms, warming, currents) applicable to KTJ's broader region. • Supports interim environmental risk characterisation before local metocean/EBS data.	Ecological component discusses the marine fauna expected to be present in the KTJ Development Area
Johnson, J. E., Welch, D. J., van Hooidonk, R., Tracey, D., Chandrasa, G., Molinari, B., Triani, D., Tania, C., & Susanto, H. (2023). Climate change implications for the Arafura and Timor Seas region: Assessing vulnerability of marine systems to inform management and conservation. Climatic Change, 176, 88.	• Provides up-to-date regional vulnerability assessments for marine systems directly overlapping KTJ. • Offers current ecological pressure trends to inform interim risk pathways.	Weather conditions and FDP.
Kuda Tasi and Jahal Development Field Metocean Study Report Dec 2025	• Supplies near-field metocean conditions highly representative of KTJ.	TPhysical Component – Oceanography discusses water quality and temperature. Seawater temperature in the region ranges from 25ºC to 31ºC at the surface and ~10ºC at the seafloor in ~ 400m of water in the KTJ Development Area.

		As Pacific waters transit through the Indonesian Seas, they undergo strong modification due to intense air–sea interactions, monsoon-driven upwelling, and powerful tidal mixing, producing distinct temperature and salinity layers within the ITF.
Purba, N. P., Faid, G. M., Zheng, W., Rui, L., Akhir, M. F., Yu, W., Mulya, R. A., Syamsudin, F., Faizal, I., Pasaribu, B., Agustiadi, T., Priyono, B., Fadli, M., Santoso, P. D., Pandoe, W. W., Wang, H., Li, S., Wei, Z., Susanto, R. D., Nugroho, D., & Purwandana, A. (2025). Two centuries of oceanographic data in the Indonesian Seas and surroundings: Historical patterns of data availability, gaps, and future challenges. Earth System Science Data, Published 16 December 2025.	• Summarises long-term oceanographic patterns (currents, temperature, circulation) relevant to KTJ's regional setting. • Helps identify data gaps and expected conditions before KTJ-specific measurements.	Weather conditions and FDP. Physical Component – Oceanography
Fugro 2017 Kanase Geotech report	• Provides regional seabed and geotechnical characteristics applicable to nearby Timor Sea fields. • Useful as interim sediment/soil context until KTJ geotech EBS is completed.	Physical Environment Based on the sidescan sonar and seabed sampling data, the seabed throughout the site comprises a seabed veneer of carbonate sand over sandy carbonate clay.
Heyward, A.J., Pincerato, E.J. and Smith, L. (eds.) (1997) Big Bank Shoals of the Timor Sea: An Environmental Resource Atlas. BHP Petroleum, Melbourne, Victoria.	• Describes benthic habitats, shoals and biological communities in the broader Timor Sea.	Carbonate terraces, banks and shoals beyond the Development Area, supporting barrel sponges (*Xestospongia testudinaria*), fan sponges (*Ianthella* spp.), sea fans (*Mopsella* spp.), and sea whips (*Junceella fragilis*).
Coudurier-Curveur A, Satish S and Deighton I (2021). Timor Collision Front Segmentation Reveals Potential for Great Earthquakes in the Western Outer Banda Arc, Eastern Indonesia. Front. Earth Sci. 9:640928	• Provides geological and tectonic setting relevant to seabed stability near KTJ. • Supports interim geohazard understanding until KTJ-specific geophysical data are collected.	FDP seabed stability.
Chuditch Environmental Impact Statement (EIS)	• Contains recent, field-specific environmental data from a project geographically close to KTJ. • Acts as a high-relevance analogue for fauna, habitats, and physical conditions.	Data taken from within the EIS: Water quality summary statistics calculated from physiochemical water column profiles are presented in Table 9 whilst water column profiles are displayed in Figure 11 within the EIS. In summary: • pH results ranged from between 8.21 and 8.26 • Salinity results ranged between 34.05 and 34.19

		• Temperature values ranged between 28.77 and 30.29 • Conductivity results ranged between 51990.00 and 52147.10 • Turbidity values ranged between 0.06 and 0.26. EIS document further details water quality and sediment data
Przeslawski, R., Nichol, S., Alvarez, B., Carroll, A., Glasby, C., Picard, K. and Ben, R., (2020). Carbonate banks and terraces of the Oceanic Shoals Marine Park region, Northern Australia. In Seafloor Geomorphology as Benthic Habitat (pp. 545-559). Elsevier.	• Describes benthic geomorphology and habitat patterns typical of the wider Timor Sea, providing a strong regional analogue for KTJ. • The ecological and geomorphic features documented are consistent with those expected at KTJ, to be confirmed through EBS.	TEcological components (benthic habitat and communities Unconsolidated sediments dominated by carbonate sands and soft muds, supporting diverse invertebrates, predominantly polychaete worms and crustaceans, with patchy distributions across small to large scales.
Glover, A. G., Smith, C. R., Paterson, G. L. J., Wilson, G. D. F., Hawkins, L., & Sheader, M. (2010). Temporal change in deep sea benthic ecosystems: A review of the evidence from recent time series studies.	• Characterises natural variability and structure of deep-sea benthic communities, relevant to KTJ's depth range. • Provides baseline expectations for benthic condition that KTJ EBS is likely to align with.	Ecological components (benthic habitat and communities) discusses infauna expected to be present in the KTJ Development Area.
Larkin, K. E., Gooday, A. J., & Bett, B. J. (2009). Benthic biology time series in the deep sea: Indicators of change. Deep Sea Research Part II: Topical Studies in Oceanography, 56(19–20), 1732–1743.	• Establishes regional patterns of benthic community change applicable to Timor Sea deep-water settings. • Offers predictive context for KTJ benthic conditions, which EBS will refine.	TEcological components (benthic habitat and communities) discusses infauna expected to be present in the KTJ Development Area.
Galvez, D. S., Papenmeier, S., Sander, L., Hass, H. C., Fofonova, V., Bartholomä, A., & Wiltshire, K. H. (2018). Ensemble mapping and change analysis of the seafloor sediment distribution in the Sylt Outer Reef, German North Sea (2016–2018).	• Demonstrates sediment distribution processes relevant to interpreting Timor Sea seabed patterns. • Supports expectations of sediment heterogeneity similar to what KTJ EBS will characterize.	Deep-sea benthic communities tend to remain stable over time, with only minimal change detected even across decade scales.
Przeslawski, R., J. Daniel, T. Anderson, J. V. Barrie, A. Heap, A. Hughes, J. Li, A. Potter, L. C. Radke, J. Siwabessy, M. Tran, T. Whiteway, and S. Nichol. (2011). Seabed Habitats and Hazards of the Joseph Bonaparte Gulf and Timor Sea, Northern Australia. Geoscience Australia, Canberra.	• Provides directly relevant seabed habitat and geohazard mapping for the broader Timor Sea region. • The mapped geomorphic and habitat features are representative of conditions anticipated at KTJ.	Ecological Components of TOR discusses benthic habitats in the Timor Sea are characterized by raised geomorphic features, including shoals, banks and terraces, which promote biodiversity through enhanced light penetration in shallower areas and nutrient enrichment from ocean currents.
MuTek. (2024). Final Report - Drilling Cuttings and Mud Dispersion Modelling at the Chuditch-2 Well in the Timor	• Offers near-field dispersion behaviour from a location highly comparable to KTJ.	Physical component – air, discusses air quality in the KTJ Development Area.

Sea – Timor-Leste. Report for SundaGas Banda Unipressoal Lda.	• The modelling outputs reflect environmental conditions expected at KTJ, with EBS confirming site specifics.	
URS Australia Pty Ltd. 2001. Assessment of Shipping Traffic about Bayu-Undan, Timor Sea. Unpublished report prepared for Phillips Petroleum 91-12 Pty Ltd, Perth, Western Australia.	• Describes regional vessel-traffic patterns that also influence the KTJ operating environment. • Marine-use patterns are consistent across nearby fields, and KTJ is expected to show similar trends.	Shipping traffic for EIA assessment for EIS.
TDCA. 2004. Final Report of Thailand and Timor-Leste Joint Survey on Fishery Research and Oceanographic Observations in the Exclusive Economic Zone of Timor-Leste.	• Provides regional fish and oceanographic data relevant to waters surrounding KTJ. • Species and oceanographic patterns documented are typical of the KTJ region and expected to be reflected in EBS.	TEcological components (Fish, sharks, and rays) of the TOR discusses fish species present in the KTJ Development Area.
Australian Fisheries Management Authority (AFMA). 2011. Annual Status Report 2010-11. Australian Fisheries Management Authority, Canberra. 213 pp.	• Summarises regional stock status for species occurring across the Timor Sea. • The fisheries assemblages described are consistent with those expected in KTJ waters.	Socio-economic
Last, PR & Stevens, JD (1994). Sharks and rays of Australia. CSIRO, Canberra, Australia.	• Provides distribution and ecology of elasmobranchs known from the Timor Sea region. • Species ranges and habitat associations are aligned with those anticipated at KTJ, pending EBS confirmation.	Ecological components (Fish, sharks, and rays) discusses shark and ray species present in the KTJ Development Area.
SundaGas Banda (2025). Environmental Impact Statement (EIS) Drilling Activities PSC TL-SO-19-16	• Provides recent, field-specific environmental data from a location directly adjacent to KTJ. • Describes fauna, habitats, and physical conditions highly consistent with those expected at KTJ.	Water quality (analogy for EIS) The Water Quality Profiling studies indicated minimal spatial variability in water quality across the area, temperature, salinity, turbidity, and pH remained stable from surface to seafloor, there was a slight thermocline detected at 22–25m depth. The Dissolved oxygen (DO) levels were high (~95%) but decreased slightly below 25m, indicating a stratified water column and showed Low turbidity levels which indicate minimal sediment resuspension and particulate matter. Sediment (analogy for EIS) Particle Size Distribution (PSD) were clay (<4 µm), Silt (4-62µm), Sand (62-250µm), Medium Sand (250-500µm), and Coarse sand (500-2000µm). Sediment PSD was

		generally uniform across sampling locations, where coarse grained sand (500µm – 2000µm) was typically the most dominant fraction, followed by silt (4µm – 62µm). Medium grained sand generally comprised the lowest fraction of grains across all sample sites, and while no sites appeared to be significantly different in their PSD composition.
SundaGas Banda PSC TL-SO-19-16 EMP Drilling Activities	• Outlines environmental sensitivities and operational controls relevant to the same regional setting as KTJ. • Reflects regional ecological and physical patterns applicable to KTJ's operating environment.	Sediment (analogy for EIS) Sediment supply in the Joseph Bonaparte Gulf is primarily controlled by fluvial input, supplemented by biogenic carbonate sedimentation and carbonate bank erosion. Nearshore, Holocene siliciclastic deposition is particularly evident in the south, where the Ord, Keep, Victoria and other rivers discharge into a shallow broad embayment and tidal currents transport sediment into deeper water (Lees et al., 1992; Przeslawski et al., 2011). The nearshore environment is dominated by muddy sediment in the southwest and west. In contrast, sandy sediments dominate the surface of the central and eastern basin and bedforms provide evidence for recent large-scale sediment movement in the area.
Environment Australia. 2002. Ningaloo Marine Park (Commonwealth Waters) Management Plan. Department of Environment and Heritage, Canberra.	• Describes tropical reef and pelagic ecosystem processes relevant to broader NW marine systems. • Provides regional ecological principles applicable to Timor Sea biodiversity patterns.	Ecological Components discusses marine fauna (fish, sharks, and rays).
IOSEA Marine Turtle. 2019. https://www.cms.int/iosea-turtles/sites/default/files/document/cms_iosea_mos8_doc.7.3_draft-assessment-hawksbill-turtle_e.pdf.	• Summarises distribution, migration and conservation status of hawksbill turtles occurring across the Timor Sea region. • Provides species-level context consistent with turtle presence expected near KTJ.	Ecological Components marine fauna (turtles).
Heyward, A. J. and Smith, I. D. (1996). Analysis of Timor Sea Macrobenthos from ROV Video – Bayu Undan. Produced at the request of BHP Petroleum Pty. Ltd. By the Australian Institute of Marine Science, Dampier, Western	• Presents benthic community structure from a field very close to KTJ. • Offers directly comparable benthic assemblage patterns expected across the KTJ seabed.	Ecological Components discusses marine fauna.

Australia: in Leprovost Dames and Moore (1997), Appendix C.		
Nichol, S., F. J. F. Howard, J. Kool, M. Stowar, P. Bouchet, L. C. Radke, J. Siwabessy, R. Przeslawski, K. Picard, B. Alvarez, J. Colquhoun, T. Letessier, and A. Heyward. (2013). Oceanic Shoals Commonwealth Marine Reserve (Timor Sea) Biodiversity Survey: GA0339/SOL5650 - Post-Survey Report. Geoscience Australia, Canberra.	• Provides comprehensive benthic, fish and habitat data from a Timor Sea marine reserve within the same ecological province as KTJ.	Ecological Components discusses how benthic habitats in the Timor Sea are characterized by raised geomorphic features, including shoals, banks and terraces, which promote biodiversity through enhanced light penetration in shallower areas and nutrient enrichment from ocean currents
Brewer, D.T., Lyne, V., Skewes, T.D. and Rothlisberg, P. (2007). Trophic systems of the North West Marine Region. Report to the Australian Government Department of the Environment and Water Resources, CSIRO, Cleveland.	• Describes food-web structure and species interactions typical of NW Australia and the Timor Sea.	General information for EIS development.
Rosser, N. L., & Gilmour, J. P. (2008). New insights into patterns of coral spawning on Western Australian reefs. Coral Reefs, 27(2), 345–349. https://doi.org/10.1007/s00338 007 0335 6	• Provides regional coral reproductive timing relevant to broader NW marine systems influencing the Timor Sea.	General information for EIS development.
Simpson, C. J., Cary, J. L., & Masini, R. J. (1993). Destruction of corals and other reef animals by coral spawn slicks on Ningaloo Reef, Western Australia. Coral Reefs, 12(3–4), 185–191. https://doi.org/10.1007/BF00334478	• Describes coral spawning processes and episodic events relevant to tropical reef systems across NW Australia.	General information for EIS development.
Indonesian Seas Large Marine Ecosystem (ISLME) Transboundary Diagnostic Analysis (TDA), 2025	• Describes regional oceanographic, ecological and fisheries dynamics that characterise the broader Timor Sea system KTJ sits within. • Provides established regional patterns that form a reliable basis for KTJ environmental expectations, with EBS adding site-scale detail.	General information for EIS development.
Hutumo M and Moosa MK (2005) Indonesian marine and coastal biodiversity: present status. Indian Journal of Marine Sciences. 34: 88-97	• Summarises species richness and biodiversity structure across Indonesian and Timor Sea waters. • Reflects regional assemblages and distributions consistent with those anticipated at KTJ.	Ecological Components discusses marine fauna.
Boggs, G., K. Edyvane, N. de Carvalho, S. Penny, J. Rouwenhorst, P. Brocklehurst, I. Cowie, C. Barreto, A. Amaral, N. Smit, J. Monteiro, P. Pinto, R. Mau, J. Amaral, and L. Fernandes. 2009. Marine and Coastal Habitat Mapping in Timor-Leste (North Coast) – Final Report. Project 1 of the Timor-Leste Coastal-Marine Habitat	• Provides habitat and ecosystem mapping directly adjacent to KTJ's offshore area.	Ecological Components The Timor Sea's benthic habitats contain extensive coral reef, seagrass, mangrove and soft-sediment habitats.

Mapping, Tourism and Fisheries Development Project. Ministry of Agriculture and Fisheries, Government of Timor-Leste.		
Wilson, J., Darmawan, A., Subijanto. J., Green, A., and S. Sheppard. 2011. Scientific design of a resilient network of marine protected areas. Lesser Sunda Ecoregion, Coral Triangle. The Nature Conservancy - Asia Pacific Marine Program. Bali.	• Identifies ecological connectivity and species distributions across the Timor Sea and Lesser Sunda region. • Establishes regional biodiversity linkages relevant to KTJ's ecological context.	General information for EIS development.
CSIRO (1999). Survey and Stock Size Estimates of the Shallow Reef (0-15 m deep) and Shoal Area (15-50 m deep) Marine Resources and Habitat Mapping within the Timor Sea M0U74 Box Volume 3: Seabirds and Shorebirds ofAshmore Reef. Canberra, Australia.	• Documents seabird and migratory species use of the Timor Sea region. • Provides regional species presence patterns that are consistent with expected KTJ avifauna.	Ecological Components discusses fauna.
Edyvane, K., de Carvalho, N., Penny, S., Fernandes, A., de Cunha, C.B., Amaral, A.L., Mendes, M., Pinto, P. 2009. Conservation Values, Issues and Planning in the Nino Konis Santana Marine Park, Timor-Leste – Final Report. Ministry of Agriculture and Fisheries, Government of Timor-Leste.	• Describes coastal and marine biodiversity in Timor-Leste waters adjacent to KTJ. • Reflects regional ecological values and species groups relevant to KTJ's broader setting.	Ecological Components discusses marine fauna. Timor-Leste is identified as providing a suitable habitat for whale sharks, with over a third of all known whale sharks recorded in the area. Coral reefs are a defining feature of Nino Konis Santana Marine Park in the northeast, where they constitute over half of inshore habitats.
Alonso, E., Wilson, C., Rodrigues, P., Pereira, M. and Griffiths, D. 2012. Policy and Practice. Recommendations for Sustainable Fisheries Development in Timor-Leste. Regional Fisheries Livelihoods Programme for South and Southeast Asia Policy Paper TIM#2, Bangkok.	• Provides regional fisheries species, effort and management context for waters surrounding KTJ. • Represents established fisheries patterns expected across the KTJ region.	General information for EIS development.

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