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PSC TL-SO 22-23 MARINE SEISMIC SURVEY ENVIRONMENTAL MANAGEMENT PLAN

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ACRONYMS AND DEFINITIONS USED IN THIS DOCUMENT

Acronym/Term	Definition
°C	degrees Celsius
μg^{-1}	micrograms per unit
µg/L	micrograms per litre
μgL^{-1}	micrograms per litre
µPa	micropascals
µPa	micropascals
AIS	Automated Identification System
ALARP	as low as reasonably practicable
ANP	Autoridade Naçional do Petróleo; National Petroleum Authority
BP	boiling point
BTEX	benzene, ethylbenzene, toluene and xylene
CH_4	methane
CM	control measure
CO_2	carbon dioxide
COLREGS	Convention on the International Regulations for Preventing Collisions at Sea, 1972
CSIRO	Commonwealth Scientific and Industrial Research Organisation
dB	decibels
DNIC	National Directorate for Communication Infrastructure
EMP	Environmental Management Plan
Eni	Eni Timor 22-23 B.V.
ENVID	Environmental Impact Identification
EP	Environmental Plan
ESD	ecologically sustainable development
et al.	and others
FAO	Food and Agriculture Organization
FLO	Fisheries Liaison Officer
FTU	Formazin turbidity units
g/m^2	grams per square metre
GHG	greenhouse gas
ha	hectares
hr	hour(s)
HSE	health, safety and environment
HSE IMS	Health, Safety and Environment Integrated Management System
Hz	hertz
IMO	International Maritime Organization
IMS	invasive marine species
IMT	Incident Management Team
in^3	cubic inches
IOGP	International Association of Oil & Gas Producers
IPIECA	International Petroleum Industry Environmental Conservation Association
ISO	International Standards Organization

Acronym/Term	Definition
ITOPF	International Tanker Owners Pollution Federation Limited
IUCN	International Union for the Conservation of Nature
JNCC	Joint Nature Conservation Committee
JPDA	Joint Petroleum Development Area
kHz	kilohertz
km	kilometres
L	litres
L_E	accumulated sound exposure levels
L_{pk}	peak pressure levels
m	metres
m/s	metres per second
MARPOL 73/78	International Convention for the Prevention of Pollution from Ships 1973, as modified by the Protocol of 1978
MDO	marine diesel oil
mg/L	milligrams per litre
mg/m^3	milligrams per cubic metre
mgl^{-1}	milligrams per litre
mgm^{-3}	milligrams per cubic metre
ms	millisecond
mm	millimetres
MMO	marine mammal observer
N_2O	nitrous oxide
nC	concentration of total petroleum hydrocarbons
NC	no contact
NM	nautical miles
NMFS	United States National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
occ/y	occurrences per year
PAM	passive acoustic monitoring
PK	peak pressure
PMS	planned maintenance system
ppb	parts per billion
ppm	parts per million
ppt	parts per trillion
PSC	Production Sharing Contract
PSU	practical salinity units
PTS	permanent threshold shift
R_{max}	maximum horizontal distance
rms	root mean square
SDS	Safety Data Sheet
SEIS	Simplified Environmental Impact Statement
SEL	sound exposure level
SEL_{24}	sound exposure level over 24 hours (cumulative)

Acronym/Term	Definition
SEL_{cum}	cumulative sound exposure levels
SOLAS	International Convention for the Safety of Life at Sea
SOPEP	Shipboard Oil Pollution Emergency Plan
SPL	sound pressure level
SundaGas	SundaGas Banda Unipessoal
t	tonnes
t CO_2-e	tonnes of carbon dioxide equivalent
the Treaty	Treaty Between Australia and the Democratic Republic of Timor-Leste Establishing their Maritime Boundaries in the Timor Sea
PSC TL-SO 22-23	permit area
TTS	temporary threshold shift
UNCLOS	United Nations Convention on the Law of the Sea

EXECUTIVE SUMMARY

This Environmental Management Plan (EMP) has been prepared for submission to and acceptance by Timor-Leste Autoridade Naçional do Petróleo (ANP).

The purpose of this EMP is to outline the environmental safeguards and mitigation measures that will be implemented throughout the proposed survey activity to protect the marine environment and ensure compliance with relevant regulatory requirements.

Proponent Details

Eni Timor 22-23 B.V. ('Eni') is the operator (87.5% equity) of Production Sharing Contract (PSC) TL-SO 22-23 ('TL 22-23') with TIMOR GAP E.P. as Joint Venture partner (12.5% equity, carried) located in Timor-Leste offshore waters. In December 2023, Eni signed a PSC with ANP for PSC TL 22-23, which became effective on 22 April 2024. There is a work program commitment to acquire seismic data in the first exploration term.

Activity Overview

Eni proposes to acquire seismic data within the PSC TL 22-23 survey area ('survey area') over a period of up to ten weeks, using towed streamer operations commencing between July and September 2025. There is also a contingent option for acquiring an extra ~35km² of 3D seismic data over the Sikatan-1/ST1 well location, in addition to the firm 2D seismic line.

Project Location, Scale and Duration

Project Location

The survey area is in the Timor Sea, south of the Sunrise-Troubadour Gas Field in Timor-Leste waters (Figure 1-1). The survey area is approximately 175km from the southeast coast of Timor-Leste, 300km southeast of Dili and 370km northwest of Darwin, Australia.

Project Scale

The proposed seismic survey covers an area of approximately 1,500km² (50km by 30km) and is located on the Sahul Shelf in water depths ranging from 40m to 180m. Herein this area is referred to as the 'survey area'.

Project Duration

Dependent on vessel availability, the seismic survey is anticipated to commence between July and September 2025. The survey is expected to take up to ten weeks to complete, including mobilisation, scouting, data acquisition, streamer deployment and recovery. Seismic data acquisition will occur with 24-hour operations, although temporary shutdown periods may be required in the event of poor weather or other adverse conditions.

Overview of Survey Activity

In towed streamer operations, seismic surveys are conducted by large, specialised vessels, which tow an array of receivers (streamers) and pneumatic sources below the water surface and generate sound waves using pulses of compressed air, to take images of geological features in the subsurface for the purpose of hydrocarbon exploration.

The sound waves, reflected from horizons at and below the seafloor, are detected and recorded by an array of receivers (hydrophones, attached to streamers), towed by the same vessel to gain images of subsurface geological features. These operations are usually escorted by support and chase vessels to protect the tow vessel and towed equipment from other vessel traffic, and to protect other users of the sea from entanglement or other damage from collisions with towed seismic source.

The seismic survey, hereafter referred to as 'survey activity', will comprise a seismic vessel towing 10 to 12 streamers up to 8km long, with 75 to 112m spacings between streamers. Streamers will be towed at a depth of approximately 20m. Each streamer will have a tail buoy attached to ensure the streamer remains straight and afloat. The tail buoy will also provide a visual reference for survey activity crew and global positioning system.

Triple source airguns will be used, towed at a depth of around 8m, with a volume up to 3,500in³. The airguns will fire at a maximum interval of 37.5m with an eight-second recording length. The final streamer configuration, sound source array and shooting configuration will be finalised after award of the tender. Sixty kilometres of 2D seismic data will also be acquired to tie the Sikatan-1/ST1 well, located in TL 19-16, into the new 3D seismic dataset. There is also a contingent option for acquiring an extra ~35km² of 3D seismic data over the Sikatan-1/ST1 well location, in addition to the firm 2D seismic line. The activity may also include acquisition of gravity and magnetic data.

The seismic vessel will traverse the survey area along pre-determined 'sail lines'. Sail lines will be surveyed once, unless interruptions to the survey activity occur. If data acquisition is disrupted along a sail line, infill data acquisition may be required. During recording, the support vessel and a chase vessel will scout ahead of the main vessel to ensure the sail lines ahead of the seismic vessel are clear of obstacles and other users of the survey area, such as fishers. After each sail line is completed, the seismic vessel will be required to complete a line turn. All vessel manoeuvring and line turns will be completed within Timor-Leste waters, with no entries into Australian waters.

The survey activity will be performed using the seismic vessel with one support vessel and three chase vessels. Crew changes, if required, will be undertaken either via the support vessel or potentially via helicopter. The seismic vessel and support vessels may be refuelled (bunkered) at sea if required. All vessels will use marine diesel oil (MDO) with a sulphur content not exceeding 0.5%, in accordance with International Convention for the Prevention of Pollution from Ships 1973, as modified by the Protocol of 1978 (MARPOL 73/78) Annex VI.

Linear and Transport Components

There are no linear or transport components within the survey area. The nearest linear infrastructure is the Timor-Leste South Submarine Cable, a fibre optic cable located approximately 55km west of the survey area. The nearest offshore oil and gas pipelines include the Bayu-Undan to Darwin pipeline (approximately 160km south) and the Barossa export pipeline (approximately 205km east), significant distances from the survey area.

Marine National Parks, Marine Protected Areas and Other Environmentally Sensitive Areas

There are no marine National Parks or marine protected areas within the survey area. The closest marine protected area in Timor-Leste waters is the Nino Konis Santana National Park, located approximately 167km northwest of the survey area on the eastern tip of Timor-Leste. Two designated marine protected areas are located on the northern coast of Timor-Leste, including the Batugadé Marine Natural Reserve (342km

to the northwest) and the Suco de Vila Marine Natural Reserve (315km to the northwest). Two proposed marine protected areas are located on the north coast of Timor-Leste, including the Lamsanak and Behau marine protected areas, located 252km and 270km to the northwest respectively. The nearest protected area in Australian waters is the Oceanic Shoals Australian Marine Park, located approximately 19km southeast of the survey area.

There are no Ramsar wetlands or World Heritage properties within 300km of the survey area. The nearest marine key biodiversity area is Perairan Nino Konis Santana (Timor-Leste), 167km north of the survey area.

Fisheries and Fishing Areas

Local (Indonesian and Timorese) fishers traditionally fish in the Timor Sea. Fishing occurs from April to December, with most activity in September and October. Fishing is typically concentrated in the vicinity of Hibernia Reef, about 520km southwest of the survey area in Australian waters. The nearest reef at which local fishing may occur is Pulau Meatimiarang (Indonesia), located 180km north of the survey area.

Fishing vessel activity from 2020 (Office for Coastal Management, 2024) indicates fishing vessels may occur within the survey area. However substantial activity is not expected, given the offshore location of the survey area and lack of suitable fishing grounds.

Illegal fishing activities have been reported in the Timor-Leste waters. These activities may involve using destructive methods such as fish aggregating devices, explosives or poisons, which pose significant threats to marine ecosystems. Given the offshore location and lack of suitable fishing grounds, substantial activity is not expected in the survey area.

Shipping Lines

Shipping traffic in proximity to the survey area is anticipated to be infrequent. The main shipping routes relevant to the survey area are predominantly northwest to southeast routes, linking Darwin and Wyndham in Australia with ports in Southeast Asia. The routes accommodate various vessels, including vessels supporting offshore oil and gas operations situated to the west and east of the survey area.

Other Users of the Sea

Approximately 4km of 2D seismic data acquisition, along with vessel manoeuvring and line turns, will occur in the northern part of SundaGas Banda Unipessoal ('SundaGas') operated PSC TL-SO 19-16 ('TL 19-16'). There is also a contingent option for acquiring an extra ~35km² 3D seismic data over the Sikatan-1/ST1 well location, in addition to the firm 2D seismic line. Eni will obtain the necessary approvals to enter and carry out manoeuvring and acquisition operations within TL 19-16. Eni is in direct contact with SundaGas with regards to 2025 operational activity for both companies and will maintain a dialogue to ensure there are no adverse impacts to operations in the survey area.

Environmental Impacts

Physical and Biological Components

There are numerous environmental sensitivities within the survey area and within the greater region that have been assessed and considered during planning of the proposed survey activity. These are summarised below:

- Benthic habitats: Key benthic habitats within the survey area include mostly flat and featureless shelf rise habitat and small areas of likely rocky reef. Key benthic habitats that do not occur within the survey area but are present in the greater region include:
  - shoals and banks, the closest being Troubadour Shoals, approximately 22km to the northeast
  - emergent coral reefs, the closest being Pulau Meatimiarang (Indonesia), approximately 180km to the north
  - shelf flats, with the nearest seamounts located approximately 260km to the north.
- Marine mammals: Whales, such as sperm and sei whales, have been recorded in the greater region but are unlikely to be found within the survey area. The pygmy blue whale is known to occur in Timor-Leste waters, with a migratory corridor along the Timor Trough, so it is possible the pygmy whale will occur within the survey area. Dolphin species considered likely to be found in the survey area include the pygmy killer whale, the common bottlenose dolphin, and the common dolphin.
- Sharks and rays: Possible shark species that may be encountered in the survey area include whale sharks and oceanic whitetips. It is also possible that the oceanic manta ray may be present. Crocodiles are considered unlikely, given the distance offshore.
- Marine reptiles: There are six marine turtle species that may be found in the survey area, including green, hawksbill, leatherback, flatback, olive ridley and loggerhead turtles. Given the distance offshore and lack of shoals, banks and emergent coral reefs, turtle numbers are expected to be low.

Cross-border Impacts

Cross-border impacts from underwater noise may occur during the survey activity. Underwater noise may travel across the Timor-Leste/Australian border, as confirmed by the underwater noise modelling (JASCO, 2024). Cross-border impacts and receptors are expected to be the same as those in Timor-Leste. No impacts to habitats in Australian waters are anticipated. Potential impacts are expected to be limited to behavioural responses from marine fauna (see Section 6.2 for more information).

Global Impacts, Including Climate Change Impacts

The combustion of fossil fuels to power the seismic and support vessels undertaking the survey activity is expected to result in atmospheric emissions. Given the very low levels of atmospheric emissions expected and the distance of the survey area offshore, air quality impacts to local communities, habitats and protected areas are not expected.

Greenhouse gas emissions will be similar to other vessels operating in the region for both petroleum and non-petroleum activities. Based on the duration of the survey activity and the vessel requirements, it is expected approximately 16,000 tonnes of (carbon dioxide equivalent) greenhouse gas will be emitted. These emissions are not

expected to contribute significantly to greenhouse gas contributions. Climate change impacts are not anticipated to result from the survey activity.

Socio-economic Impacts

No significant impacts to current users of the sea are expected. Potential impacts to local fishers may occur; however, these are expected to be low. No adverse economic impacts are expected. The survey activity is expected to provide positive economic benefits to Timor-Leste through employment opportunities, and potentially provide a future opportunity for oil and gas development. Adverse impacts to the local population and their quality of life are not expected, given the distance of the survey area from populations and communities.

Minor seismic data acquisition, along with manoeuvring and line turns, will be carried out in the northern part of TL 19-16. SundaGas, the operator of TL 19-16, is planning to drill the Chuditch-2 appraisal well during the third quarter of 2025. Drilling operations may therefore take place within TL 19-16 at the same time as the survey activity. However, as the Chuditch-2 appraisal well is located 20km south of the manoeuvring area for the survey area, there will be no spatial overlap of activities. Eni and SundaGas will stay in close communication before and during their planned operations. There are no operational activities planned in the Greater Sunrise blocks in 2025, which are located directly north of the survey area. No adverse impacts to existing hydrocarbon exploration and operations as a result of the survey activity are therefore expected.

The survey area is in offshore waters that are not accessed for tourism activities, so no adverse impacts to tourism are expected.

Risk Assessment Process

Eni has implemented its Health, Safety and Environment (HSE) Risk Management and Hazard Identification Procedure (ENI-HSE-PR-001) for identifying and assessing risks. The purpose of the procedure is to ensure the HSE, asset and reputational hazards are identified, risk-assessed and managed in a systematic and consistent way. In this way, risks associated with Eni projects and operational changes are effectively managed and addressed in compliance with company and legislative requirements.

With robust controls in place, all risks associated with planned impacts from the survey activity have been assessed as Low, except the risk of underwater noise from the seismic source, which has been assessed as Medium. Noise has been modelled (refer to Section 6.2) to ensure a robust impact assessment is presented, and control measures have been applied to reduce the impacts from the seismic source to as low as reasonably practicable. All risks associated with unplanned events have been assessed as Low and therefore acceptable when the control measures are implemented.

The planned and unplanned risks associated with the survey activity include:

Planned activities:

- Interaction with Other Marine Users
- Underwater Noise – Seismic Source
- Noise Emissions – Vessels and Mechanical Equipment
- Atmospheric Emissions
- Light Emissions
- Planned Vessel Discharges.

Unplanned events:

- Vessel Collision or Entanglement with Marine Fauna
- Loss of Equipment and Dropped Objects
- Non-Hazardous and Hazardous Waste Loss to Marine Environment
- Minor Hydrocarbon or Chemical Leaks
- Introduction of Invasive Marine Species
- Marine Diesel Oil Spills to Sea.

The potential environmental impacts and risks associated with the survey activity are summarised in Table 0-1. Controls to manage the impacts and risks are presented within Table 0-1 and in Sections 6 and 7. Control implementation is expanded on in the in Section 8.

Classification of the Proposed Project

Eni submitted the PSC TL-SO 22-23 Marine Seismic Survey Project Document to ANP on 10 January 2025. In accordance with Decree Law No. 39/2022, ANP assessed the survey activity as a Category B (Ref: ANP/HSE/S25/011), on the basis that the survey activity in PSC TL-SO 22-23 meets the criteria to be considered 'oil and gas exploration' and Eni is required to apply for an environmental licence in accordance with Decree Law No. 39/2022, including preparing and having this Simplified Environmental Impact Statement (SEIS) and accompanying EMP assessed.

Table 0-1: Impact assessment summary

Risk ID	Activities/ Products/ Services	Description of Hazardous Event and Potential Impact	Inherent Risk			Risk Reduction Measures	Residual Risk		
			Frequency	Severity	Risk		Frequency	Severity	Risk
PLANNED									
P1	Interaction with Other Marine Users	The presence of vessels (the seismic vessel and support vessels) and seismic survey equipment (streamers, buoys).	E	1	L	• Navigation lighting and aids in accordance with the International Regulations for Preventing Collisions at Sea (COLREGS) and Chapter V of International Convention for the Safety of Life at Sea (SOLAS). • Support/chase vessels used to deter non-survey activity vessels from the survey area, as well as identify debris and fish aggregating devices. • Support/chase vessels will be able to identify, tow and recover fishing equipment and debris. • Fisheries Liaison Officers onboard vessels • Streamers marked with tail buoys. • Stakeholder engagement	B	1	L
P2	Noise Emissions – Seismic Source	Noise emissions generated by operation of the seismic source during the survey activity. Potential impacts: • Change in ambient noise. • Behavioural impact to or displacement of marine fauna (masking, avoidance). • Injury/mortality to marine fauna (temporary threshold	E	3	H	• Vessels will adhere to the Joint Nature Conservation Committee (JNCC) Guidelines for Minimising the Risk of Injury to Marine Mammals from Geophysical Surveys (2017). • Vessels will adhere to Eni Minimum HSE Requirements in Geophysical Operations, including requirements for offshore seismic surveys. • Use of sufficient marine mammal observers (MMO) and passive acoustic monitoring (PAM) operatives on vessels. • Marine megafauna interaction requirements included in survey activity inductions.	B	3	M

Risk ID	Activities/ Products/ Services	Description of Hazardous Event and Potential Impact	Inherent Risk			Risk Reduction Measures	Residual Risk		
			Frequency	Severity	Risk		Frequency	Severity	Risk
		shift (TTS)/permanent threshold shift (PTS)).				• No equipment testing outside of the survey area. • Airgun firing (including testing) must not exceed the planned maximum production volumes outlined in the environmental licence application. • Pre-shooting survey searches and soft starts incorporated into the survey activity. • Cetacean sighting and compliance reports to be submitted to ANP (End of Activity Report). • Incorporate JNCC mitigations for night-time and poor visibility conditions, including use of PAM operatives in addition to MMO visual mitigation. • If unplanned break in operations occurs during night-time or poor visibility conditions, mitigation zone is to be monitored using PAM procedures. • If PAM operatives are not available, the survey activity will be delayed until conditions are suitable for visual conditions.			

Risk ID	Activities/ Products/ Services	Description of Hazardous Event and Potential Impact	Inherent Risk			Risk Reduction Measures	Residual Risk		
			Frequency	Severity	Risk		Frequency	Severity	Risk
P3	Noise Emissions – Vessels, Mechanical Equipment and Helicopters	Noise emissions generated by operation of the seismic, support and chase vessels, helicopters, and mechanical equipment during the survey activity. Potential impacts: • Change in ambient noise. • Behavioural impact to marine fauna (masking, avoidance). • Injury/mortality to marine fauna (TTS/PTS).	E	1	L	• Vessels to be maintained in accordance with the applicable preventative maintenance systems (PMS). • Marine megafauna interaction requirements included in survey activity inductions.	B	1	L
P4	Atmospheric Emissions	Atmospheric emissions will be released from the seismic and support vessels as a result of combustion for power generation and transport. Potential impacts: • Impact to local air quality. • Contribution to greenhouse gas emissions.	E	1	L	• International Air Pollution Prevention Certificate – in accordance with MARPOL 73/78 Annex VI. • Fuel type used (marine diesel) – in accordance with MARPOL 73/78 Annex VI. • Equipment (engines, thrusters, generators, etc) is maintained in accordance with the applicable PMS. • Vessel incinerators will be maintained to manufacturer's specification and operated in accordance with MARPOL 73/78 Annex VI. • Ozone depleting substances shall not be deliberately released – in accordance with MARPOL 73/78 Annex VI.	E	1	L

Risk ID	Activities/ Products/ Services	Description of Hazardous Event and Potential Impact	Inherent Risk			Risk Reduction Measures	Residual Risk		
			Frequency	Severity	Risk		Frequency	Severity	Risk
P5	Light Emissions	Lights on the seismic vessel and support vessels will be required on a 24-hour basis for safety and navigational purposes, which could lead to changes in marine fauna behaviour. Potential impacts: • Behavioural impact (e.g. avoidance/attraction/ disorientation) to marine fauna (note the activities are distant from sensitive turtle nesting areas or sensitive features such as protected areas).	E	1	L	• Management of lighting in accordance with the COLREGS and Chapter V of SOLAS.	B	1	L
P6	Planned Vessel Discharges	Sewage, greywater, food waste, deck drainage, bilge water, cooling water and brine will be routinely discharged to the marine environment from the seismic vessel and support vessels. Potential impacts: • Localised decrease in water quality.	E	1	L	• Sewage treatment system in accordance with MARPOL 73/78 Annex IV. • Waste management procedure in accordance with MARPOL 73/78 Annex V. • Oily water treatment system in accordance with MARPOL 73/78 Annex I. • Control oily water discharge in accordance with MARPOL 73/78 Annex I. • Valid International Oil Pollution Prevention Certificate, which confirms that required measures to reduce impacts of planned oil discharges are in place on vessels.	B	1	L

Risk ID	Activities/ Products/ Services	Description of Hazardous Event and Potential Impact	Inherent Risk			Risk Reduction Measures	Residual Risk		
			Frequency	Severity	Risk		Frequency	Severity	Risk
		• Behavioural impact (e.g. avoidance/attraction) to marine fauna.				• Vessels will have and be compliant with a Garbage Management Plan in accordance with MARPOL 73/78 Annex V, as appropriate to vessel class. • Equipment/machinery involved in the treatment of wastes will be routinely maintained. • Chemical selection process in Eni is followed and all chemicals to be used must be submitted for approval to ANP before use. • All crew will participate in the vessel and environmental induction prior to the commencement of the survey activity			
UNPLANNED									
U1	Vessel Collision or Entanglement with Marine Fauna	Potential for vessels to collide with marine fauna, including cetaceans and turtles, and for marine fauna entanglement with towed seismic streamers, buoys and attached equipment. Potential impacts: • Injury/mortality to fauna.	B	2	L	• Vessels will adhere to the JNCC Guidelines for Minimising the Risk of Injury to Marine Mammals from Geophysical Surveys (2017). • Vessels will adhere to Eni Minimum HSE Requirements in Geophysical Operations, including requirements for offshore seismic surveys. • Use of sufficient MMOs and PAM operatives on vessels. • Marine megafauna interaction requirements included in survey activity inductions. • Any vessel strike incident to marine mammals shall be reported to ANP as soon as possible. • Turtle guards on seismic tail-buoys	A	2	L
U2	Loss of Equipment and	Loss of seismic survey equipment or accidental dropped objects, including loss of	B	1	L	• Approved procedures for streamer deployment. • Routine maintenance and inspection of streamer equipment.	A	1	L

Risk ID	Activities/ Products/ Services	Description of Hazardous Event and Potential Impact	Inherent Risk			Risk Reduction Measures	Residual Risk		
			Frequency	Severity	Risk		Frequency	Severity	Risk
	Dropped Objects	streamers and other seismic survey equipment (due to human errors, equipment failures, etc). Potential impacts: • Localised impact to seabed. • Localised impact to benthic fauna. • Localised impact to marine fauna from ingestion/ entanglement.				• Streamers will be fitted with: ○ streamer recovery devices (self-inflating) ○ surface marker buoys ○ secondary retaining devices ○ tail buoys. • Support and chase vessels will search for and recover lost in-water equipment where possible and safe to do so. • Relevant persons will be notified via radio in the event of a loss of in-water equipment. • All wastes will be collected and segregated into clearly marked containers before onshore disposal by a licenced waste management contractor. • All bins on deck will be covered to prevent rubbish blowing overboard. • Records will be maintained of solid and hazardous waste volumes generated and transferred for onshore recycling or disposal. • Waste management procedure will be implemented, including safe handling, treatment, transportation and appropriate segregation and storage of all waste generated. • Lost waste will be recovered when safe and practicable to do so.			

Risk ID	Activities/ Products/ Services	Description of Hazardous Event and Potential Impact	Inherent Risk			Risk Reduction Measures	Residual Risk		
			Frequency	Severity	Risk		Frequency	Severity	Risk
U3	Non-hazardous and Hazardous Waste Loss to Marine Environment	Hazardous (e.g. rags, oil filters, personal protective equipment), and non-hazardous (e.g. plastic, cardboard) solid waste losses (from human errors, equipment failures, improper storage, etc). Potential impacts: • Change in water quality. • Marine fauna ingestion/ entanglement. • Localised impact to benthic fauna.	B	1	L	• Hazardous and non-hazardous waste management process in place in accordance with MARPOL 73/78 Annex V: ○ All wastes will be collected and segregated into clearly marked containers before onshore disposal by a licenced waste management contractor. ○ All bins on deck will be covered to prevent rubbish blowing overboard. ○ Records will be maintained of solid and hazardous waste volumes generated and transferred for onshore recycling or disposal. ○ Waste management procedure will be implemented, including safe handling, treatment, transportation and appropriate segregation and storage of all waste generated. • Lost waste will be recovered when safe and practicable to do so. • All crew will participate in the vessel and environmental induction before the survey activity begins.	A	1	L
U4	Minor Hydrocarbon or Chemical Leaks	Minor quantities of chemicals or hydrocarbons can be accidentally released to the marine environment from human errors (including incorrect management or disposal of hazardous wastes), equipment failures (hydraulic hoses), improper storage or incorrect handling and spills during MDO bunkering.	B	2	L	• Spill response plan in place for vessels. • Spill response kits located close to hydrocarbon storage/bunkering areas and appropriately stocked and replenished as required. • A waste management procedure will be implemented, including safe handling, treatment, transportation and appropriate segregation and storage of all waste generated. • Chemical selection process in Eni is followed and all chemicals to be used must be submitted for approval to ANP before use.	B	1	L

Risk ID	Activities/ Products/ Services	Description of Hazardous Event and Potential Impact	Inherent Risk			Risk Reduction Measures	Residual Risk		
			Frequency	Severity	Risk		Frequency	Severity	Risk
		Potential impacts: • Change in water quality. • Localised behavioural impact to marine fauna (avoidance). • Injury/mortality to marine fauna.				• Hydrocarbon or chemical storage containers will be properly stored with lids that are tight and secured to prevent spillage during vessel movement or rough weather. • Storage containers will be managed in a manner that provides for secondary containment in the event of a spill or leak. • Storage containers will be labelled with the technical product name as per the Safety Data Sheet. • Hazardous substances will be stored, segregated, handled and used in accordance with the product's Safety Data Sheet. • Vessels to be maintained in accordance with the applicable PMS. • Refuelling transfer procedures to prevent bunkering spills.			
U5	Introduction of Invasive Marine Species	Introduction of non-endemic marine species from the vessels used to complete the survey activity, leading to colonisation and displacement of native species. Potential impacts: • Change in ecosystem dynamics. • Change in the functions, interests or activities of other users.	B	3	M	• Seismic, chase and support vessels will comply with Timor-Leste entry requirements and International Maritime Organization's International Convention for the Control and Management of Ships Ballast Water and Sediments 2004-MARPOL 73/78 (as appropriate to vessel class), including: – Ballast water exchanges conducted >50NM from land and in >200m water depth. • International Convention on the control of harmful anti-fouling systems on ships, which requires vessels (applicable to vessels only, of appropriate class) have a valid international anti-fouling systems certificate. • Implementation of invasive marine species risk assessment tool (by Eni Logistics).	A	3	L

Risk ID	Activities/ Products/ Services	Description of Hazardous Event and Potential Impact	Inherent Risk			Risk Reduction Measures	Residual Risk		
			Frequency	Severity	Risk		Frequency	Severity	Risk
U6	Marine Diesel Oil Spills to Sea	Vessel collision causing a large-scale hydrocarbon release with widespread impacts to water quality. Potential impacts: • Change in water quality. • Behavioural impact to marine fauna (avoidance). • Change in the functions, interests or activities of other users (fisheries).	B	3	M	• Navigation equipment and procedures on vessels compliant with COLREGS and Chapter V of SOLAS. • Fuel type used (marine diesel) – in accordance with MARPOL 73/78 Annex VI, which limits the sulphur content of fuels. • Vessel Spill Response Plan in place for vessels. • Oil Spill Contingency Plan in place for survey activity. • Support and chase vessels used to deter non-survey vessels from survey area. • Support and chase vessels will have a communication sheet in Bahasa and Tetum with key survey information, to be provided to fishers encountered during the survey activity. • Support and chase vessels will have Fisheries Liaison Officers onboard who are Bahasa and Tetum speakers. • Refuelling transfer procedures to prevent bunkering spills.	A	3	L

1 INTRODUCTION

1.1 Background

In December 2023, Eni Timor 22-23 B.V. (Eni) signed a Production Sharing Contract (PSC) with the Autoridade Nacional do Petróleo (ANP) for TL-SO 22-23 ('TL 22-23'), which became effective on 22 April 2024. There is a commitment to acquire seismic data in the first three-year exploration period. This seismic data acquisition is a key element of Eni's exploration strategy in Timor-Leste's offshore region, aimed at enhancing geological understanding, identifying hydrocarbon potential, and determining the optimal location for an exploration well within the PSC.

The survey area is situated in the Timor Sea, south of the Sunrise-Troubadour Field, within Timor-Leste waters. The survey area is approximately 175km from Timor-Leste's southeast coast, 300km southeast of Dili, and 370km northwest of Darwin, Australia. The proposed survey activity spans roughly 1,500km² (50km by 30km) on the Sahul Shelf, with water depths ranging from 40m to 180m.

The location of the survey elements (comprising the 3D seismic, shooting, manoeuvring and contingency 3D seismic areas, as well as the 2D seismic line end points) is shown in Figure 1-1 and Figure 1-2, with the coordinates of the four corner points and the nearby Sikatan-1-ST1 well listed in Table 1-1.

The survey activity aims to enhance subsurface imaging using advanced broadband towed streamer technology. The survey activity will significantly improve the resolution and quality of existing seismic datasets, which comprise vintage 2D lines from the 1990s and early 2000s. Approximately 60km of 2D seismic data will be acquired to tie the new 3D seismic dataset to Sikatan-1/ST1. There is a contingent option for acquiring an extra ~35km² 3D seismic data over the Sikatan-1/ST1 well location, in addition to the firm 2D seismic line.

The Sikatan-1/ST1 well is located approximately 75m south of PSC TL-SO 22-23 in SundaGas Banda Unipessoal ('SundaGas') operated PSC TL-SO 19-16 (TL 19-16). The newly acquired seismic data will enable Eni to better evaluate the hydrocarbon potential of the block.

Table 1-1: Location of the survey elements

Point	Longitude	Latitude
3D Seismic Full-fold Area		
1	128° 17' 10.0683" E	10° 13' 58.0220" S
2	128° 22' 38.5976" E	9° 58' 02.6655" S
3	127° 54' 43.7083" E	9° 57' 58.3756" S
4	127° 49' 13.8484" E	10° 13' 53.1484" S
2D Line		
1	127° 47' 46.5042" E	10° 16' 12.4404" S
2	128° 15' 26.2941" E	9° 58' 38.5212" S
Shooting Area		
1	127° 45' 00.1139" E	10° 19' 45.9622" S
2	127° 53' 25.5166" E	9° 55' 23.9371" S
3	128° 23' 31.5320" E	9° 55' 28.5627" S
4	128° 16' 17.0246" E	10° 16' 32.0984" S
5	127° 57' 14.7195" E	10° 16' 28.9732" S
6	127° 56' 05.8325" E	10° 19' 48.3505" S
7	127° 45' 00.1139" E	10° 19' 45.9622" S
Manoeuvring Area		
1	128° 14' 54.6663" E	10° 22' 06.0149" S
2	128° 25' 59.8389" E	9° 49' 54.8730" S
3	127° 52' 01.9203" E	9° 49' 54.7547" S
4	127° 39' 47.2705" E	10° 25' 18.7528" S
5	127° 54' 10.4737" E	10° 25' 22.0367" S
6	127° 55' 19.4065" E	10° 22' 02.6714" S
7	128° 14' 54.6663" E	10° 22' 06.0149" S
Sikatan-1/ST1 Well		
Well	127° 49’ 37.17” E	10° 15’ 02.19” S
Contingent 3D		
1	127° 48' 04.8946" E	10° 17' 12.4855" S
2	127° 49' 13.8484" E	10° 13' 53.1484" S
3	127° 52' 19.3966" E	10° 13' 53.8059" S
4	127° 51' 10.4596" E	10° 17' 13.1573" S

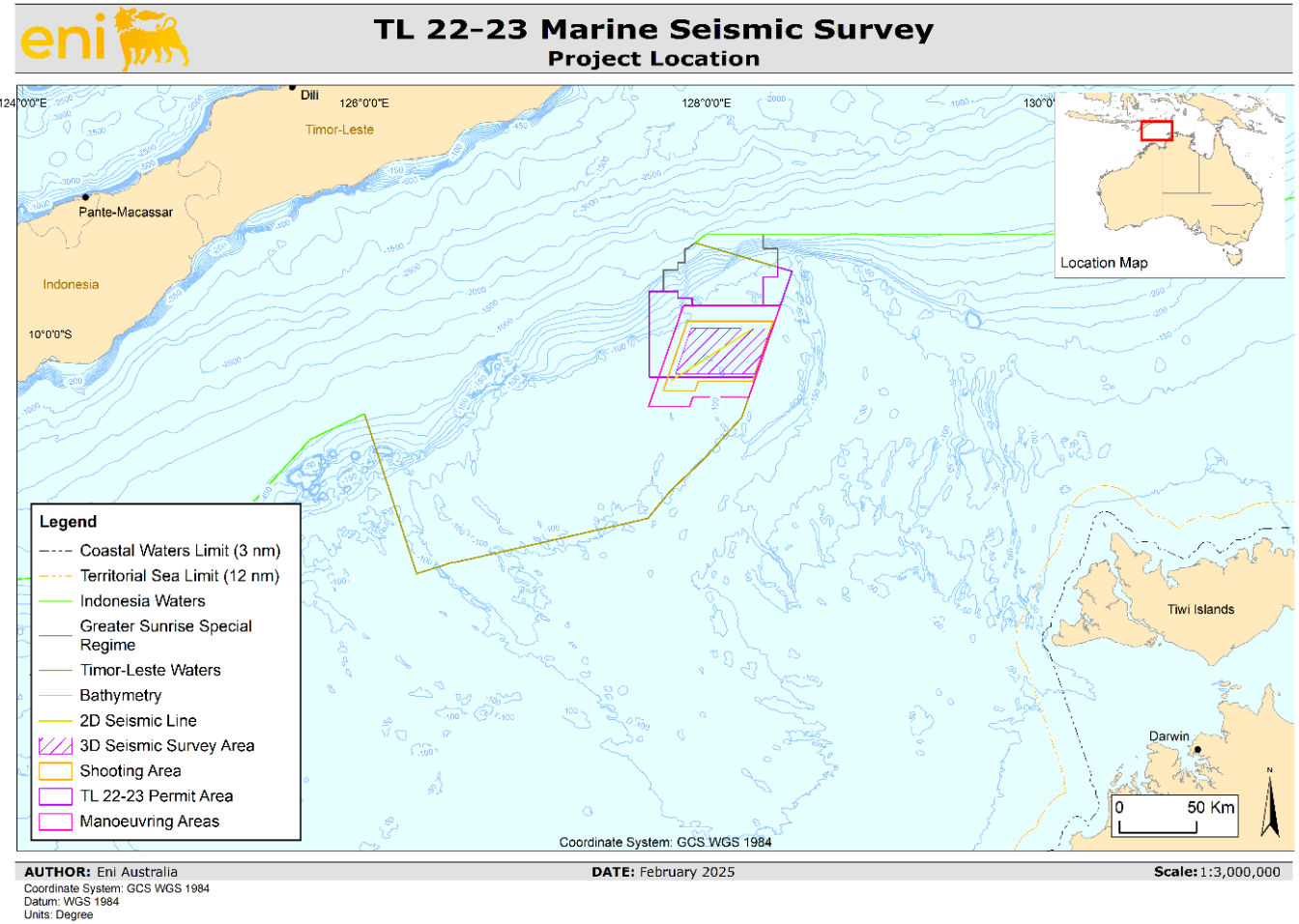

Figure 1-1: Project location (regional)

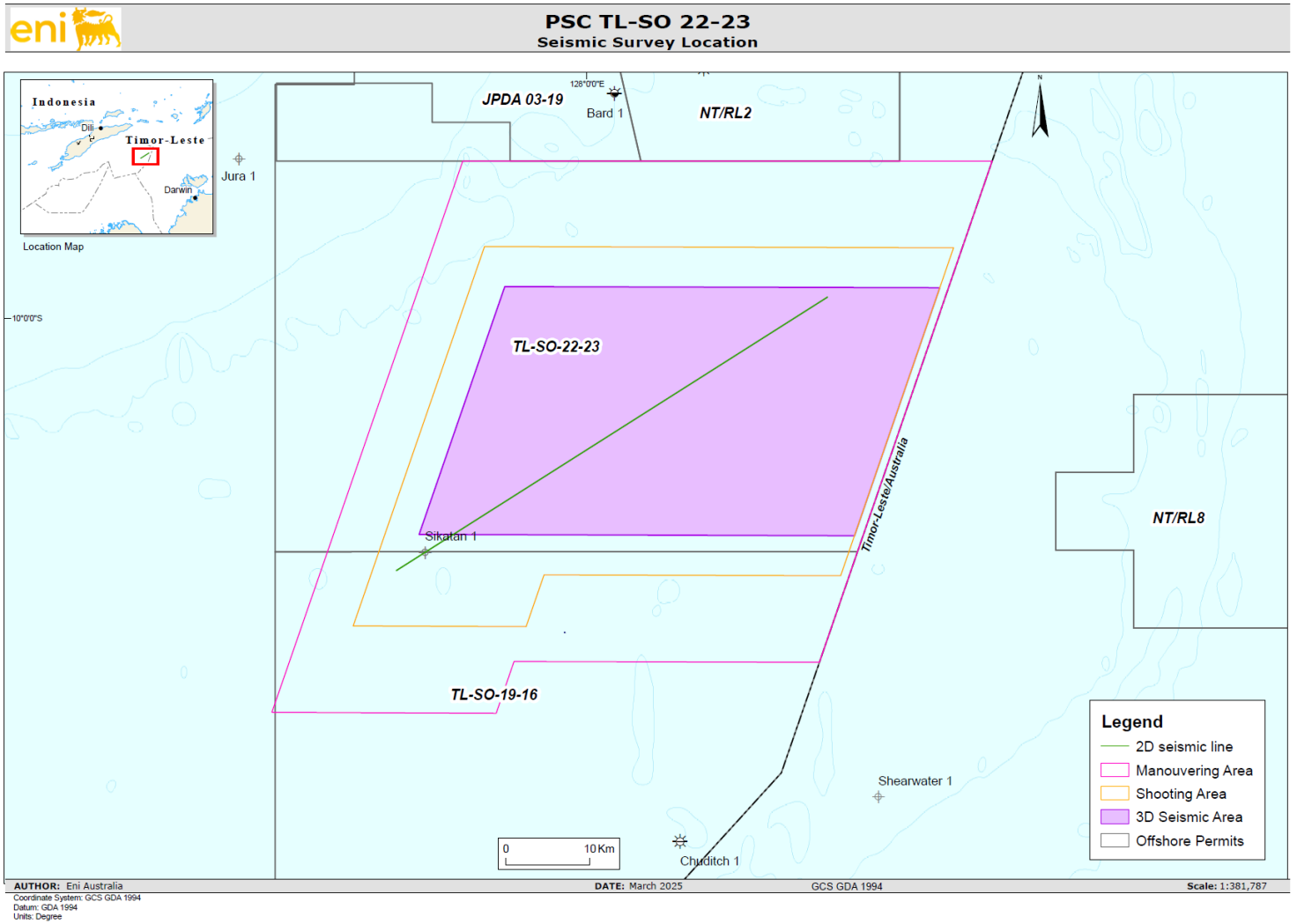

Figure 1-2: Project location (close-up)

1.2 Purpose and Scope of this Document

This document is the Environmental Management Plan (EMP) for the PSC TL-SO 22-23 survey activity. The EMP provides a framework to ensure seismic data acquisition activities are conducted in a manner that minimises environmental risks and aligns with best environmental management practices. The purpose of this EMP is to outline the environmental safeguards and mitigation measures that will be implemented throughout the survey activity to protect the marine environment and ensure compliance with relevant regulatory requirements.

The scope of this EMP covers the acquisition of three-dimensional (3D) and two-dimensional (2D) seismic data within PSC TL-SO 22-23 in Timor-Leste offshore waters. The survey activity is a commitment for the first three-year exploration term of the PSC, is designed to enhance subsurface imaging for hydrocarbon exploration. The key activities included in the scope of this EMP are:

- 3D seismic data acquisition across an area of approximately 1,500km² using broadband towed streamer technology
- 2D seismic data acquisition along approximately 60km, primarily to tie into the Sikatan-1-ST1 well
- deployment and recovery of seismic streamers, including 10 to 12 streamers towed at a depth of approximately 20m
- operation of seismic sound sources, using airgun arrays with a maximum volume of 3,500in³, fired at an interval of 37.5m
- support vessel and chase vessel operations to ensure safe and effective survey activity execution
- implementation of environmental management measures, including marine mammal observation and soft-start procedures to minimise acoustic disturbance.

This EMP comes into effect upon acceptance by ANP and remains in force until the completion of the survey activity.

1.3 Survey Activity Proponent

Eni is the operator of PSC TL-SO 22-23 (87.5%) in conjunction with TIMOR GAP E.P. (12.5%), who is the joint venture partner. As operator of PSC TL-SO 22-23, Eni assumes overall responsibility for the PSC area and direct responsibility for the survey activity.

Eni's Timor-Leste office is in Dili. Eni also has offices in Australia, with the Australian head office located in Perth (address below) and a secondary office in Darwin, Australia. Eni is a subsidiary of Eni S.p.A., one of the world's major integrated energy companies, operating in 70 countries around the world, with headquarters in Milan, Italy.

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2 ENVIRONMENTAL LEGISLATION

2.1 Treaty Establishing Maritime Boundaries in the Timor Sea

On 6 March 2018, the Timor-Leste and Australia governments signed the Treaty Between Australia and the Democratic Republic of Timor-Leste Establishing their Maritime Boundaries in the Timor Sea (the Treaty). The Treaty delimited the maritime areas between Australia and Timor-Leste in the Timor Sea; it provides Timor-Leste sovereignty over the waters and seabed within the previously defined Joint Petroleum Development Area (JPDA). The Treaty was ratified on 31 August 2019.

PSC TL-SO 22-23 is a new PSC that was awarded after the Treaty and is entirely under Timor-Leste jurisdiction.

2.2 Timor-Leste Legislative Framework as Relevant to the Survey Activity

Activities in in the survey area are governed by Decree-Law No. 25/2019 (dated 27 August 2019), which is pursuant to Article 31 of the Petroleum Activities Law (Law No. 13/2005), of 2 September 2005, as amended by Law No. 1/2019, of 18 January 2019 and Law No. 6/2019, of 4 December 2019. Decree Law No. 25/2019 applies to all petroleum operations with respect to offshore petroleum resources conducted under the Petroleum Activities Law.

Autoridade Naçional do Petróleo Timor-Leste (ANP) is responsible for administering Decree Law 25/2019.

The legislation that apply to survey activity are outlined in Table 2-1.

2.2.1 Environmental Licencing

Decree Law 39/2022 on Environmental Licensing (first amendment to Decree Law 5/2011 on Environmental Licensing) provides the procedures and other requirements related to obtaining an environmental licence before starting development activities, including for offshore oil and gas activities in Timor-Leste waters. Decree Law 39/2022 defines the environmental licencing procedure for projects likely to have environmental or social impacts, then assigns a project category classification based on the nature, size, technical characteristics, location and potential environmental impacts, and defines the requirements for the environmental impact assessment process based on the category classification (Category A, B or C).

Ministerial Diploma No. 46/2017 supports Decree Law 39/2022 and provides the minimum content requirements for the environmental licence process, including for the Simplified Environmental Impact Assessment and this accompanying EMP.

Table 2-1: Summary of Timor-Leste legislative framework as relevant to the survey activity

Permit / Authorisation / Licence	Activity	Legislation
Environmental Licence: • Project Document • Terms of Reference (Category A only) • Environmental Impact Statement (EAI) (Category A and B) • Environmental Management Plan (PGA) (Category A and B)	Survey activity	• Decree Law 26/2012 Environmental Basic Law • Decree Law 5/2011 Environmental Licencing • Ministerial Diploma 46/2017 Regulation on Requirements of Detailed Screening, Definition of Scope and Terms of Reference, Environmental Impact Statements and Environmental Management Plans for Environmental Evaluation • Decree Law 6/2020 Establishing the Legal Regime for the Protection and Conservation of Biodiversity • UNTAET Reg. 19/2000 On Protected Places • UNTAET Guideline on Ambient Noise (2002) • Constitution of the Democratic Republic of East Timor • National Cultural Policy
Sanitary Quarantine Inspection and Entry Approval	Vessel entering Timor-Leste waters	• Decree Law 21/2003 Quarantine and Sanitary Control on Goods Imported and Exported (Ch. IV Art. 46)
Vessel Declaration	Vessel customs requirements	• Decree Law 11/2004 Customs Code of Timor-Leste (Ch. II, Art.28)
Import Permit Application	Import (temporary) of materials and equipment	• Decree Law 1/2006 General Regulation on Quarantine
Import / Export License	Domestic (offshore / onshore) temporary transfer of plastic materials	• Decree Law 37 / 2020 Sale, Import and Production of Bags, Packaging and other Plastic Objects

2.3 International Agreements and Conventions

The key international environmental agreements and conventions that apply to the survey activity are outlined in Table 2-2. Information is also provided on how the survey activity will comply with relevant agreements and conventions.

Table 2-2: International agreements and conventions applicable to the survey activity

Agreement/Convention	Description	Relevance to EMP
Convention for the Prevention of Pollution from Ships 1973/1978 (MARPOL 73/78)	This convention aims to preserve the marine environment by eliminating pollution from oil and other harmful substances and by minimising accidental discharge of such substances. It contains six Annexes, each dealing respectively with oil, noxious liquid substances, harmful packaged substances, sewage, garbage, and air pollution. Detailed rules are laid out as to the extent to which (if at all) such substances can be released in different sea areas.	Vessels will comply with MARPOL 73/78 annexes, including: • Annex I (Prevention of pollution by oil) • Annex II (Control of pollution by noxious liquid substances in bulk) • Annex III (Prevention of pollution by harmful substances carried by sea in packaged form) • Annex IV (Pollution by sewage from ships) • Annex V (Pollution by garbage from ships) • Annex VI (Prevention of air pollution from ships).
International Convention for the Safety of Life at Sea 1974 (SOLAS)	This convention sets out minimum standards for construction, equipment and operation of merchant ships. The convention requires signatory flag states to ensure the ships flagged by them comply with these standards as a minimum.	Vessels will fully comply with SOLAS requirements, including navigation lighting and aids.
Convention on the International Regulations for Preventing Collisions at Sea 1972 (COLREGS)	These regulations outline internationally recognised navigation rules to be used by vessels at sea to avoid collisions. The regulations are published by the International Maritime Organization (IMO).	Vessels will comply with COLREG navigational requirements as implemented in Timor-Leste waters.
United Nations Convention on the Law of the Sea (UNCLOS)	Article 60 of the UNCLOS in Part V states '*Any installations or structures which are abandoned or disused shall be removed to ensure safety of navigation, taking into account any generally accepted international standards established in this regard by the competent international organization. Such removal shall also have due regard to fishing, the protection of the marine environment, and the rights and duties of other States'.* IMO is considered the competent organisation to deal with this requirement. IMO published Resolution A.672(16) Guidelines and Standards for the Removal of Offshore Installations and Structures on the	Relevant only in that IMO Resolution A.672(16) recognises that structures on the continental shelf should be removed, but coastal states may make decisions to leave structures partially or completely in the sea. Timor-Leste is a member state of the IMO. Applicable vessels will also comply with MARPOL 73/78 annexes relating to marine pollution prevention, including: • Annex I (Prevention of pollution by oil) • Annex II (Control of pollution by noxious liquid substances in bulk)

Agreement/Convention	Description	Relevance to EMP
	Continental Shelf and in the Exclusive Economic Zone (IMO, 1989). Part XII of the UNCLOS sets up a general legal framework for protecting the marine environment. The convention imposes obligations on State Parties to prevent, reduce and control marine pollution from the various major sources, including pollution from land, the atmosphere, vessels and dumping (Articles 207 to 212). Subsequent articles provide for enforcing national marine pollution laws in different situations that may arise. Timor-Leste is a State Party under the convention.	• Annex III (Prevention of pollution by harmful substances carried by sea in packaged form) • Annex IV (Pollution by sewage from ships) • Annex V (Pollution by garbage from ships) • Annex VI (Prevention of air pollution from ships).
Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972 (the London Protocol)	The London Protocol contributes to the international control and prevention of marine pollution by prohibiting the dumping of certain hazardous materials.	Hazardous material will not be dumped at sea as part of the survey activity.
International Convention for the Control and Management of Ships Ballast Water and Sediment 2004	The convention aims to prevent the spread of harmful aquatic organisms from one region to another via ballast water and sediment.	Internationally sourced vessels that could introduce invasive marine species and potential from ballast water exchange.
International Convention on the Control of Harmful Anti-fouling Systems on Ships 2008	The convention prohibits the use of harmful organotins in anti-fouling paints used onboard vessels. It establishes a mechanism to prevent the potential future use of other harmful substances in anti-fouling systems.	Vessels of applicable classes will have a valid International Anti-fouling Systems Certificate.
Convention on Biological Diversity 1992	The objectives of the convention are the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of the benefits arising out of the utilisation of genetic resources.	Relevant insofar that the survey activity may impact biological diversity, including protected species or species listed under the International Union for the Conservation of Nature (IUCN) Red List.
World Heritage Convention 1972	This international convention is intended to protect examples of the world's natural or cultural heritage sites of outstanding universal value. Ratification of the convention indicates a commitment to protect these properties and their values. Timor-Leste has ratified the World Heritage Convention.	There are no World Heritage properties within 300km of the survey activity.

Agreement/Convention	Description	Relevance to EMP
International Convention on Civil Liability for Oil Pollution Damage 1969	The Civil Liability Convention ensures adequate compensation is available to persons who suffer oil pollution damage resulting from maritime casualties involving oil-carrying ships by placing liability for such damage on the owner of the ship.	Relevant to potential oil spills from all survey vessels.
International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties 1969	The convention gives State Parties powers to intervene on ships on the high seas when their coastlines are threatened by an oil spill from that ship.	Relevant to potential oil spills from all survey vessels.
Kyoto Protocol	This is an international treaty that extends the 1992 United Nations Framework Convention on Climate Change, which commits state parties to reduce greenhouse gas (GHG) emissions. Timor-Leste has ratified the Kyoto Protocol.	To reduce impact of GHG emissions associated with survey activity, vessels will comply with MARPOL 73/78 Annex VI and applicable planned maintenance system (PMS).
The Paris Agreement	The Paris Agreement aims to limit global temperature rise this century to well below 2°C above preindustrial levels and to pursue efforts to limit the temperature increase even further to 1.5°C. Timor-Leste has ratified the Paris Agreement.	To reduce impact of GHG emissions associated with survey activity, vessels will comply with MARPOL 73/78 Annex VI and applicable PMS.
United Nations Framework Convention on Climate Change 1992	The convention is an international environmental treaty with the objective of stabilising GHG concentrations at a level that would prevent dangerous anthropogenic interference with the climate system. Timor-Leste has ratified the United Nations Framework Convention on Climate Change 1992.	To reduce impact of GHG emissions associated with survey activity, vessels will comply with MARPOL 73/78 Annex VI and applicable PMS.
Vienna Convention for the Protection of the Ozone Layer 1985 and the Montreal Protocol on Substances that Deplete the Ozone Layer 1987	The Vienna Convention is a multilateral environmental agreement that acts as a framework for international efforts to protect the ozone layer. The accompanying Montreal Protocol specifies goals for reducing the use of chlorofluorocarbons, the main chemical agents causing ozone depletion. Timor-Leste has ratified the Vienna Convention.	To reduce use and prevent the release of ozone-depleting substances, vessels will comply with MARPOL 73/78 Annex VI for air emissions and use low sulphur fuel.
Joint Nature Conservation Committee (JNCC) Guidelines for Minimising the	These guidelines outline measures to reduce the risk of injury to marine mammals during geophysical surveys,	The guidelines will be followed during the seismic survey to ensure marine mammals are protected. This

Agreement/Convention	Description	Relevance to EMP
Risk of Injury to Marine Mammals from Geophysical Surveys (2017)	including visual monitoring, passive acoustic monitoring (PAM), soft-starts, and pre-shooting searches to detect marine mammals in the survey area.	includes the use of marine mammal observers (MMO) and PAM operatives, as well as pre-shooting surveys and soft starts to minimise noise impacts on marine fauna.

3 DESCRIPTION OF THE SURVEY ACTIVITY

3.1 Overview of the Survey Activity

In December 2023, Eni signed a PSC with ANP for PSC TL-SO 22-23, which became effective on 22 April 2024. There is a commitment to acquire seismic data in the first three-year exploration period. As such, Eni proposes to acquire seismic data from the survey area using towed streamer operations with a duration of up to ten weeks. This will involve acquiring approximately 1,500km² of 3D broadband towed streamer seismic and 60km of 2D seismic data within the southeast part of the survey area. There is also a contingent option for acquiring an extra ~35km² of 3D seismic data over the Sikatan-1/ST1 well location, in addition to the firm 2D seismic line.

3.2 Category of the Survey Activity

Article 4 of Decree Law 39/2022, entitled Definition of Categories and Type of Environmental Procedure, provides the following:

1. The classification of projects is made in accordance with Annex I and Annex II and is structured in the following categories:
   a. Category A – includes projects that may potentially cause significant environmental impacts and are subject to the procedure of Environmental Impact Assessment, based on impact analysis and an EMP in accordance with the provisions in this law.
   b. Category B – includes projects that may cause environmental impacts and are subject to the procedure of Initial Environmental Examination, based on the EMP in accordance with the provisions of this law.
   c. Category C – includes projects where environmental impacts are negligible or non-existent, and not subject to any procedure for Environmental Assessment in accordance with the provisions of this law.
2. In the following cases, the category is determined by considering the severity of likely impacts:
   a. A project that might raise some or significant adverse impacts that do not fall into the category of Appendix I and II.
   b. A project that may raise significant adverse impacts falls under the category of Appendix II.

On 10 January 2025, Eni submitted the Project Document for the survey activity for assessment, which included an assessment of the survey activity against the criteria in Appendix I and Appendix II of Decree Law 39/2022; Classification of Category A Projects and Classification of Category B projects respectively. The outcomes of this assessment are provided in Table 10-1 and Table 10-2 of the Project Document. The results of the assessment are summarised here.

After the Project Document was assessed and in accordance with Decree Law No. 39/2022, ANP gave the survey activity a Category B classification (Ref: ANP/HSE/S25/011). Eni must therefore submit a SEIS and an EMP (this document) for the survey activity. Survey Activity Nature, Size and Location

3.2.1 Location

The survey area, which encompasses the 3D and 2D seismic areas, as well as manoeuvring and shooting areas, is located in the Timor Sea, south of the Sunrise-Troubadour Gas Field in Timor-Leste offshore waters (Figure 1-1). The survey area is approximately 175km from the southeast coast of Timor-Leste, 300km southeast of Dili and 370km northwest of Darwin, Australia. The survey area covers approximately

1,500km² (50km by 30km) in water depths ranging from 40 to 180m. There is also a contingent option for acquiring an extra ~35km² of 3D seismic data over the Sikatan-1/ST1 well location, in addition to the firm 2D seismic line.

The location of the survey area (including contingency area) is shown in Figure 1-1 and Figure 1-2, with the coordinates for the corner points provided in Table 1-1.

3.2.2 Survey Activity Duration

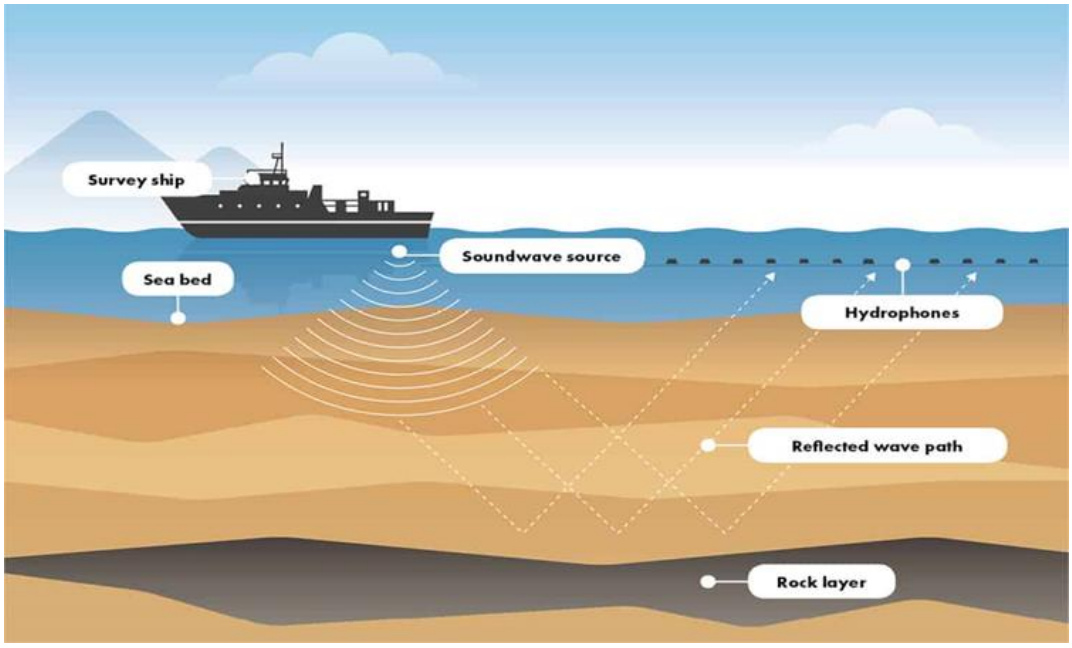
The survey activity is planned to commence between July and September 2025. The survey activity is expected to take up to ten weeks to complete, including mobilisation, scouting, data acquisition, streamer deployment and recovery.

Seismic data acquisition will occur 24 hours a day, although temporary shutdown periods may be required in the event of poor weather or other adverse conditions. Once confirmed, the actual survey start and end dates will be communicated to all relevant persons in accordance with regulatory requirements.

3.2.3 Seismic Survey Operations

In towed streamer operations, seismic surveys are conducted using large, specialised vessels, which tow an array of receivers (streamers) and pneumatic sources towed below the water surface that generate sound waves using pulses of compressed air in order to image geological features in the subsurface for the purpose of hydrocarbon exploration.

The sound waves, reflected back from horizons at and below the seafloor, are detected and recorded by an array of receivers (hydrophones, attached to streamers), towed by the same vessel in order to image subsurface geological features. These operations are usually escorted by support and chase vessels to protect the tow vessel and towed equipment from other vessel traffic, and to protect other users of the sea from entanglement or other damage from collisions with towed seismic source. An indicative schematic of these activities is shown in Figure 3-1.



Source. Australian Energy Producers (2024).

Figure 3-1: Indicative seismic survey schematic

3.2.3.1 Streamer Configuration

The survey activity will comprise a seismic vessel towing 10 to 12 streamers, approximately 8km long, with 75 to 112.5m spacings between streamers. Streamers will be towed at a depth of approximately 20m. Each streamer will have a tail buoy attached to ensure it remains straight and afloat. The tail buoy will also provide a visual reference for seismic vessel crew and global positioning system. The final streamer configuration will be confirmed after award of the seismic contract.

3.2.3.2 Seismic Sound Source Configuration

The survey activity will have a shooting configuration that allows the use of a triple source array. The survey activity will use airguns as the sound source, with a volume less than 3,500in³. The sound sources will be towed at a depth of 8m. The airguns will fire at a maximum interval of 37.5m with an eight second recording length. The sound source array and shooting configuration will be finalised after award of the tender, and included in the final seismic acquisition plan.

Before the survey activity begins, the seismic source will be tested within the survey area and soft-start procedures will be implemented before reaching the full volume planned for the seismic source. The same equipment and methods will be used to acquire the 2D seismic data as for the 3D data, with the only differences related to data processing.

3.2.3.3 Survey Activity Plan

The seismic vessel will traverse the survey area via an array comprised of 'sail lines'. Sail lines are typically parallel and adjacent to each other and will be surveyed by the seismic vessel, with the seismic sound source and streamers active throughout the survey activity. The sail lines are expected to be 31km long on average. During recording, the seismic vessel will travel at a speed of approximately 4.5 knots.

Sail lines will be surveyed once, unless interruptions to the survey activity occur as a result of weather. If data acquisition is disrupted along a sail line, infill data acquisition may be required.

During recording, the support vessel and a chase vessel will ensure the sail lines ahead of the seismic vessel are clear of obstacles and other users of the survey area, such as fishers. After completing each sail line, the seismic vessel will be required to complete a line turn to complete the next adjacent sail line and allow the streamers to straighten out. Additional vessel manoeuvring areas will therefore be required to ensure adequate coverage of the survey area, as shown in Figure 1-1 and Figure 1-2. All vessel manoeuvring and line turns will be completed within Timor-Leste waters, with no entries into Australian waters.

The parameters of the survey activity are provided in Table 3-1.

Table 3-1: Parameters of the survey activity

Parameter	Survey Activity
Survey Area (refer to Figure 1-1)	
Permit area	PSC TL-SO 22-23
Survey area	Approximately 1,500km² 3D seismic
2D seismic	Approximately 60km 2D seismic
Contingent option	Approximately 35km² 3D seismic over Sikatan-1/ST1
Survey Activity	
Survey timing	Commencing July to September 2025
Survey duration	Up to 10 weeks
Length of sail lines	Average of approximately 31km
Speed	Approximately 4.5 knots during recording
Seismic Source	
Type	Airgun
Number of sources	3
Volume	Up to 3,500in³
Pressure	Approximately 75bar-m
Sound source tow depth	8m
Firing interval	37.5m
Record length	8 seconds
Streamers	
Number	10 to 12
Streamer length	Approximately 8km
Distance between streamers	75 to 112.5m
Streamer tow depth	Approximately 20m
Vessels	
Seismic vessel	One seismic vessel – to be determined with contractor
Support vessels	One support vessel Three chase vessels
Refuelling	Refuelling (bunkering) will occur at sea, depending on the specific vessel and contractor
Crew changes	Crew changes if required via support vessel or helicopter

3.2.3.4 2D Seismic Data Acquisition

Approximately 60km of 2D seismic data will be acquired to tie the Sikatan-1/ST1 well into the 3D seismic data. The Sikatan-1/ST1 well is located approximately 75m south of PSC TL-SO 22-23, in SundaGas-operated PSC TL 19-16. Approximately 4km of seismic sail line will be required within TL 19-16 for full imaging of the Sikatan-1/ST1 well location. Seismic operations for the 2D seismic line will therefore extend south into TL 19-16. The 2D seismic data will be acquired within the seismic shooting area of the survey area, as shown in Figure 1-1 and Figure 1-2.

3.2.3.5 Contingent Extra 3D Seismic Data Acquisition

There is a contingent option to acquire an extra ~35km² of 3D seismic data over the Sikatan-1/ST1 well location, in addition to the firm 2D seismic line. This would be

achieved by continuing the sail lines southwards in the south-west corner of the full fold area, to a total sail line length of around 37km. The total width of this extra 3D seismic area would be approximately 6km and would be acquired within the seismic shooting area of the survey area.

3.2.3.6 Gravity and Magnetic Data Acquisition

The planned survey activity may also include acquiring gravity and magnetic data. Gravity data may be acquired using a gravity meter mounted onboard the seismic vessel. Magnetic data may be acquired using a magnetometer towed behind the seismic vessel.

3.2.4 Crew and Vessel Services

The survey activity will be performed using a seismic vessel (Figure 3-2) with one support vessel and three chase vessels. Crew changes will be undertaken via the support vessel or possibly helicopter.

The seismic vessel and support vessels may be refuelled (bunkered) at sea if required. All vessels will use marine diesel oil (MDO).

Source. Petroleum Exploration Society of Australia (2024).

Figure 3-2: Indicative survey activity vessel

3.2.4.1 Vessel Selection

Selection of the vessels will depend on technical requirements for the survey activity operations and Eni's vessel selection criteria. Selection criteria include:

- The contractor must be able to meet Eni and Timor-Leste environmental and safety standards.
- The contractor must meet Eni's prequalification assessment.

All vessels will have all necessary certification and registration and will fully comply with all relevant regulations, including the International Convention for the Prevention of

Pollution from Ships (MARPOL), and International Convention for the Safety of Life at Sea (SOLAS), as appropriate. The vessels must also comply with necessary approvals and vessel inspections before entry into the survey area.

3.3 Justification for the Survey Activity

Acquisition of approximately 1,500km² of 3D and 60km 2D seismic data are work commitments for the first exploration period of PSC TL-SO 22-23. There is some coverage of the PSC area by vintage 2D seismic lines, which were acquired in the 1990s and early 2000s. The proposed 3D survey activity is located over a prospective geological feature identified on the vintage 2D seismic data. The new data acquisition will significantly improve imaging and definition of the subsurface feature in the survey area for the purpose of hydrocarbon exploration and for locating a well.

A seismic feasibility study was carried out by Eni to determine the most appropriate survey area and acquisition parameters to fully image the subsurface feature. The acquisition parameters will be finalised after award of the seismic tender.

3.4 The Proponent's Approval of the Environmental Management Plan

The project proponent, Eni, endorses this EMP prepared by its consultant, Worley Consulting. Evidence of this endorsement is confirmed by the signatories on the cover page.

3.5 Roles and Responsibilities

Table 3-2 summarises key roles and responsibilities of Eni personnel and contractors for implementing the survey activity.

Table 3-2: Roles and responsibilities for the survey activity

Roles	Responsibilities
Onshore personnel	
Eni Exploration Manager	Reviewing this EMP and confirming all environmental risks have been identified, mitigation strategies are effective and will be undertaken during field management and the survey activity, including emergencies or potential emergencies. Ensuring: • compliance with all environmental regulations and this EMP • the requirements of the EMP are communicated to third-party contractors • all personnel are inducted and are aware of their environmental responsibilities • environmental inspections are undertaken on survey vessels to verify compliance with the EMP Reporting all environmental incidents to the HSE and Quality Manager and Incident Management Team (IMT) Leader. Notifying ANP of the start of the survey activity Notifying ANP of the end of the survey activity Reporting to ANP any environmental incident.

Roles	Responsibilities
HSE & Quality Manager (office-based)	Reviewing this EMP and confirming all environmental risks have been identified, mitigation strategies are effective and will be undertaken during the survey activity, including emergencies or potential emergencies. Providing and maintaining effective emergency response arrangements for the survey activity where there is potential environmental risk. Performing incident investigations. Reporting to ANP any environmental incident.
Environmental Advisor (office-based)	Reviewing HSE management plans for acceptability and ensuring compliance with this EMP. Reporting to ANP any environmental incident. Coordinating and reviewing environmental inspections to ensure compliance with this EMP. Providing advice in the event of an oil spill or other environmental incident.
Offshore personnel	
Eni Offshore Representative	Reviewing this EMP and confirming all environmental risks have been identified and mitigation strategies are effective and will be undertaken during the survey activity, including emergencies or potential emergencies. Notifying the Eni Exploration Manager and HSE & Quality Manager, should additional environmental risks arise during the survey activity that have not been identified in this EMP. Ensuring all offshore personnel comply with the health, safety and environmental requirements. Ensuring all personnel receive the Eni environmental induction before starting the survey activity. Providing a daily log of activities and environmental incidents to the Exploration Manager. In the event of an emergency, communicating with the Eni IMT in Perth. Implementing and complying with all operational plans, including this EMP. Ensuring all required plans, audits and reviews are undertaken in accordance with the regulatory requirements and as required by this EMP. Implementing and closing out actions in an action register. Ensuring all monitoring is undertaken in accordance with this EMP and data is made available to the Exploration Manager. Ensuring adherence to management and mitigation measures outlined to minimise interaction with cetaceans and other marine fauna. Ensuring all whale interaction reports are submitted to the Environment Advisor. Notifying ANP of the details of environmental incidents. Investigating hydrocarbon spills, should they occur.

Roles	Responsibilities
Vessel Master	Ensuring full compliance with all applicable navigational safety standards and regulations. Conducting emergency drills. Supervising vessel crew to ensure they are fit for duty and undertaking work only within their area of qualification and training. Monitoring, reporting and taking appropriate action to remedy any vessel or equipment defects that may impact on safety and environmental performance of the vessel. Maintaining logs with respect to MARPOL 73/78 regulations. Ensuring all crew are appropriately qualified, trained and equipped for their roles. Ensuring vessel activities comply with the requirements of this EMP. Notifying all vessel-related incidents immediately to the Eni Site Representative.
Vessel operators, technicians and crew	Applying operating procedures in letter and in spirit. Following good housekeeping procedures and work practices. Encouraging improvement in environmental performance, wherever possible. Immediately reporting environmental incidents or spillage of hydrocarbons or chemicals to the Vessel Master.

4 EXISTING ENVIRONMENT

4.1 Climate

The climate of the Timor Sea is monsoonal, with a wet season and a dry season. The wet season starts between September and November as the southeast trade winds weaken. The early part of the wet season is marked by frequent thunderstorms and, as the season progresses, several days of heavy rain may occur. During dry season, trade winds become re-established over northern Australia and the monsoon retreats. The local climate of Suai, the largest community on the southern coastline of Timor-Leste. approximately 295km to the northwest of the survey area, is tropical and generally hot, characterised by the distinct wet and dry seasons referred to above.

From June to October (the approximate dry season), the average monthly rainfall in Dili is around 30mm, while from November to May (the approximate wet season), the monthly average rainfall is around 165mm.

The climate of Timor-Leste is heavily influenced by the El Nińo Southern Oscillation and generally relatively low seasonal variability in average monthly temperatures (World Bank Group, 2021). Monthly average maximum temperatures in November are 26°C, while July has the lowest monthly average temperature of 21.9°C (World Bank Group, 2021).

4.2 Oceanography

4.2.1 Currents and Tides

The main forces contributing to surface water motion in the survey area are:

- wind stress
- astronomical tides
- general oceanic circulation.

Surface currents reflect seasonal wind regimes, with summer easterly to north-easterly currents, and winter westerly to south-westerly currents. Typical values for current speed are 2 to 4% of the wind speed. Local wind-driven surface currents may attain maximum speeds of 0.7m/s during extreme monsoonal or trade wind surges. More typically, speeds would be in the range of 0.2 to 0.4m/s.

The tides in the vicinity of the survey area are semidiurnal (two highs and lows each day) with a slight diurnal inequality (difference in heights between successive highs and low). There is a well-defined spring-neap lunar cycle, with spring tides occurring two days after the new and full moon. Near-surface tidal currents in the region are anti-clockwise rotational, directed towards the south-southeast during mid flood and towards the north-northwest during mid ebb. Speeds will range from about 0.2m/s on neap tides to 0.4m/s on spring tides.

Table 4-1 provides the estimated tide levels for the Greater Sunrise Field, located about 30km north of the survey area. The highest astronomical tide is 3.1m above lowest astronomical tide and the mean ranges for spring and neap tides are 2.4m and 0.2m respectively.

Table 4-1: Estimated tide levels for the nearby Sunrise Gas Field

Tide	Level (m)
Highest Astronomical Tide	3.1
Mean High Water Spring	2.8
Mean High Water Neap	1.9
Mean Sea Level	1.7
Mean Low Water Neap	1.7
Mean Low Water Spring	0.4
Lowest Astronomical Tide	0.0

Source. WNI (2001) Preliminary Metocean Conditions Sunrise Pipeline Timor Sea, R1032

The Pacific Indian Throughflow flows south through the Indonesian Archipelago and into the Eastern Indian Ocean. This current may introduce a small south-westerly component to the current regime in the survey area. The throughflow appears to be subject to the pronounced interannual variations of El Niño Southern Oscillation events. Current speeds vary depending on the season. Lowest speeds would occur in April at the end of the northwest monsoon, when winds blow towards the Pacific, while highest speeds would occur in September, associated with the southeast monsoon (Wijffels et al., 2002).

4.2.2 Sea and Swell

Waves at the survey area comprise contributions from:

- Southern Ocean swells
- summer monsoonal swells
- winter easterly swells
- locally generated seas.

The most persistent swell arrives from the west and southwest, with typical heights of 2m in dry season and 1m in wet season. Since longer period swell suffers less dissipation, periods of long-travelled swell commonly reach 18 seconds and occasionally exceed 20 seconds. Shorter period swell (six to 10 seconds) may result from tropical cyclones, dry season easterlies over the Arafura Sea and the eastern portions of the Timor Sea, and wet season westerlies over the western portions of the Timor Sea.

Local wind-generated sea is highly variable but typically ranges in period from two seconds to six seconds, with heights of up to 6m in strong persistent forcing at some locations (Swan et al., 1994).

4.2.3 Bathymetry

The survey area is located on the Sahul Shelf, on the continental slope, in an area of largely flat and featureless seabed ranging in depth from 40 to 180m (refer to Figure 4-1). The Sahul Shelf extends about 300km out from and runs parallel to the northern Australian coastline. To the northwest, the continental slope continues to decline steadily, reaching depths of more than 2,000m in the Timor Trough.

There are no shoals or banks located within the survey area. However, a system of shoals and banks does occur to the east, north and northwest. These systems occur along the northeastern outer edge of the Sahul Rise, in the vicinity of the Greater Sunrise Field (refer to Section 4.4.3.1).

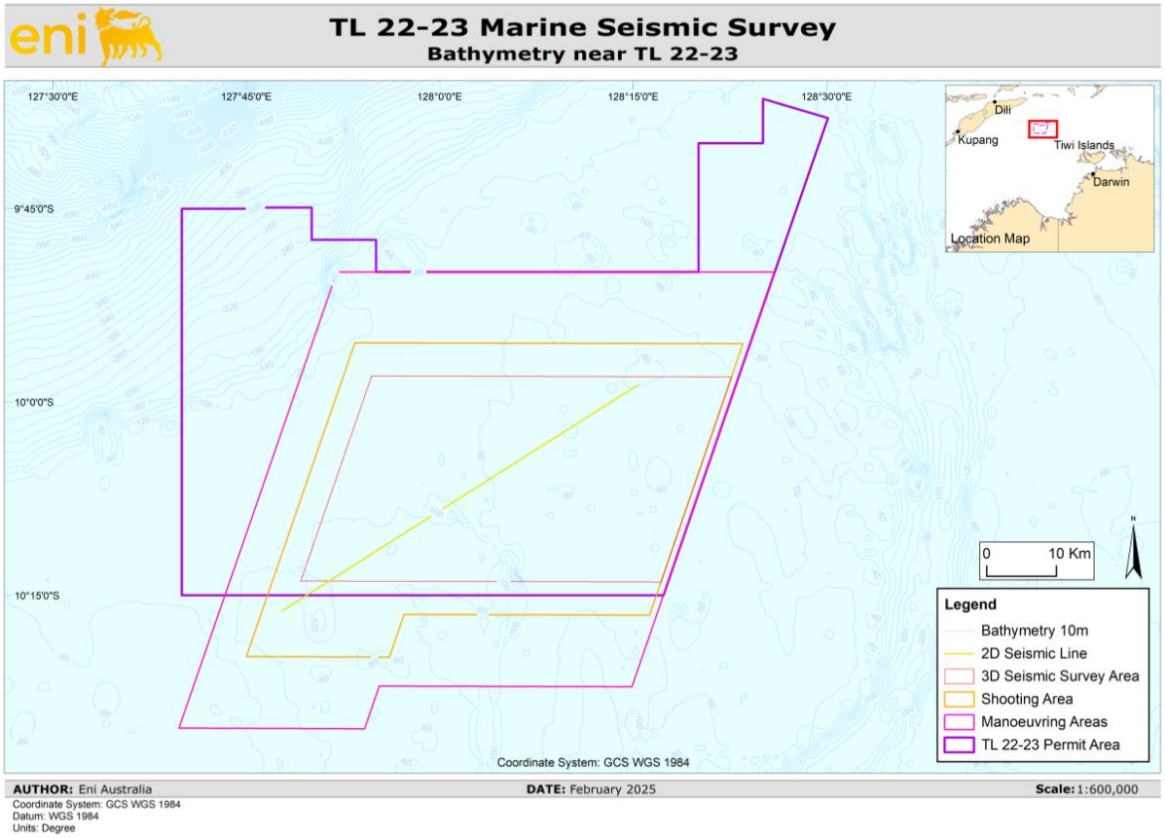


Figure 4-1: Bathymetry in the survey area

4.2.4 Marine Water Quality

A baseline environmental survey of the Kitan Field (located approximately 190km southwest of the survey area) was conducted by Gardline Marine Sciences Pty Ltd (Gardline) in May 2010. Physico-chemical characteristics of the seawater column were sampled at three sites using a YSI 6600 multi-parameter probe, which measured pH, temperature, conductivity and dissolved oxygen (DO). Profiles were taken during day and night at all sites, down to water depths of 200m.

Surface seawater temperatures recorded were between 29.0°C and 29.6°C. Subsurface temperatures were steady to about 60m depth. Below this, temperatures dropped steadily, indicating a consistent thermocline among all sampling sites. At depths close to 200m, temperatures reached as low as 12.4°C. This pattern of vertical stratification is typical of tropical seas (Geoscience Australia, 2003). Salinity levels were lower in the surface mixed layer (34.0 to 34.2ppt) and showed a consistent halocline from around 60m, with increasing salinity at depth (up to 34.6ppt at 190m depth).

4.2.5 Seismicity and Tsunamis

The island of Timor is a thrust fold belt formed when the Australian continental plate collided with the Asiatic plate. It is bounded to the south by a deep marine foreland basin (Timor Trough). The basin formed by lithospheric flexure in response to thrust loading. The survey area is located south of the Timor Trough on the Australian continental plate, which is moving northwards at approximately 77 mm/year.

The subduction zone beneath the island of Timor is no longer active, due to choking of the collision zone by continental crust. The first phase of deformation of the Timor area by continent-arc collision and jamming of the subduction zone by thicker continental

crust is reported to have occurred between 9.8 to 3 million years, once all the oceanic crust had been subducted.

The Timor Trough and onshore Timor area remain tectonically active and numerous earthquakes occur every year, associated with ongoing collision of the Asiatic and Australian plates and the subducted slab. Since the mid-1970s, hundreds of earthquakes have been recorded in the region. Most of the earthquakes are of relatively low magnitude, but higher magnitude earthquakes also occur.

4.3 Geology and Marine Sediments

The survey area is located on a rise of the Sahul Shelf, situated on the northern continental Australian shelf bordered by the Timor Trough to the north. Benthic substrate within the survey area is mapped as calcareous gravel, sand and silt (CSIRO, 2015). The edge of the Sahul Shelf is predominantly comprised of carbonate sediments (Sinclair Knight Merz, 2001).

The Echuca Shoals horizon is the primary objective of the survey activity, located at approximately 2,000 to 3,000m below the seabed in the survey area. The secondary objective is the Permian horizon, located at approximately 3,700 to 4,800m below the seafloor in the survey area. The Early Cretaceous Echuca Shoal Formation is a strong marker horizon on seismic and well logs (Ahmad and Munson, 2013; Pattillo and Nicholls, 1990) and typically consists of glauconitic marine claystone and siltstone. The Top Permian is marked by a regional limestone (Dombey Formation), which is a strong seismic reflector. Both horizons can be tied to offset wells such as Troubadour-1 and Sikatan-1/ST1.

No sediment sampling is available over the survey area. However, sampling of marine sediments in the nearby Greater Sunrise Field (approximately 30km north of the survey area) show that sediments are predominantly carbonate sandy silt below a depth of approximately 0.7m, with the layer above being of marginally coarser grading. Sediments over the survey area are expected to be similar (Woodside, 2001).

4.4 Biological Environment

4.4.1 Regional Overview

The marine fauna of the Timor Sea is part of the Indo-West Pacific biogeographical province. Most species are widely distributed in this region. Marine biology studies consider the tropical waters across the north of the Australian continent (extending from the north of Western Australia around to the Great Barrier Reef) to represent one continuous biological province (Wilson and Allen, 1987).

4.4.2 Continental Shelf

Across the northern continental shelf, the predominant animals living within seabed sediments (infauna) are polychaetes (burrowing worms) and crustaceans (such as prawns, shrimp and crabs). These two groups comprise 84% of the total species in sediment samples, with a high diversity of species but a low abundance of each individual species (Heyward et al., 1997). The remaining 16% of species include echinoderms (such as sea stars, sea urchins and feather stars), molluscs (as in, gastropods and bivalves), nemerteans (ribbon worms), sponges and fish.

Epibenthic communities (animals living on or near the seabed) in deeper waters are generally low in fauna abundance and diversity, probably due to the limited sea floor topography and hard substrate. The main taxa found in these areas include sponges

and gorgonians (sea whips and sea fans). While the abundance may be low, the diversity of Timor Sea shelf slope invertebrates may be high.

4.4.3 Marine Habitats

4.4.3.1 Shoals and Banks

Shoals and banks within the region are known to be inhabited by diverse biological communities. On shoals in less than 50m water depth (where adequate light may penetrate), epibenthic fauna can be abundant and diverse. These areas are of ecological significance due to their regional uniqueness and their patchy distribution in an otherwise broad area of featureless seafloor.

Shoals and banks do occur in the vicinity of the survey area (Figure 4-2). However, there are no shoals or banks located within the survey area itself. The nearest shoals and banks to the survey area include:

- Troubadour Shoals, approximately 21.9km to the northeast
- Sunrise Bank, approximately 24.6km to the north
- Margaret Harries Bank, approximately 26.1km to the southeast
- an unnamed Timor Sea shoal, approximately 32.3km to the west.

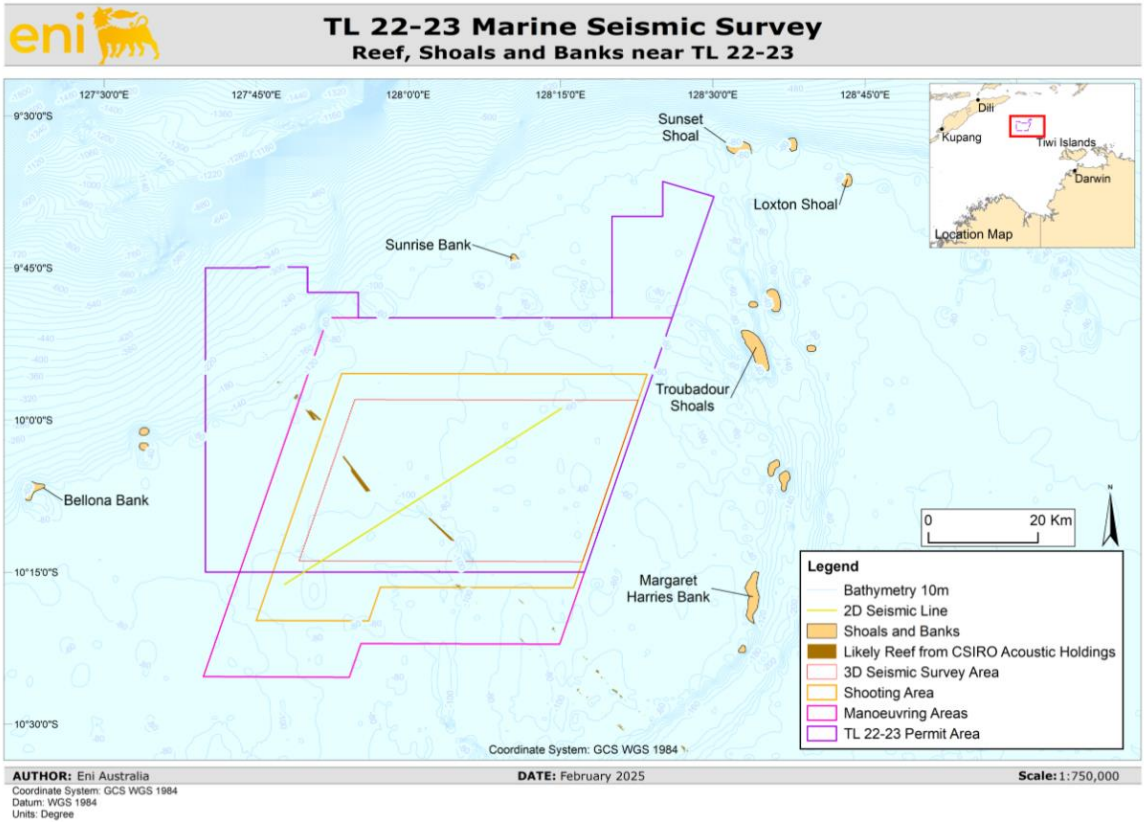


Figure 4-2: Reef, shoals and banks near the survey area

Characterisation of shoal environments in the Timor Sea is predominantly understood from surveys undertaken at the Big Bank Shoals by Heyward et al. (1997), which are located approximately 190km southwest of the survey area, in addition to surveys of several banks in the Greater Sunrise area 30 to 50km to the north.

Submerged banks of the region vary in their habitat and species composition but are generally characterised by mixed *Halimeda* algae, sponge and soft coral communities, with some hard corals on the more consolidated sediments. Shallower areas of shoals may also be used as foraging areas for turtles, including green turtles and hawksbill turtles (Sinclair Knight Merz, 2001).

Surveys undertaken at banks in the vicinity of the Greater Sunrise Field indicated the submerged banks contain extensive diverse and abundant benthic communities. The Sunrise Bank (located 25km north of the survey area) was found to comprise a mixture of coral types and the calcareous algae *Halimeda*.

4.4.3.2 Seamounts

Although no seamounts have been identified within the survey area itself, unnamed seamounts occur within the region of the survey area. The nearest seamounts are located approximately 260km to the north in Indonesian waters (Yesson et al., 2020).

4.4.3.3 Emergent Coral Reefs

Emergent coral reefs and associated islands have high species diversity both within and between the reefs. There are no emergent coral reefs in the survey area. The nearest of these emergent coral reef and associate island systems, Pulau Meatimiarang (Indonesia), is approximately 180km north of the survey area (refer to Section 4.4.3.6).

4.4.3.4 Rocky Reefs

The Institute of Marine and Antarctic Studies has compiled multiple benthic habitat datasets across the Australian continental shelf, which also includes the survey area. These datasets include both validated (by ground-truthing seafloor observations) and unvalidated (predicted, but not ground-truthed) habitat data. Within the survey area, several areas have been mapped as 'likely rocky reef'; however, this is an unvalidated output from a dataset based on regional data from CSIRO acoustic modelling. Therefore, the presence of these reefs within the survey area has not been confirmed to date. Typically, rocky reefs occur at waters depths of between approximately 70 to 95m.

Species associated with rocky reefs in the region include green turtles, hawksbill turtles, reef manta rays, and fish species including common predators such as groupers, emperors and snapper (Department of Sustainability, Environment, Water, Population and Communities, 2012).

4.4.3.5 Shelf Flats

South of the Sahul Shelf system lies extensive shelf flats of depths varying from 70m to approximately 100m. These soft sand-silty seafloors are generally flat and undulating with a sparse assemblage of species. Species present are mainly polychaetes and crustaceans, with sponges, ascidians, echinoderms, gorgonians or soft corals present depending on depth and local sediment characteristics (Lavering, 1993; Marsh and Marshall, 1983).

4.4.3.6 Corals

Emergent coral reefs and associated islands have high species diversity, both within and between the reefs. No emergent coral reefs occur within the survey area; the nearest emergent coral reef at Pulau Meatimiarang (Indonesia) is about 180km north of the survey area.

Soft coral communities occur on submerged shoals and banks within the region, and some hard corals occur on more consolidated sediments. Scleractinian corals and octocorals both occur at the Sunrise Bank (Sinclair Knight Merz, 2001), located 25km north of the survey area. Coral-dominated communities at the Sunrise Bank are predominantly comprised of species adapted to deep water and low levels of light with horizontal morphologies (Sinclair Knight Merz, 2001). Near the Greater Sunrise Gas Field, reef habitat was observed between 126m and 150m water depth, including soft corals, black corals and gorgonians (Sinclair Knight Merz, 2001).

In relatively flat, soft and sandy/silty substrates, solitary hard corals may occur as well as sparse epibenthic communities containing gorgonians and soft corals.

4.4.4 Plankton

Zooplankton and phytoplankton were sampled in the Kitan Field (located approximately 190km southwest of the survey area) by Gardline (2010) in surface waters (less than 20m depth). Phytoplankton species abundances were highly dominated by the green algae chlorophyta, which consisted mainly of the genus Prasinophyte.

4.4.5 Benthic Fauna

Benthic fauna in the survey area is expected to be widely represented in the region. Across the continental shelf, the predominant animals living within seabed sediments (infauna) are polychaetes (burrowing worms) and crustaceans (such as prawns, shrimp and crabs). Epibenthic communities (animals living on or near the seabed) in deeper waters are generally low in fauna abundance and diversity, probably due to the limited sea floor topography and hard substrate. The main taxa found in these areas include sponges and gorgonians (sea whips and sea fans). While the abundance may be low, the diversity of Timor Sea shelf slope invertebrates may be high.

4.4.6 Protected Species

The IUCN Red List of Threated Species is widely recognised as the most comprehensive objective global approach for evaluating the conservation status of animal species, including marine fauna. The IUCN Red List categorises threatened species as either:

- Critically Endangered – species facing a high risk of extinction in the wild
- Endangered – species likely to become extinct, or
- Vulnerable – species likely to become endangered unless circumstances threatening its survival and reproduction improve.

IUCN listed species that may occur in the survey area, as per the available literature and data, are listed in Table 4-2. The IUCN listed species shown in Table 4-2 have been assessed for likelihood (unlikely, possible, likely) based on each species' known distribution, their habitat preferences (as in, water depths and typical distance offshore), the occurrence of those habitats within the survey area, and known observations in Timor-Leste waters.

All these animals are widely distributed oceanic species. There are no oceanographic or topographic features in the survey area that could offer special breeding or feeding habitat for these species, although it is noted the Timor Trough may be used by whales as a migratory path.

Table 4-2: Protected species that could occur in the vicinity of the survey area

Species	Common Name	Status	Habitat Summary	Potential Presence Within Survey Area
Cetaceans				
Balaenoptera musculus	Blue whale	Endangered	Open ocean, worldwide distribution. Considered to be endangered. Occasional visitor to region.	Unlikely
Balaenoptera musculus brevicauda	Pygmy blue whale	Data Deficient	Present in Indonesian waters, with the waters around Sawu Island acting as nurseries and feeding grounds. The survey area is located within the migration corridor of this species.	Possible
Physeter macrocephalus	Sperm whale	Vulnerable	Global in deep waters in all oceans and confluent seas. However, known to occur close to coasts (in water depths exceeding 200m). Native to Australia, Indonesia and Timor-Leste.	Unlikely
Balaenoptera borealis	Sei whale	Endangered	Typically found in deep offshore waters, often in temperate and subtropical regions. Prefer areas with high concentrations of plankton. Unlikely to be present in the survey area due to their preference for deeper waters.	Unlikely
Megaptera novaeangliae	Humpback whale	Least Concern	Widely distributed through the world's oceans and migrate between mating and calving grounds in tropical waters. Considered to be endangered. Known migration path not near survey area.	Unlikely
Balaenoptera edeni	Bryde's whale	Least Concern	Temperate to tropical waters, both oceanic and inshore. Occasional visitor to region.	Possible
Globicephala macrorhynchus	Short-finned pilot whale	Least Concern	Inhabit deep offshore waters, often in tropical and subtropical regions. Known to dive deep to feed on squid and other cephalopods (typically 200-1,000m). Possible presence in the survey area due to their wide distribution.	Possible

Species	Common Name	Status	Habitat Summary	Potential Presence Within Survey Area
Feresa attenuata	Pygmy killer whale	Least Concern	Found in deep tropical and subtropical waters. Tend to form small, tight-knit groups. Likely to be present in the survey area due to their habitat preferences. Typically found in depths of 200-1,000m.	Likely
Peponocephala electra	Melon-headed whale	Least Concern	Inhabit deep tropical and subtropical waters and form large pods. Often found in areas with high ocean productivity. Possible presence in the survey area due to their habitat preferences. Typically found in depths of 200-1,000m.	Possible
Ziphius cavirostris	Cuvier's beaked whale	Least Concern	Found in deep offshore waters, known for deep diving capabilities. Prefer areas with steep underwater topography, such as continental slopes and canyons. Possible presence in the survey area due to suitable habitat.	Possible
Pseudorca crassidens	False killer whale	Near Threatened	Deep offshore waters, forming large pods. Known to feed on fish and squid. Typically found in depths of 200-1,000m.	Possible
Grampus griseus	Risso's dolphin	Least Concern	Deep offshore waters, prefer areas with steep underwater topography. Known to form large pods. Typically found in depths of 200-1,000m.	Possible
Lagenodelphis hosei	Fraser's dolphin	Least Concern	Deep tropical and subtropical waters. Known to form large pods. Typically found in depths of 200-1,000m.	Possible
Tursiops truncatus	Common bottlenose dolphin	Least Concern	Tend to occur in open coastal waters of less than 200m depth. Occur in temperate and tropical waters around the world, in both coastal and offshore waters.	Possible
Steno bredanensis	Rough toothed dolphin	Least Concern	Deep tropical and subtropical waters, prefer areas with steep underwater topography. Known to form large pods. Typically found in depths of 200-1,000m.	Possible

Species	Common Name	Status	Habitat Summary	Potential Presence Within Survey Area
Stenella longirostris	Spinner dolphin	Least Concern	Deep tropical and subtropical waters. Prefer areas with high ocean productivity. Typically found in depths of 0-200m.	Possible
Stenella attenuata	Pantropical spotted dolphin	Least Concern	Deep tropical and subtropical waters, prefer areas with high ocean productivity. Known to form large pods. Typically found in depths of 0-200m.	Possible
Orcinus orca	Killer whale	Data Deficient	Found in all oceans, highly social, forming large pods. Apex predators feeding on a variety of marine animals. Typically found in depths of 0-1,000m.	Possible
Tursiops aduncus	Indo-Pacific bottlenose dolphin	Near Threatened	Inhabit coastal and offshore waters in tropical and subtropical regions. Highly social, forming large pods. Often seen near coral reefs and seagrass beds. Typically found in depths of 0-200m.	Possible
Delphinus delphis	Common dolphin	Least Concern	Found in temperate and tropical waters around the world. Likely presence in the survey area due to suitable habitat and frequent sightings in the region. Typically found in depths of 0-200m.	Possible
Manta Rays				
Mobula alfredi	Reef manta ray	Vulnerable	Found in tropical and subtropical waters, often near coral reefs. Unlikely due to preference for coral reefs.	Unlikely
Mobula birostris	Oceanic manta ray	Endangered	Inhabit open ocean waters and are known to migrate long distances. Occasionally seen in offshore waters.	Possible
Sharks				
Rhincodon typus	Whale sharks	Endangered	Found in tropical and warm temperate waters and known to migrate long distances.	Possible
Carcharhinus longimanus	Oceanic whitetip	Critically Endangered	Inhabit open ocean waters and known to be highly migratory.	Possible

Species	Common Name	Status	Habitat Summary	Potential Presence Within Survey Area
Marine Turtles				
Dermochelys coriacea	Leatherback turtle	Vulnerable	Tropical to sub-polar oceans, inhabiting pelagic marine foraging areas throughout the water column. Nesting occurs on beaches with soft sands and shallow approach angles. Known to migrate through Timor Sea.	Possible
Caretta caretta	Loggerhead turtle	Vulnerable	Broad tropical and sub-tropical distribution, occurring in proximity to coral and rocky reefs, seagrass beds and muddy bays. Widespread throughout Timor Sea waters, although no breeding in Timor-Leste.	Possible
Lepidochelys olivacea	Olive ridley turtle	Vulnerable	A wide tropical and sub-tropical distribution and moderately abundant in the region, including the Timor Sea. Nests on beaches in Timor-Leste, Indonesia and Australia.	Possible
Natator depressus	Flatback turtle	Data Deficient	Non-oceanic species nesting only in Australia, with some northern foraging areas. Found in shallow, soft-bottomed seabed habitats along the northern Australian continental shelf and away from reefs.	Possible
Chelonia mydas	Green turtle	Endangered	Tropical and subtropical waters throughout the world, including the Timor Sea. Feed in intertidal and subtidal habitats, including coral and rocky reefs, seagrass meadows, and algal turfs on sand or mud flats.	Possible
Eretmochelys imbricata	Hawksbill turtle	Critically Endangered	Found in tropical, subtropical and temperate waters in all oceans of the world. Nesting sites identified in Timor-Leste (Jaco Island and Tutuala Beach). Likely to be found foraging in habitats such as coral reef or hard bottom habitat.	Possible

Further discussion has been provided in the next subsections for all IUCN species identified above with a threatened categorisation of Vulnerable, Endangered and

Critically Endangered in addition to several other IUCN-listed species of particular note in the region. These additions include the:

- Data Deficient pygmy blue whale, given the species' known migration corridor along the Timor Trough
- Data Deficient flatback turtle, given its possible occurrence due to habitat preferences and for completeness as the only marine turtle without a threatened IUCN listing
- Least Concern crocodile, given its cultural significance in Timor-Leste.

4.4.7 Whales and Dolphins

Twenty cetacean species on the IUCN Red List have been identified as potentially occurring within the survey area. Of these, the pygmy killer whale (*Feresa attenuata*), common dolphin (*Delphinus delphis*) and the bottlenose dolphin (*Tursiops truncatus*) are likely to occur near the survey area.

4.4.7.1 Blue Whales and Pygmy Blue Whales

The IUCN Red List status for blue whales is Endangered. There are two recognised subspecies of blue whale in the southern hemisphere, both recorded in the waters surrounding Timor-Leste. These are the Antarctic (or 'true') blue whale (*Balaenoptera musculus*) and the pygmy blue whale (*Balaenoptera musculus brevicauda*). Antarctic blue whale numbers have been severely depleted by historic whaling, though numbers are slowly recovering; they are unlikely to be present in the survey area.

There is a lack of information about the number of pygmy blue whales before they were exploited, and the current total worldwide population is unknown (Commonwealth of Australia, 2015). The waters offshore of Timor-Leste are known to be a migration corridor for pygmy blue whales, with the mapped migration corridor boundary located approximately 32km northwest of the survey area. Furthermore, pygmy blue whales were observed in September and November (two and three, respectively), during the 2008 nearshore marine megafauna survey, along the north Timor-Leste coast (Dethmers et al., 2009). This confirms Timor-Leste is an important migratory corridor for pygmy blue whales in more coastal areas.

Blue whales generally migrate between warmer, lower latitude breeding grounds, where mating and calving take place during winter months, and colder, higher latitude feeding grounds in the summer months (Commonwealth of Australia, 2015). Feeding of blue whales is likely to occur in water depths of 500 to 1,000m (McCauley et al., 2004).

The waters of the survey area are outside the known pygmy blue whale migratory corridor, and the water depth of between 40 to 180m depth is shallower than the foraging water depth of 500 to 1,000m. However, given the proximity to the migration corridor and the known occurrence of pygmy blue whales in Timor-Leste waters, it is possible pygmy blue whales will be encountered within the survey area.

4.4.7.2 Sperm Whales

Sperm whales (*Physeter macrocephalus*) are found worldwide and are the largest of all the toothed whale species. Their global distribution is comparable to the killer whale, with regular observations from both polar and equatorial waters (Whitehead, 2002). The IUCN Red List status for sperm whales is Vulnerable.

Sperm whales are sighted frequently in deeper waters and form large aggregations (100-1,000 animals) in foraging grounds of high oceanic productivity (Whitehead,

2002). Female sperm whales have restricted home ranges in water deeper than 1,000m and less than 40° latitudes (Whitehead, 2002). Male sperm whales will remain with their mothers for several years until early adulthood (4-21 years), at which time they will join larger male-only herds that migrate to polar waters to feed and return to tropical and temperate waters to breed (Whitehead, 2002). No global population estimates for sperm whales are available.

The marine megafauna survey undertaken in Timor-Leste in 2008 identified a single sperm whale in the south-eastern coast (Dethmers et al., 2009). Sperm whales are known to occur close to coasts in water depths exceeding 200m, and are native to Australia, Indonesia and Timor-Leste. Considering the mostly deep-water distribution of sperm whales and the relatively shallow depths of the survey area (between 40 and 180m), it is unlikely they will be encountered.

4.4.7.3 Sei Whales

The IUCN Red List status for sei whales is Endangered. The sei whale (*Balaenoptera borealis*) has a patchy and wide-ranging distribution, favouring deep, offshore habitat more than other large whale species. During the summer they are found between latitudes of 40° to 50° south, and lower winter latitudes are unknown (Advisian, 2017). The marine megafauna survey undertaken in Timor-Leste in 2008 recorded one potential sighting of a sei whale but it was inconclusive (Dethmers et al., 2009). As they prefer higher latitudes and colder waters, it is considered unlikely that the species will be encountered in the survey area.

4.4.8 Marine Reptiles

The tropical Indo-Pacific region supports marine turtle species, six of which may be found using the waters within the survey area and surrounding shoals. Shallow shoal areas, such as the Troubadour Shoals or Sunrise Bank, can provide foraging areas, particularly for green (*Chelonia mydas*) and hawksbill (*Eretmochelys imbricata*) turtles. While these turtle species may occur, turtle numbers are unlikely to be high, given the absence of shoals within the survey area, and the distances from shorelines, internesting beaches and known foraging areas.

4.4.8.1 Leatherback Turtle

Leatherback turtles (*Dermochelys coriacea*) are listed as a Vulnerable under the IUCN Red List and are found in tropical to sub-polar oceans. Leatherback turtles inhabit pelagic marine foraging areas, throughout the water column, with nesting occurring on beaches with soft sands and shallow approach angles.

4.4.8.2 Loggerhead Turtle

Loggerhead turtles (*Caretta caretta*) are listed as Vulnerable under the IUCN Red List and are known to have a broad tropical and sub-tropical distribution, occurring near coral and rocky reefs, seagrass beds and muddy bays. Loggerhead turtles are carnivorous, feeding primarily on crustaceans and molluscs (Spotila, 2004) and are likely to be found foraging in areas that support high densities of these organisms.

4.4.8.3 Olive Ridley Turtle

Olive ridley turtles (*Lepidochelys olivacea*) are listed as Vulnerable under the IUCN Red List and are known to have a wide tropical and sub-tropical distribution. Olive ridley turtles feed on jellyfish, tunicates, sea urchins, bivalves and crabs.

4.4.8.4 Green Turtle

Green turtles (*Chelonia mydas*) are listed as Endangered under the IUCN Red List and are found in tropical and subtropical waters throughout the world. Green turtles feed in intertidal and subtidal habitats, including coral and rocky reefs, seagrass meadows, and algal turfs on sand or mud flats (Limpus, 2009).

4.4.8.5 Hawksbill Turtle

Hawksbill turtles (*Eretmochelys imbricata*) are listed as Critically Endangered under the IUCN Red List and are found in tropical, subtropical and temperate waters in all oceans of the world. Hawksbill turtles feed primarily on sponges, but also forage on cephalopods, gastropods, cnidarians, seagrass and seaweed (Carr and Stancyk, 1975; Witzell, 1983; Limpus et al., 1992; Spotila, 2004) and are likely to be found foraging in habitats that support these organisms; as in, coral reef or hard bottom habitat.

4.4.8.6 Flatback Turtle

Flatback turtles (*Natator depressus*) are listed as Data Deficient under the IUCN Red List and are found in shallow, soft-bottomed seabed habitats along the northern Australian continental shelf and away from reefs (Department of Climate Change, Energy, the Environment and Water, 2024). Flatback turtles mostly feed on soft-bodied prey, including jellyfish, soft corals and sea cucumbers, feeding in predominantly subtidal, soft-bottomed habitats.

4.4.8.7 Sea Snakes

In addition to the IUCN-listed marine turtles, sea snake species may also occur in the vicinity of the survey area; however, these are most likely to be associated with the various submerged banks and shoals outside the survey area. These include the Troubadour Shoals, the Sunrise Bank, and Margaret Harries Bank and various unnamed Timor Sea shoals.

4.4.8.8 Fish, Sharks and Rays

Fish densities are likely to be low in the open oceanic waters in which the survey area is situated. The broader area of the Timor Sea region supports pelagic fish species that are used in traditional and commercial fisheries. The region supports large populations of cartilaginous fishes such as sharks and rays. The most prolific of the sharks are the whalers, represented by at least 12 species in the region. They are common in all environments

The survey area may host various elasmobranch species, including rays and sharks. Key species expected in this region include the giant manta ray, whale shark and oceanic whitetip shark. These species are commonly found in tropical and subtropical waters and are discussed below.

4.4.8.9 Manta Ray

Manta rays consist of two individual species: the oceanic, or giant, manta ray (*Manta birostris*) and the reef, or coastal, manta ray (*Manta alfredi*). The IUCN Red List status for reef manta rays is Vulnerable, and for oceanic manta rays, Endangered.

The oceanic manta ray is the largest ray species in the world and is found in tropical marine waters worldwide and only on occasion in temperate regions (Department of Fisheries, 2011). The oceanic manta ray spends time on the surface, sometimes even

jumping out of the water, and has also been observed diving to depths of over 1,000m (Arkive, 2016). The species is a seasonal visitor to coastal and offshore sites and is commonly recorded on productive coastlines with regular upwellings, oceanic islands, and offshore pinnacles and seamounts (Marshall et al., 2009). Oceanic manta rays also visit shallow reefs to be cleaned by 'cleaner fishes' and to feed (Arkive, 2016).

The marine megafauna survey undertaken in 2008 sighted several groups of five or more oceanic manta rays in Timor coastal waters during the month of November (Dethmers et al., 2009).

Given the partly oceanic pelagic nature of the oceanic manta ray, its known distribution in tropical marine waters and observations in Timor-Leste coastal waters, it is possible the species will be encountered in the survey area.

Reef manta rays are also an oceanic pelagic species; however, typically occur in productive nearshore environments more characteristic of the coastal waters of Timor-Leste than the survey area. They typically reside near coral and rocky reefs, islands, atolls and continental coastlines (Marshall et al., 2009). As such, they are unlikely to be encountered in the survey area.

4.4.8.10 Whale Shark

The whale shark (*Rhincodon typus*) has a broad distribution in tropical and warm temperate seas, usually between latitudes 30° north and 35° south (Wilson et al., 2001; Wilson et al., 2006). The IUCN Red List status for whale sharks is Endangered. Whale sharks are highly migratory, and the species' movements are closely associated with productivity pulses, ocean circulation and water temperatures, although this is little understood. Whale shark presence coincides with the coral mass spawning period, when there is an abundance of food (krill, planktonic larvae, and schools of small fish) in the waters adjacent to the reef. Whale sharks inhabit both coastal and oceanic habitats, mostly in the epipelagic zone (Tyminsky et al., 2015) (between 0 to 200m depth).

Frequent sightings of whale sharks have been recorded in Timor-Leste during the east monsoon period from August until the beginning of the west monsoon in November (Stacey et al., 2012). According to fishers in the area, whale sharks occur regularly in the Timor Passage south of Roti Island, and also offshore Suai (south-western Timor-Leste) and in the Savu Sea between Timor and the island of Flores (Dethmers et al., 2009).

A marine megafauna survey undertaken in 2008 in Timor-Leste waters (Dethmers et al., 2009) sighted only three whale sharks in May, June and November; all sightings were recorded in the northwest near Dili. Given the known occurrence of whale sharks in Timor-Leste waters, and the depths of the survey area, it is possible whale sharks will be encountered within the survey area.

4.4.8.11 Oceanic Whitetip Shark

The oceanic whitetip (*Carcharhinus longimanus*) has a widespread distribution in tropical and subtropical oceans (Young et al., 2017), usually far offshore in epipelagic waters (0 to 200m) and most typically in surface waters. The oceanic whitetip has also been recorded at depths of 1,082m (Bonfil et al., 2008; Tolotti et al., 2015; Weigmann, 2016).

The IUCN Red List status for oceanic whitetip sharks is Critically Endangered. Given the widespread distribution of the oceanic whitetip, the oceanic environment and water depths of the survey area, it is likely the species will be encountered.

4.4.9 Birds

Bird life in the vicinity of the survey area is limited, given the oceanic environment. A large variety of seabird species is expected to migrate across the region or forage within the coastal waters of the Timor Sea, including numerous species migrating between Australia and the northern hemisphere. Shoreline species may pass through these areas during migrations or enter for short periods during foraging.

Migratory shorebird species found at the Nino Konis Santana National Park (167km northwest of the survey area) may migrate through the survey area. These may include species listed as Threatened under the IUCN Red List, including the Endangered far eastern curlew (*Numenius madagascariensis*), the Endangered great knot (*Calidris tenuirostris*) and the Vulnerable sharp-tailed sandpiper (*Calidris acuminata*) (Avibase, 2024).

4.4.10 Conservation Areas

There are no marine National Parks or marine protected areas within the survey area, as shown in Figure 4-3. There are, however, marine protected areas within the greater region, including five designated or proposed marine protected areas in Timor-Leste waters. The closest marine protected area in Timor-Leste waters is the Nino Konis Santana National Park, located approximately 167km northwest of the survey area on the eastern tip of Timor-Leste (Figure 4-3). Two designated marine protected areas are located on the northern coast of Timor-Leste, northwest of the survey area. These are the Batugadé Marine Natural Reserve (342km to the northwest, in western Timor-Leste) and the Suco de Vila Marine Natural Reserve (315km to the northwest, on the eastern coast of Atauro Island). There are also two proposed marine protected areas on the north coast of Timor-Leste. These are the proposed Lamsanak and Behau marine protected areas, located 252km and 270km to the northwest respectively (Figure 4-3, Table 4-3).

The nearest protected area is the Oceanic Shoals Australian Marine Park, located approximately 19km southeast of the survey area.

The nearest marine key biodiversity areas, as shown in Figure 4-3, are Perairan Nino Konis Santana (Timor-Leste), 167km north of the survey area, Perariran Kepulauan Lemola (Indonesia), 175km north, Sungai Klere (Timor-Leste), 225km northwest, and Tiwi Islands and Seagull Island (Australia), 250km and 204km southeast respectively.

Protected areas in the region and all designated and proposed marine protected areas in Timor-Leste are summarised in Table 4-3.

Table 4-3: Summary of protected areas in the greater region

Name	Type of Protected Area	Distance to Survey Area (km)	Direction
Oceanic Shoals	Australian Marine Park	19.6	South-east
Nino Konis Santana National Park	National Park	167.2	North-west
Lagoa Maurei no Alafalu	Protected Area	178.2	North-west
BeMatanIrabere	Protected Area	187.3	North-west
Monte Legumau	Protected Area	190.6	North-west
Monte Burabo'o	Protected Area	191.7	North-west
Monte Matebian	Protected Area	198.5	North-west
Monte Builo	Protected Area	202.1	North-west
Monte Laretame	Protected Area	216.9	North-west
Monte Cutete	Protected Area	217.3	North-west
Ribeira de Clere	Protected Area	228.1	North-west
Lagoa Modomahut	Protected Area	228.1	North-west
Monte Bibileo	Protected Area	232.9	North-west
Monte Aitana	Protected Area	234.7	North-west
Lagoa Welenas	Protected Area	234.7	North-west
Makfahik	Protected Area	236.4	North-west
SamikSaron	Protected Area	243.0	North-west
Monte Diatuto	Protected Area	250.3	North-west
Lamsanak	Proposed Marine Protected Area	252.1	North-west
Monte Kuri	Protected Area	265.4	North-west
Lagoa BikanTidi	Protected Area	270.4	North-west
Parke Nasional Kay Rala Xanana Gusmão	National Park	270.7	North-west
Behau	Proposed Marine Protected Area	278.5	North-west
Area Mangal Metinaro	Protected Area	281.8	North-west
Monte Tatamailau	Protected Area	285.0	North-west
Area Mangal Hera	Protected Area	289.4	North-west
Cristo Rei Protected Area	Protected Area	294.7	North-west
Monte Lakus/Sabi	Protected Area	294.7	North-west
Suco de Vila	Marine Nature Reserve	314.9	North-west
Batugadé	Marine Nature Reserve	341.9	North-west

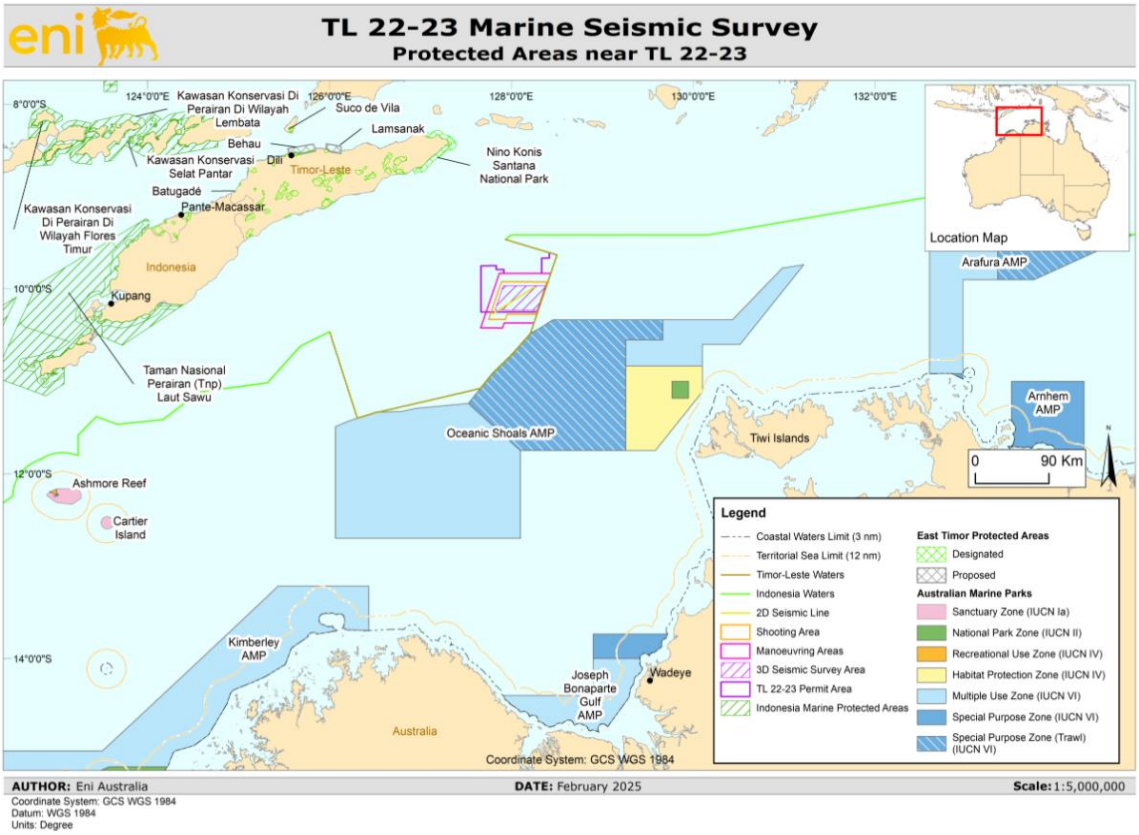


Figure 4-3: Protected areas near the survey area

4.5 Socio-economic and Cultural Environment

4.5.1 Indigenous Heritage

Due to the remote offshore location, there are no Indigenous heritage sites within, or in the immediate vicinity of, the survey area. Any unknown Indigenous heritage sites or artefacts of significance are considered unlikely.

4.5.2 Non-Indigenous Heritage

There are no national heritage sites or areas of archaeological significance within, or in the immediate vicinity of, the survey area.

4.5.3 Fisheries

Local (Indonesian and Timorese) fishers traditionally fish in the Timor Sea. Fishing occurs from April to December, with most activity in September and October. Fishing is typically concentrated in the vicinity of Hibernia Reef, approximately 520km southwest of the survey area in Australian waters. The nearest reef at which local fishing may occur is Pulau Meatimiarang (Indonesia), located 180km north of the survey area.

Fishing vessel activity from 2020 (Office for Coastal Management, 2024) indicates fishing vessels may occur within the survey area (Figure 4-4). However, substantial activity is not expected, given the offshore location of the survey area and lack of suitable fishing grounds.

Illegal fishing activities have been reported in Timor-Leste waters. These activities may involve destructive methods such as fish aggregating devices, explosives or poisons,

which pose significant threats to marine ecosystems. Given the offshore location and lack of suitable fishing grounds, substantial activity is not expected in the survey area.

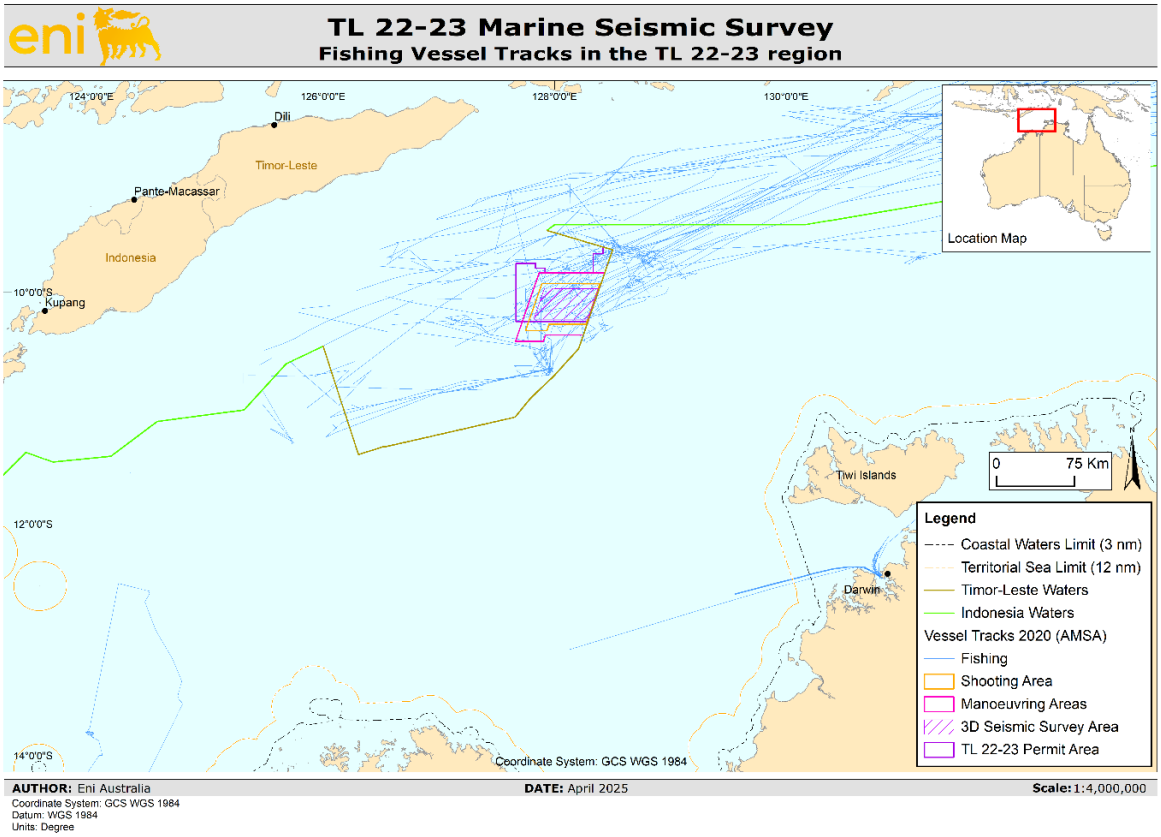


Figure 4-4: Fishing vessel tracks in relation to the survey area

4.5.4 Tourism and Recreational Activities

The survey area is in offshore waters that are not accessed for tourism activities (recreational fishing and boating and charter boat operations). These tend to be focused on islands, nearshore waters and coastal areas.

4.5.5 Ports and Commercial Shipping

Shipping traffic close to the survey area is anticipated to be infrequent. The main shipping routes relevant to the survey area are predominantly northwest to southeast routes linking Darwin and Wyndham in Australia with ports in Southeast Asia (Figure 4-5). The routes accommodate various vessels, including vessels supporting offshore oil and gas operations situated to the west and east of the survey area.

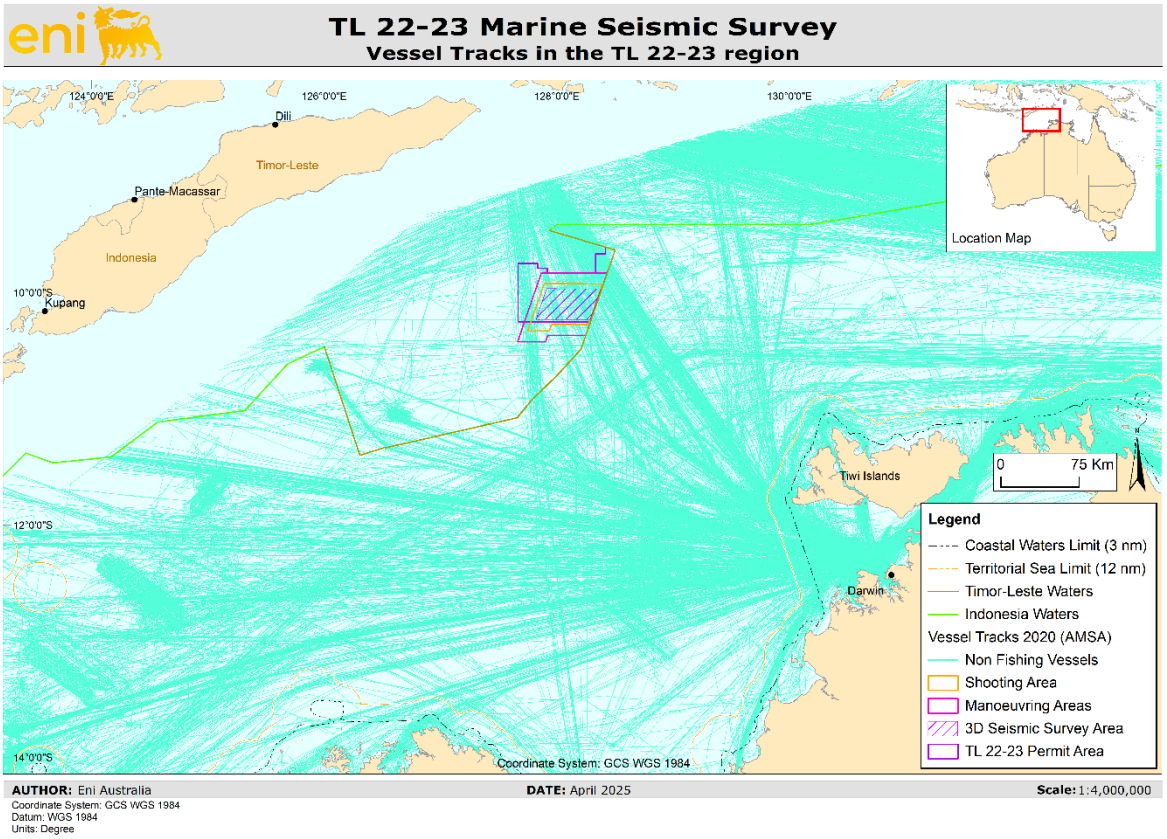


Figure 4-5: Vessel tracks in relation to the survey area

4.5.6 Hydrocarbon Exploration and Operations

The undeveloped Sunrise-Troubadour Gas Field is located to the north of the survey area within blocks JPDA 03-19 (operator TIMOR GAP Greater Sunrise 03-19 Unipessoal Lda, 62.33%) and NT/RL2 (operator Woodside Energy Ltd, 35%), which are directly adjacent to PSC TL-SO 22-23. Eight exploration and appraisal wells were drilled on the Sunrise-Troubadour Field between 1974 to 2008. The closest offset wells to the north are Troubadour-1 and Bard-1, which are located approximately 10km from the boundary of PSC TL-SO 22-23. The closest exploration well in the south is Sikatan-1/ST1, which is positioned approximately 75m south of the PSC boundary in TL 19-16. Exploration well Jura-1 is 4km from the western boundary of PSC TL-SO 22-23 in open acreage; the Eni-operated Blackwood Gas Discovery in NT/RL8 is 30km to the east of the survey area in Australian waters. The seismic survey vessel will not be required to enter JPDA 03/19 or NT/RL2 for vessel manoeuvring when acquiring seismic data.

There is currently no production close to PSC TL-SO 22-23 in either Timor-Leste or Australian waters. The Santos-operated Bayu-Undan Development (about 150km to the southwest) is currently the only producing facility in the region. Immediately south of PSC TL 22-23 is TL 19-16, operated by SundaGas. TL 19-16 contains the undeveloped Chuditch Gas Discovery. The seismic vessel will be required to enter TL 19-16 as part of vessel manoeuvring. Approximately 4km of 2D seismic data will also be acquired within TL 19-16 to fully image the Sikatan-1ST well location. There is also a contingent option for acquiring an extra ~35km² of 3D seismic data over the Sikatan-1/ST1 well location, in addition to the firm 2D seismic line.

Eni will obtain the necessary approvals to enter and carry out manoeuvring and acquisition operations within TL 19-16. Eni is in direct contact with SundaGas with regards to 2025 operational activity for both companies, and will maintain dialogue to ensure there are no adverse impacts to operations in the survey area.

4.5.7 Key Infrastructure Installations

There are no infrastructure installations within the survey area. Key infrastructure in the region is shown in Figure 4-6.

The nearest infrastructure installations include offshore oil and gas pipelines, including the Bayu-Undan to Darwin pipeline (approximately 150km south) and the Barossa export pipeline (approximately 205km east). Santos's Bayu-Undan Development (about 150km to the southwest) is currently the only producing facility in the region. The closest oil and gas well to the survey area is Sikatan-1/ST1 exploration well, immediately south of the permit boundary (Figure 4-6). The nearest fibre optics cable was installed in 2024 and is located 55km west of the survey area (Figure 4-7).

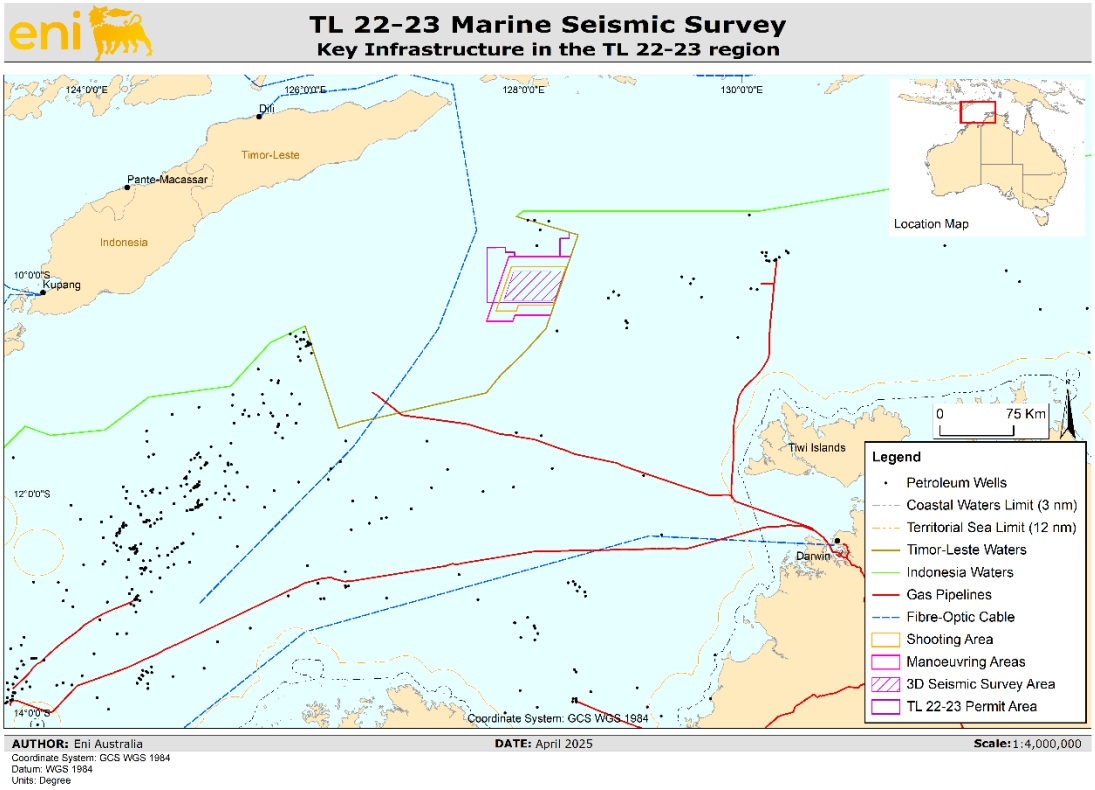
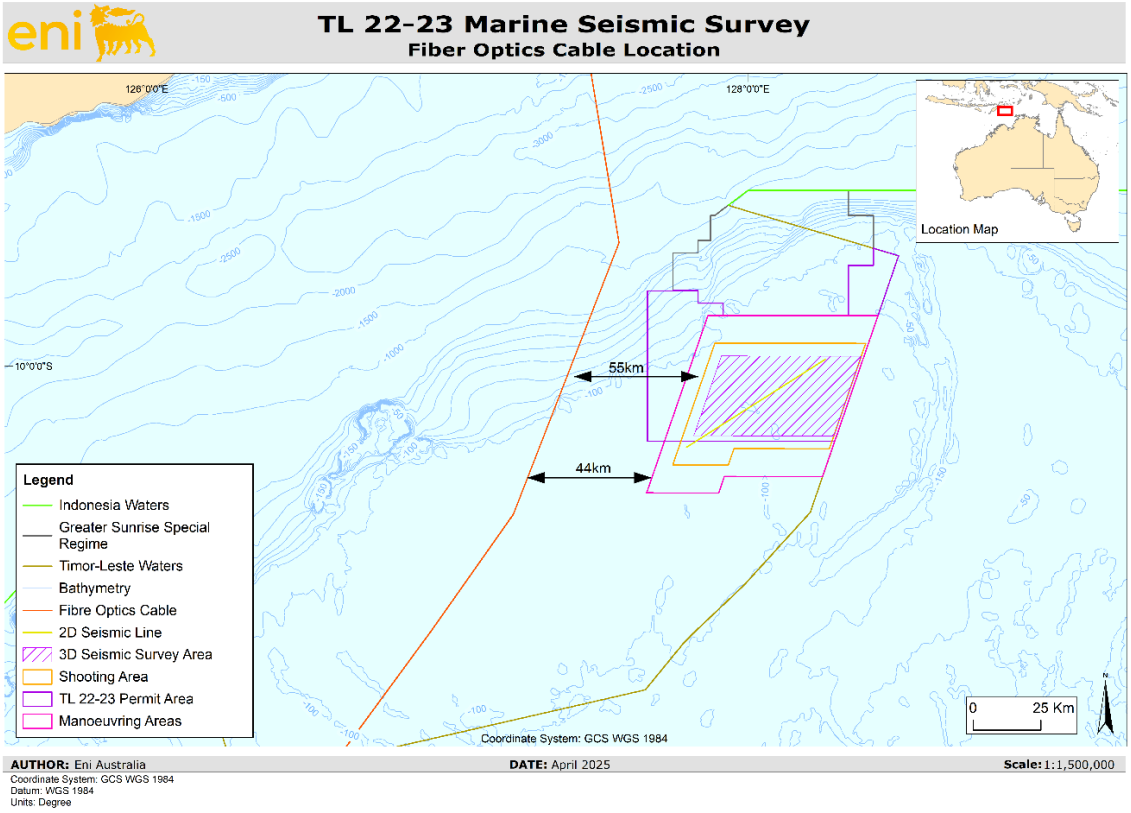


Figure 4-6: Key infrastructure in relation to the survey area



Source: submarine cable map, 2024

Figure 4-7: Fibre optics in relation to the survey area

5 ENVIRONMENTAL RISK ASSESSMENT

5.1 Environmental Risk Assessment Methodology

5.1.1 Risk Assessment

Eni has implemented its Health, Safety and Environment (HSE) Risk Management and Hazard Identification Procedure (ENI-HSE-PR-001). The purpose of the procedure is to ensure the HSE, asset and reputational hazards are identified, risk-assessed and managed in a systematic and consistent way. In this way, risks associated with projects and operational changes are effectively managed and addressed in compliance with company and legislative requirements.

The procedure is based on Eni's philosophy that to manage environmental risks is to eliminate or mitigate the risk during the planning phase. Managing risks through design is contingent upon identifying, at an early stage in the survey activity, the sources, and pathways by which environmental impacts can occur and the sensitivities of the receiving environment in which the survey activity is situated. Where risks and impacts are unable to be eliminated at the planning phase, the HSE Risk Management and Hazard Identification Procedure provides a robust framework that must be applied to understand the residual risk and impact from the key survey activity covered in this EMP.

The procedure is consistent with the Australian Standard for Risk Management: ISO 31000:2018 Risk Management – Principles and Guidelines and ISO 14001:2015 Environmental Management Systems. A general outline of the formal risk management process is provided in Figure 5-1.

Under Article 134(1) of Decree Law No. 32/2016 of Offshore Petroleum Operations, environmental risks must be managed in accordance with applicable law and to as low as reasonably practicable (ALARP).

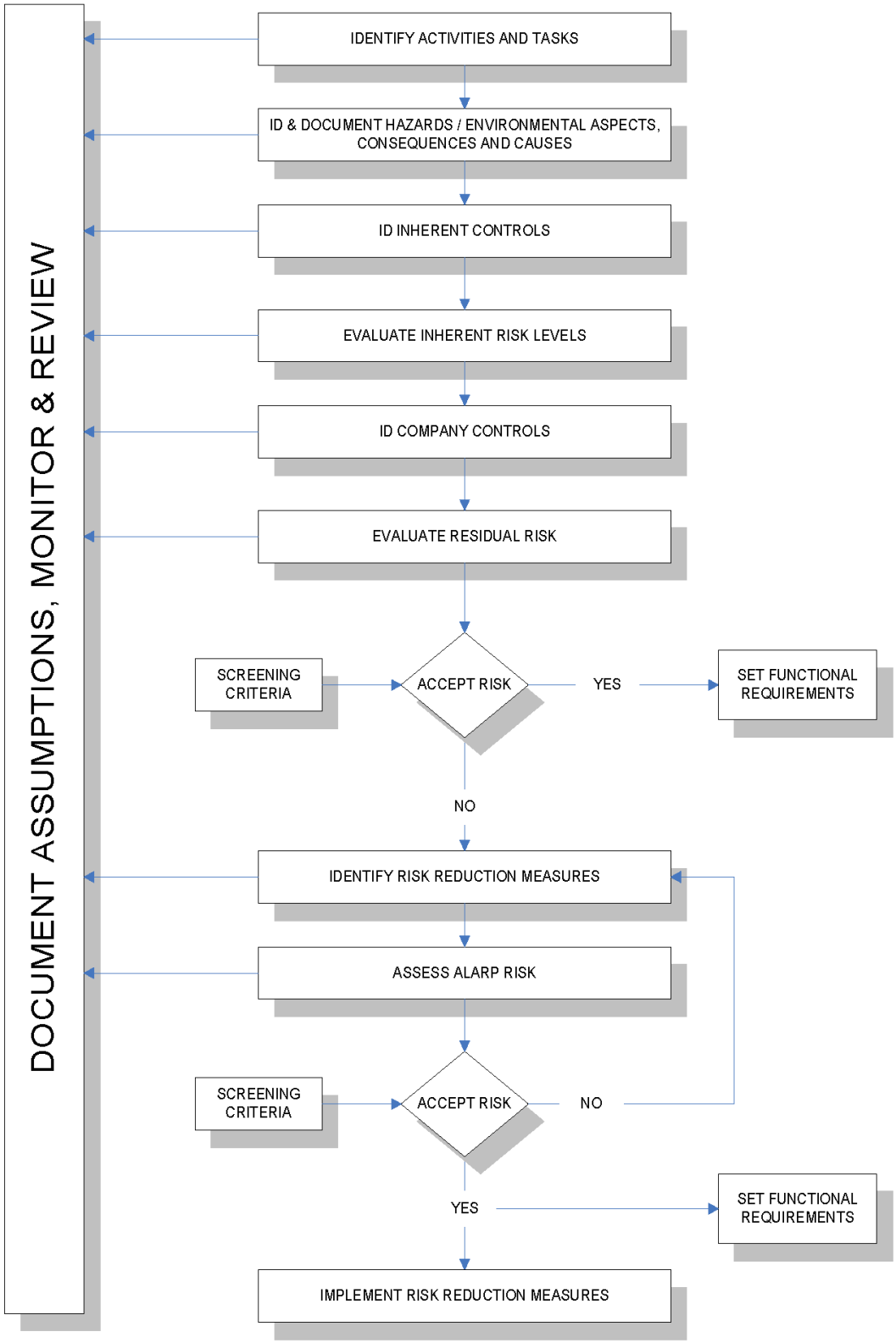


Figure 5-1: Overview of the risk management process

Before starting a systematic risk assessment process, it is essential to ensure the context of the risk assessment (why, when, who, what, where) is fully understood. This is achieved by:

1. identifying activities and tasks for the survey activity, the sources of impact and risk, and the associated environmental aspects
2. identifying activities and tasks for the survey activity, the sources of impact and risk, and the associated environmental aspects identifying environmental values and sensitivities within and adjacent to the survey area and the environment that may be affected.

Using that information, the process continues by:

3. defining the potential environmental effects (impacts and risks) the aspects identified in Step 1 may have on the values identified
4. identifying the potential environmental consequences and severity of the impact (Table 5-1)
5. identifying the likelihood of occurrence of the consequence, according to a six-level scale (Table 5-2)
6. evaluating overall environmental risk levels using the Eni environmental risk matrix (Figure 5-2)
7. identifying mitigation measures, assigning management actions, and further recommending risk reduction measures according to the hierarchy of controls (Table 5-3), with consideration of the risk management actions (Table 5-4), to reduce the risk to an acceptable level.

Inherent risk levels assume inherent controls are in place. Residual risk levels are based on the inherent controls and the application of additional risk reduction measures.

Table 5-1: Environmental consequence descriptors

Descriptor	Description
(1) Slight	No stakeholder impact **OR** temporary impact on the area. Involved area is less than 0.1 square mile. Spill is less than 1m³ – no sensitive impact on ground. Small discharges with confined and temporary impact on the area. No noticeable impact on water, air, soil and biodiversity. Negligible impact due to GHG emissions. Good materials, energy and water selection and use. Negligible financial consequences.
(2) Minor	Some local stakeholder concern or less than one week for clean-up **OR** one year for natural recovery **OR** impact on a small number of uncompromised species. Involved area is less than 1 square mile. Spill is less than 10m³ – impact on localised ground. Sufficiently large discharges to impact the environment, but no long-lasting effect. Short term, localised impact on water, air, soil and biodiversity (on a limited number of non-threatened species). Slight impact due to GHG emissions. Adequate materials, energy and water selection and use. Single breach of statutory or prescribed limit, or single complaint.

Descriptor	Description
(3) Local	Regional stakeholder concern **OR** one to two years for natural recovery **OR** one week for clean-up **OR** threatening to some species or impact on protected natural areas. Involved area less than 10 square miles. Spill is less than 100m³. Limited discharges affecting the neighbourhood and damaging the environment with longer effects. Short-term, more widespread impact on water, air, soil and biodiversity (on a higher number of non-threatened species). Limited impact due to GHG emissions. Inadequate materials, energy and water selection and use. Repeated breaches of statutory or prescribed limit, or many complaints.
(4) Major	National stakeholder concern **OR** impact on licences **OR** two to five years for natural recovery **OR** up to five months for clean-up **OR** threatening to biodiversity or impact on internesting areas for science. Involved area is less than 100 square miles. Spill is less than 1,000m³. Large discharges with severe and long-lasting environmental damage. Medium-term, widespread impact on water, air, soil and biodiversity (on some threatened species or one ecosystem function). Extensive measures (financially significant) required to restore the impacted area. Significant impact due to GHG emissions. Poor materials, energy and water selection and use. Extended breaches of statutory or prescribed limits, or widespread nuisance.
(5) Extensive	International stakeholder concern **OR** impact on licences and acquisitions **OR** more than five years for natural recovery **OR** less than five months for clean-up **OR** reduction of biodiversity **OR** impact on special conservation areas. Involved area is greater than 100 square miles. Spill is greater than 1,000m³. Large discharges with severe and persistent environmental damage. Long-term, broad-scale impact on water, air, soil and biodiversity (likely permanent species loss and impact on ecosystem function). Very poor materials, energy and water selection and use. Extensive impact due to GHG emissions. Major financial consequences for the company. Ongoing breaches well above statutory or prescribed limits.

Table 5-2: Likelihood scale

ID	Likelihood	Frequency (occurrence per year)	Description
0	Non-credible	<10-6 occ/y	Theoretically possible but not known or reasonably expected to have occurred in the exploration and production industry
A	Rare	10-6 ≤ occ/y < 10-4	Known or reasonably expected to have occurred in the exploration and production industry under similar circumstances
B	Unlikely	10-4 ≤ occ/y < 10-3	Known or reasonably expected to have occurred in company under similar circumstances
C	Possible	10-3 ≤ occ/y < 10-1	Known or reasonably expected to have occurred in the company more than once under similar circumstances
D	Likely	10-1 ≤ occ/y < 1	Known or reasonably expected to have occurred in the company more than once a year under similar circumstances
E	Almost certain	≥1 occ/y	Known or reasonably expected to have occurred at the considered location, more than once a year under similar circumstances

Table 5-3: Hierarchy of controls

Control Category	Description
Elimination	The causes of the hazardous event are removed such that it is no longer credible it will occur
Substitution (alternatives)	Replace with a less hazardous substance or method; for example, use a wet method instead of dry and introduce a non-dusting powder for one that is friable
Engineering (plant and equipment)	Physical controls; for example, containment, exhaust ventilation, mechanical aids
Procedural (signage, warnings or administrative)	Human controls; for example, supervision, work methods, housekeeping, personal hygiene, information, instruction and training
Personal protective equipment	In all cases, use of personal protective equipment should be considered as the only barrier **only** when control measures within the above categories are not practicable

Table 5-4: Risk management actions

Risk Rating	Significance	Risk Management Actions
Low (green)	Continuous improvement	The level of risk is broadly acceptable and generic control measures are required, aimed at avoiding deterioration[1].
Medium (yellow)	Risk reduction measure	The level of risk can be tolerable only once a structured review of the risk reduction measures has been performed; where necessary, the relevant guidance from the local authorities should be adopted for application of ALARP. ALARP is a concept that applies well to personnel and environmental risk. Asset risk is often most easily judged on a basis of costs and benefits alone.
Medium-High (orange)	Risk reduction measure	The level of risk can be tolerable only once a structured review of the risk reduction measures has been performed; where necessary, the relevant guidance from the local authorities should be adopted for application of ALARP. ALARP is a concept that applies well to personnel and environmental risk. Asset risk is often most easily judged on a basis of costs and benefits alone[2].
High (red)	Intolerable risk	The level of risk is not acceptable and risk control measures are required to lower the risk to another level of significance.

Note 1: The exception to the appropriate risk management actions for the Low risks are where a low risk to people is identified on the matrix position A3, then risk reduction measures are required.

Note 2: The exception to the appropriate risk management actions for Medium-High risk is the case of a 4B risk where the impact is on third parties onshore and is considered intolerable.

Consequence					Likelihood or Annual Frequency					
Severity	Company Reputation	People (Health & Safety)	Environment	Assets / Project	0 - Non credible / Could happen in E&P industry (Freq <10-6 /y)	A - Rare / Reported for E&P industry (Freq 10-6 to 10-4 /y)	B - Unlikely / Has occurred at least once in Company (Freq 10-4 to 10-3 /y)	C - Credible / Has occurred several times in Company (Freq 10-3 to 10-1 /y)	D - Probable / Happens several times per year in Company (Freq 10-1 to 1 /y)	E - Frequent / Several times per year at one location (Freq >1 /y)
1	**1**-Slight impact	**1**-Slight health effect / injury	**1**-Slight effect	**1**-Slight damage	**Low**	**Low**	**Low**	**Low**	**Low**	**Low**
2	**2**-Minor impact	**2**-Minor health effect / injury	**2**-Minor effect	**2**-Minor damage	**Low**	**Low**	**Low**	**Medium**	**Medium**	**Medium**
3	**3**-Local impact	**3**-Major health effect / injury	**3**-Local effect	**3**-Local damage	**Low**	**Low**	**Medium**	**Medium - High**	**High**	**High**
4	**4**-National impact	**4**-PTD or single fatality	**4**-Major effect	**4**-Major damage	**Low**	**Medium**	**Medium - High**	**High**	**High**	**High**
5	**5**-International impact	**5**-Multiple fatalities	**5**-Extensive effect	**5**-Extensive damage	**Medium**	**Medium - High**	**High**	**High**	**High**	**High**

Figure 5-2: Eni environmental risk matrix

5.1.2 Risk Reduction

Impacts or risks identified as requiring additional controls – the application of mitigation and management measures beyond what is standard practice for offshore petroleum activities – are subject to further review to identify the controls that must be provided or modified to reduce the residual risk.

Risk assessment is an iterative process of:

- identifying a risk
- assessing a risk
- deciding whether residual risk is tolerable
- if not tolerable, generating a new risk or mitigation measures
- assessing the effectiveness of the mitigation measures.

The acceptability of a risk, after controls and mitigation measures have been applied, is determined in accordance with ratings and associated management actions outlined in Table 5-4.

5.1.3 Risk Identification Workshops

An environmental hazard identification (ENVID) workshop was held on 19 September 2024 by Eni to identify and manage the environmental impacts and risks that may credibly arise from the survey activity. The ENVID workshop was attended by representatives from Eni's exploration and environment teams along with environmental consultants from Worley Consulting.

The environmental impacts and risks were assessed during the ENVID workshop using the methodology within the Eni HSE Risk Management and Hazard Identification Procedure (ENI-HSE-PR-001).

5.2 As Low As Reasonably Practicable and Acceptance Criteria

5.2.1 As Low As Reasonably Practicable Criteria

The ALARP principle recognises that no industrial activity is entirely risk free. ALARP is defined as a level of impact and risk that is not unacceptable and cannot be reduced further without expending costs that are disproportionate to the benefit gained. Cost may be in terms of financial, health, safety and schedule implications.

For risks to be reduced to ALARP, the criteria that must apply are:

- there are no reasonably practicable alternatives to the activity, or
- the cost (as in, sacrifice) for implementing further measures is disproportionate to the reduction in risk.

When deciding whether risks are managed to ALARP, the items considered were:

- risk level
- existing layers of protection, including both preventive and mitigative controls
- feasibility of additional controls or alternative arrangements
- practicality of additional controls or alternative arrangements

- cost of additional controls or alternative arrangements
- effectiveness of additional controls or alternative arrangements
- impact on risks from additional controls or alternative arrangements.

5.2.2 Acceptance Criteria

Eni considers a range of factors when evaluating the acceptability of environmental impacts associated with its activities. This evaluation is outlined in Table 5-5.

Table 5-5: Eni acceptability factors

Demonstration of Acceptability	
Compliance with Legal Requirements, Laws and Standards	Considers the legal aspect, particularly compliance with applicable legislative prescriptions and regulations in force which imply specific procedures to be performed by the Titleholder to control the environmental aspect.
Policy Compliance	The risk or impact must be compliant with the objectives of Eni policies.
Social Acceptability	Considers the 'social' aspects that can alter stakeholder perception of the Titleholder's commitment regarding the safeguard and protection of the environment and that can cause serious harm to the Titleholder's public image.
Area Sensitivity/ Biodiversity	The proposed risk or impact controls, management control measures and environmental performance standards must be consistent with the nature of the receiving environment.
Ecologically Sustainable Development Principles	The overall activity is consistent with principles of ESD.
ALARP	There is a consensus among the risk assessment team that risks, or impacts are ALARP.

6 ROUTINE ACTIVITIES

6.1 Interaction with Other Marine Users (Risk ID P1)

6.1.1 Summary of Environmental Risk

Hazard	Interaction with Other Marine Users		
	Frequency	Severity	Risk
Inherent Risk	E	1	L
Residual Risk	B	1	L

6.1.2 Description of Hazard

The presence of the seismic, chase and support vessels ('survey vessels') and the streamers and associated seismic equipment have the potential to interact with fishers and, to a lesser extent, commercial shipping.

High levels of fishing are not expected within the survey area; however, local Timorese and Indonesian fishers, including traditional fishing vessels and equipment, may be encountered within or pass through the survey area (Section 4.5.3). Commercial shipping traffic may infrequently pass through the survey area (Section 4.5.5).

Illegal fishing activities have been reported in Timor-Leste waters. These activities may involve destructive methods such as fish aggregating devices, explosives or poisons, which pose significant threats to marine ecosystems. Given the offshore location and lack of suitable fishing grounds, substantial activity is not expected in the survey area.

The survey vessels will be required to enter the northern part of TL 19-16 (operated by SundaGas) as part of the 2D seismic data acquisition and during vessel manoeuvring and line turns. Eni will obtain the necessary approvals to enter and carry out manoeuvring and acquisition operations within TL 19-16. Eni is in direct contact with SundaGas with regards to 2025 operational activity for both companies, and will maintain dialogue to ensure there are no adverse impacts to operations in the survey area.

6.1.3 Potential Environmental Impact

Low levels of traditional and subsistence fishing from Timor-Leste and Indonesia may occur within the survey area, resulting in potential impacts to traditional fishers. The presence of the survey vessels and the seismic streamer array may result in the temporary displacement of traditional fishing vessels and the need to alter fishing operations. The presence of the seismic streamer equipment may also result in the entanglement of fishing equipment, such as nets, lines and fish aggregating devices. Entanglement in the seismic streamers may result in damage to fishing and seismic equipment, inconvenience, and delay due to the need to disentangle equipment. Temporary displacement, damage or entanglement of equipment and delays to fishing activities may result in reduced income for fishers.

The seismic vessel will typically move along planned seismic lines at a consistent speed of approximately 4.5 knots, and will proactively manage operational information with other operators and fishers active in the survey area. In addition, due to the nature of the survey activity, the vessels will only occupy a portion of the survey area at any time.

The limited manoeuvrability of the seismic vessel means fishers may be asked to take measures to avoid the seismic vessel and towed equipment. Some commercial shipping vessels may also be asked to deviate from their intended route to avoid interaction.

Fishing vessels are expected to easily and actively avoid the survey vessels. Streamers and vessels will be marked with visual aids and Fishery Liaison Officers (FLOs) will be onboard the support and chase vessels to communicate with fishers as required. As such, the impact of the survey activity on fishers is considered to be minimal, temporary, and localised to the immediate vicinity of the survey vessels and streamers.

Given the low levels of shipping traffic and the use of navigation lighting and aids, minimal impacts to commercial shipping are expected.

Illegal fishing activities have been reported in Timor-Leste waters. These activities may involve destructive methods such as fish aggregating devices, explosives or poisons, which pose significant threats to marine ecosystems. Given the offshore location and lack of suitable fishing grounds, substantial activity is not expected in the survey area. Support/chase vessels may be used to deter non-survey activity vessels from the survey area, as well as identify debris and fish aggregating devices.

Transboundary impacts are not anticipated as the survey activity will be confined to within Timor-Leste waters. The likelihood of impacts to other marine users, including vessels crossing into or out of Australian waters, is considered low. Consequently, no cumulative impacts are expected.

6.1.4 Management Control Measures

Standard control measures (CMs) relating to this risk include:

- Navigation lighting and aids in accordance with the COLREGS and Chapter V of SOLAS.
- Support and chase vessels will have FLOs onboard who are Bahasa and Tetum speakers. Support and chase vessels will have a communication sheet in Bahasa and Tetum, with key survey information to be provided to fishers encountered during the survey activity.
- Stakeholder engagement.
- Streamers marked with tail buoys.
- Support/chase vessels used to deter non-survey activity vessels from the survey area, as well as identify debris and fish aggregating devices.
- Support/chase vessels will be able to identify, tow and recover fishing equipment and debris.

No additional control measures were adopted. Evaluation of additional control measures is provided in Table 6-1.

6.1.5 As Low As Reasonably Practicable Demonstration

Vessels are essential for conducting the survey activity. Due to the remote nature of the survey area, interactions with recreational and tourism activities are not expected. Potential impacts on commercial fishing activities are also expected to be slight.

Fishers from Indonesia and Timor-Leste traditionally fish in the Timor Sea, primarily in the vicinity of Hibernia Reef, located approximately 520km southwest of the survey area in Australian waters. Another potential fishing area is Pulau Meatimiarang (Indonesia), located 180km north of the survey area. Indigenous fishing activities typically occur from April to December, with peak activity in September and October. While active fishing is unlikely within the survey area, Indigenous fishing vessels may transit through the region.

Several control measures have been implemented to minimise risks and ensure compliance with maritime safety regulations. Engineering controls, such as navigation lighting and aids, are maintained in accordance with the COLREGS and Chapter V of SOLAS. These measures are mandatory and impose negligible operational costs, ensuring the survey vessels remain visible to other marine users.

Administrative controls have also been adopted, including ongoing stakeholder engagement to notify relevant parties of upcoming operations and potential disruptions to their activities. Markings on the tail buoy will serve as a critical control measure to indicate the presence of the towed seismic streamer. In compliance with the COLREGS, the tail buoy will be fitted with reflective tape, lights and a radar reflector. An Automated Identification System (AIS) transponder will also be installed to enhance visibility, allowing commercial marine users with AIS receivers to detect the end of the towed streamer.

Other additional control measures (Table 6-1) were considered but rejected due to minimal environmental benefit. Given these implemented controls, the residual risk associated with vessel interactions is assessed as slight and the impact of vessel operations in the survey area is deemed to be ALARP.

Table 6-1: Demonstration of 'as low as reasonably practicable' for interaction with other users

Control Type	Control/ Management	Evaluation	Adoption?
Eliminate	Eliminate the use of survey vessels	The survey vessels cannot be eliminated without compromising the capability of Eni to complete the survey activity. Completion of the survey activity is a requirement of the PSC. Interactions between vessels and other maritime traffic cannot be completely avoided; however, the risk remains low due to the limited vessel activity in the survey area.	No
Substitute	N/A	N/A.	N/A
Engineering	Navigation lighting and aids in accordance with COLREGS and Chapter V of SOLAS	Navigation lighting and aids are a requirement under COLREGS and Chapter V of SOLAS. Negligible costs of operating navigational equipment.	Yes (standard CM)
Isolation	N/A	N/A.	N/A
Administrative	Stakeholder engagement	Benefits outweigh negligible costs. Important control to ensure other marine users are aware of upcoming operations and potential business disruptions.	Yes (standard CM)
	Support/chase vessels used to deter non-survey vessels from survey area	Ensures safe operations by preventing interactions between the survey vessels and third-party marine users.	Yes (standard CM)
	FLOs onboard vessels	Acts as a point of contact between the survey activity and stakeholders, ensuring clear	Yes (standard CM)

Control Type	Control/ Management	Evaluation	Adoption?
		communication and reducing the likelihood of conflicts. Their presence enhances compliance and stakeholder cooperation.	
	Markings on tail buoy	Under COLREGS, all possible measures need to be taken to indicate the presence of a towed object. Tail buoy indicates the end of the towed streamer and will be fitted with markings to indicate its presence/location. Markings will include reflective tape, lights and radar reflector. An AIS transponder will be fitted to the tail buoy to allow for detecting the end of the streamer by commercial marine users with AIS receiving capabilities.	Yes (standard CM)

6.1.6 Acceptability Demonstration

Demonstration of Acceptability	
Compliance with Legal Requirements, Laws, Standards	Vessels compliant (where applicable) with standard maritime safety/navigation procedures, including COLREGS and Chapter V of SOLAS.
Policy Compliance	The management is aligned with Eni policies and standards.
Social Acceptability	The survey area is not within an area of known shipping or high fishing activity.
Area Sensitivity/ Biodiversity	There are fauna species that are protected under international agreements that could occur in the survey area. However, these are widely distributed oceanic species and there is no particular seabed, oceanographic or topographic features in or near the survey area that could offer special breeding or feeding habitat for these species.
ESD Principles	The impact assessment presented throughout this section demonstrates compliance with the principles of ESD.
ALARP	The residual risk has been demonstrated to be ALARP.

6.2 Underwater Noise – Seismic Source (Risk ID P2)

6.2.1 Summary of Environmental Risk – Seismic Survey

Hazard	Underwater Noise – Seismic Source		
	Frequency	Severity	Risk
Inherent Risk	E	3	H
Residual Risk	B	3	M

6.2.2 Description of Hazard

The survey activity will use a seismic source, consisting of an airgun array with a maximum capacity of 3,500in³, towed at a water depth of 8m. The source will be used to generate acoustic pulses by periodically discharging compressed air into the water column at an interval of approximately eight seconds, as the vessel transits along planned survey lines within the survey area.

A 3,480in³ seismic source is expected to produce far-field horizontal source levels of up to a maximum of 248.8dB re 1µPa m (peak, or 'PK') and per-pulse sound exposure level (SEL) of 199.6 (JASCO, 2024).

6.2.2.1 Underwater Noise Modelling Methodology

Underwater sound will be generated by the seismic source, general vessel activities (including engine sound and operation of thrusters), and helicopter movements during crew transfers or medical evacuations.

To assess the potential magnitude and extent of impacts from underwater noise produced by the survey activity, Eni commissioned JASCO Applied Sciences (JASCO) to model sound propagation within the survey area. The objective of this acoustic modelling study was to evaluate the potential effects of sound (potential injury and behavioural disruption) to marine fauna, including cetaceans, marine reptiles, fishes, and zooplankton from the seismic array.

The modelling study considered a 3,480in³ seismic source in a triple array with 96m cross-line separation. JASCO's specialised Airgun Array Source Model was used to predict the acoustic signature and spectra for the seismic source. The Airgun Array Source Model accounts for individual airgun volumes, airgun bubble interactions and array geometry to yield accurate source predictions.

Two scenarios were considered (Figure 6-1):

- Scenario 1 accounted for 1,566 impulses during the approximately 18.6-hour period of acquisition within the 24-hour scenario, inclusive of run-ins and run-outs.
- Scenario 2 accounted for 1,641 impulses during the approximately 19.2-hour period of acquisition within the 24-hour scenario, inclusive of run-ins and run-outs.

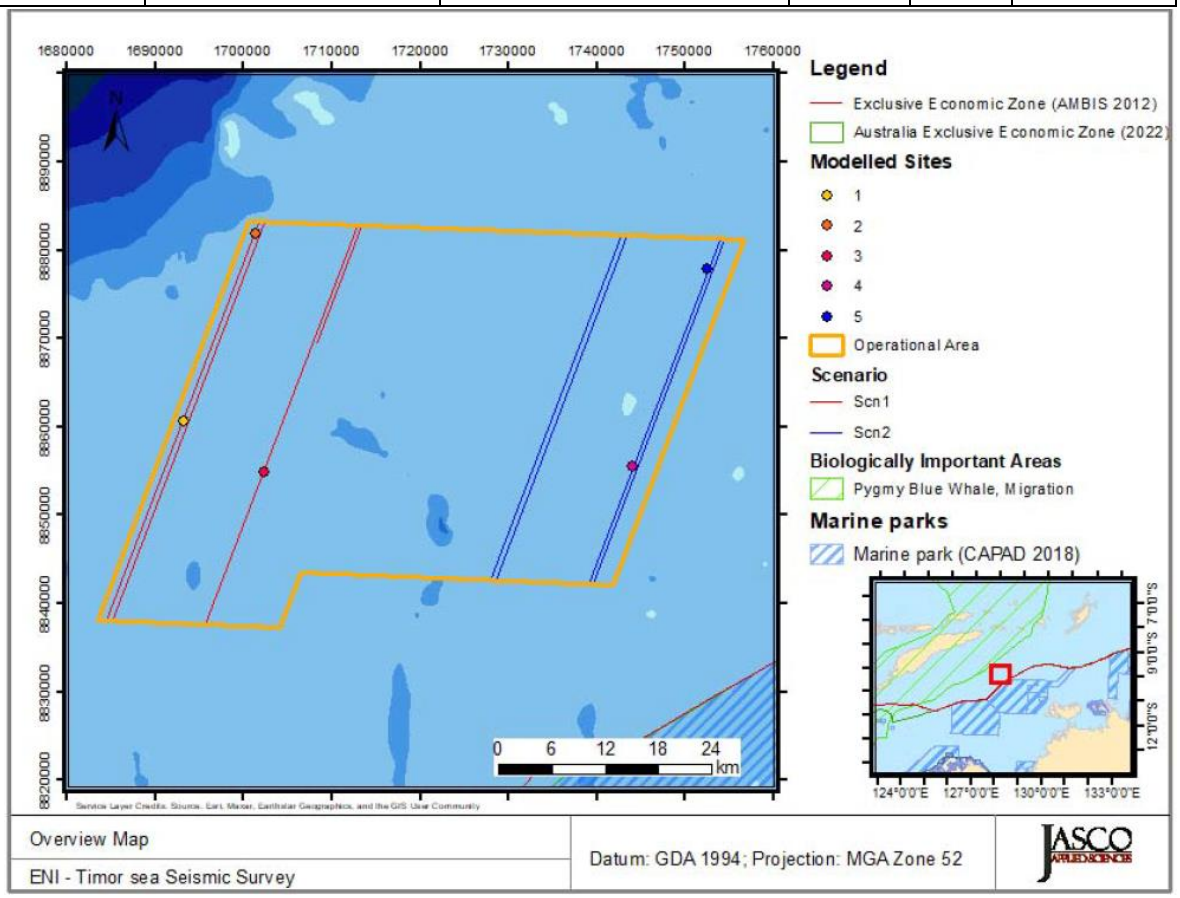


Figure 6-1: Overview map of considered seismic shooting area for the SEL_{24h} Scenario 1 and 2

Complementary underwater acoustic propagation models were used in conjunction with the array signature to estimate sound levels, considering site-specific environmental influences. Single-impulse sound fields were predicted at five sites within the proposed survey area (Table 6-2), and accumulated sound exposure fields were predicted for two representative scenarios for likely survey operations over 24 hours. A conservative sound speed profile, one that would be most supportive of sound propagation conditions for the potential survey period, was defined and applied throughout.

The modelling methodology considered source directivity and range-dependent environmental properties. Estimated underwater acoustic levels are presented as sound pressure levels (SPL, L_p), zero-to-peak pressure levels (PK, L_{pk}), and either single-impulse (as in, per-pulse) or accumulated sound exposure levels (SEL, L_E) as appropriate for different noise effect criteria. The duration period for cumulative SEL is defined as a 24-hour period over which sound energy is integrated; the level is specified with the abbreviation SEL_{24h}.

It should be noted that due to the cumulative 24-hour exposure level of the SEL_{24h} metric, there is an assumption that the receiver, such as a marine animal, remains in a fixed position throughout this timeframe. However, in reality, marine mammals, fish and sea turtles are unlikely to stay in one location for an entire 24-hour period, especially if the habitat is not location-specific. Their movement patterns, influenced by behaviour and the proximity and movement of the noise source, mean they would typically be exposed to these noise levels for shorter durations. Consequently, the reported radius for SEL_{24h} criteria does not imply that marine fauna within this radius will necessarily experience impairment. Instead, it indicates an animal could be exposed to sound levels that might cause permanent or temporary threshold shifts if it were to

remain in that location for 24 hours. This understanding helps in more accurately assessing the potential impact of noise on marine fauna.

Table 6-2: Location details for the single impulse modelled sites

Site	Latitude	Longitude	MGA[1] Zone 52		Water Depth (m)
			X (m)	Y (m)	
1	-10.12615	127.83066	371887	8880410	87
2	-9.9348202	127.89688	379072	8901593	96
3	-10.174505	127.91383	381018	8875094	75
4	-10.155547	128.28654	421843	8877304	78
5	-9.9556026	128.35561	429366	8899428	76

[1] *Map Grid of Australia (MGA).*

6.2.2.2 Thresholds

To evaluate the potential effects of underwater noise, it is essential to establish exposure criteria that determine the levels of sound that may negatively impact animals. Permanent threshold shift (PTS) occurs when an animal experiences lasting injury to its hearing organs. This type of hearing loss is irreversible and can result in prolonged exposure to loud noise or sudden intense sound. Temporary threshold shift (TTS) occurs when the receptor hair cells in the cochlea become fatigued due to exposure to loud sounds. This causes a temporary reduction in hearing sensitivity that usually returns after a period of rest. Without proper mitigation measures, the impulsive sound from seismic sources has the potential to cause permanent (PTS) or temporary (TSS) threshold shifts in hearing, as well as behavioural disturbances in marine fauna.

Mammals

To better understand these impacts to marine mammals, the U.S. National Oceanic and Atmospheric Administration (NOAA, 2019) and U.S. National Marine Fisheries Service (NMFS, 2024) established specific thresholds to determine the distances within which various sound levels can affect marine mammals of different hearing groups (Table 6-3).

Table 6-3: Acoustic effects of impulsive noise on marine mammals; unweighted sound pressure level, SEL24h and peak thresholds

Hearing Group	NOAA (2019)	NMFS (2024)			
	Behaviour	PTS Onset Thresholds*		TTS Onset Thresholds*	
	SPL (L_p; dB re 1µPa)	Weighted SEL_{24h} ($L_{E,24h}$; dB re 1µPa²·s)	PK (L_{pk}; dB re 1µPa)	Weighted SEL_{24h} ($L_{E,24h}$; dB re 1µPa²·s)	PK (L_{pk}; dB re 1µPa)
Low frequency	160	183	222	168	216
High frequency		193	230	178	224
Very high frequency		159	202	144	196
Otariid seals		185	230	170	224
Phocid seals		183	223	168	217

$L_{E,24h}$ denotes cumulative sound exposure over a 24-hr period and has a reference value of 1µPa2s.

L_{pk} denotes peak sound pressure is flat weighted or unweighted and has a reference value of 1µPa.

L_p denotes sound pressure level and has a reference value of 1µPa.

[*] *Dual metric acoustic thresholds for impulsive sounds: Use whichever results in the largest isopleth for calculating PTS and TTS onset.*

Sea Turtles

Due to limited data about sea turtles' responses to acoustic exposure and the absence of studies on hearing loss from loud sounds, Popper et al. (2014) suggested using thresholds for fish with poor hearing as a conservative estimate for sea turtles. Finneran et al. (2017) revised these thresholds, noting that sea turtles, with their best sensitivity at low frequencies and poor auditory sensitivity, likely have TTS and PTS thresholds similar to fish rather than marine mammals. McCauley et al. (2000) observed that caged green and loggerhead sea turtles exhibited increased swimming activity at received levels above 166dB re 1µPa (SPL) and erratic behaviour above 175dB re 1µPa, indicating agitation. The Recovery Plan for Marine Turtles in Australia (2017) acknowledges the 166dB re 1µPa SPL as a level that may elicit a behavioural response, with 175dB re 1µPa recommended as a criterion for behavioural disturbance. These thresholds are shown in Table 6-4.

Table 6-4: Acoustic effects of impulsive noise on sea turtles: unweighted sound pressure level, 24-hour sound exposure level, and peak pressure thresholds

Effect Type	Criterion	SPL (L_p; dB re 1µPa)	Weighted SEL_{24h} ($L_{E,24h}$; dB re 1µPa²·s)	PK (L_{pk}; dB re 1µPa)
Behavioural response	McCauley et al. (2000)	166	NA	
Behavioural disturbance		175		
PTS onset[1]	Finneran et al. (2017)	NA	204	232
TTS onset[1]			189	226

[1] *Dual metric acoustic threshold for impulsive sounds: Use whichever results in the largest isopleth for calculating PTS and TTS onset.*

L_p denotes sound pressure level and has a reference value of 1µPa.

L_{pk} denotes peak sound pressure is flat weighted or unweighted and has a reference value of 1µPa.

$L_{E,24h}$ denotes cumulative sound exposure over a 24-hr period and has a reference value of 1µPa2s.

Sharks, Fish and Plankton

Susceptibility to injury from noise exposure in fish varies significantly based on the presence and role of the swim bladder in hearing. Different thresholds have been proposed for fish without a swim bladder (such as sharks and rays), fish with a swim bladder not used for hearing, fish that use their swim bladders for hearing, and fish eggs and fish larvae generally accepted to represent plankton (Popper et al., 2014). Table Table 6-5 presents the relative accepted thresholds from Popper et al. (2014).

Table 6-5: Criteria for seismic noise exposure for fish, adapted from Popper et al. (2014)

Type of Animal	Mortality and Potential Mortal Injury	Impairment			Behaviour
		Recoverable Injury	TTS	Masking	
Fish: No swim bladder (particle motion detection)	>219dB SEL_{24h} or >213dB PK	>216dB SEL_{24h} or >213dB PK	>>186dB SEL_{24h}	(N) Low (I) Low (F) Low	(N) High (I) Moderate (F) Low
Fish: Swim bladder not involved in hearing particle motion detection)	210dB SEL_{24h} or >207dB PK	203dB SEL_{24h} or >207dB PK	>>186dB SEL_{24h}	(N) Low (I) Low (F) Low	(N) High (I) Moderate (F) Low
Fish: Swim bladder involved in hearing (primarily pressure detection)	207dB SEL_{24h} or >207dB PK	203dB SEL_{24h} or >207dB PK	186dB SEL_{24h}	(N) Low (I) Low (F) Moderate	(N) High (I) High (F) Moderate
Fish eggs and fish larvae (relevant to plankton)	>210dB SEL_{24h} or >207dB PK	(N) Moderate (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low

Peak sound pressure level: dB re 1µPa; SEL_{24h} dB re 1µPa²·s.

All criteria are presented as sound pressure even for fish without swim bladders since no data for particle motion exist.

Relative risk (high, moderate, low) is given for animals at three distances from the source defined in relative terms as near (N), intermediate (I), and far (F)

6.2.2.3 Modelling Results

This section presents the modelling results for sound fields in terms of SEL accumulated over 24 hrs of survey activity, for the two modelled scenarios (Section 6.2.2.1). Frequency-weighted SEL_{24h} sound fields were used to estimate the maximum distances (R_{max}) to marine mammal (cetacean) and turtle permanent threshold shift (PTS) and temporary threshold shift (TTS) thresholds (listed in Table 6-6) and to estimate maximum distance and the area to injury and TTS guidelines for fish (Table 6-7).

The SEL_{24h} sound fields are presented as contour maps for the two modelled scenarios for cetaceans and turtles (Figure 6-2 and Figure 6-3) and fish (Figure 6-4 and Figure 6-5). The maps present the unweighted SEL_{24h} in 10dB steps, as well as the isopleths corresponding to thresholds or guidelines for which R_{max} was greater than 20m.

Table 6-6: Maximum-over-depth distance (km) to frequency-weighted 24-hour sound exposure thresholds for permanent and temporary threshold shift for marine mammals and sea turtles for the 3,480in³ array.

Hearing Group	Threshold for SEL_{24h} ($L_{E,24h}$; dB re 1µPa2.s)	Scenario 1		Scenario 2	
		R_{max} (km)	Area (km²)	R_{max} (km)	Area (km²)
PTS					
Low-frequency cetaceans	183	2.82	425.65	3.08	469.44
High-frequency cetaceans	193	-	-	-	-
Very high-frequency cetaceans	159	0.16	1.44	0.16	2.07
Sea turtles	204	0.16	1.44	0.16	2.07
TTS					
Low frequency cetaceans	168	42.12	5462.88	44.99	4770.23
High-frequency cetaceans	178	0.16	1.44	0.16	2.07
Very high-frequency cetaceans	144	0.58	122.68	0.58	133.88
Sea turtles	189	1.22	226.45	1.23	233.16

$L_{E,24h}$ denotes cumulative sound exposure over a 24-hr period and has a reference value of 1µPa2s.

Dash indicates the threshold was not reached within the limits of the modelling resolution (20m).

Table 6-7: Distances to 24-hour sound exposure level based fish criteria in the water column for 3,480in³ array

Hearing Group	Threshold for SEL_{24h} ($L_{E,24h}$; dB re 1µPa2.s)	Scenario 1		Scenario 2	
		R_{max} (km)	Area (km²)	R_{max} (km)	Area (km²)
Mortality and Potential Mortal Injury					
Fish: no swim bladder	219	0.15	1.3	0.15	1.41
Fish with swim bladder not involved in hearing, fish eggs and fish larvae	210	0.16	1.44	0.16	2.07
Fish with swim bladder involved in hearing	207	0.15	1.44	0.16	2.07
Fish Recoverable Injury					
Fish: no swim bladder	216	0.15	1.3	0.16	1.58
Fish with swim bladder involved and not involved with hearing	203	0.17	1.31	0.18	6.56
Fish TTS					
All fish	186	4.96	921.21	4.98	851.05

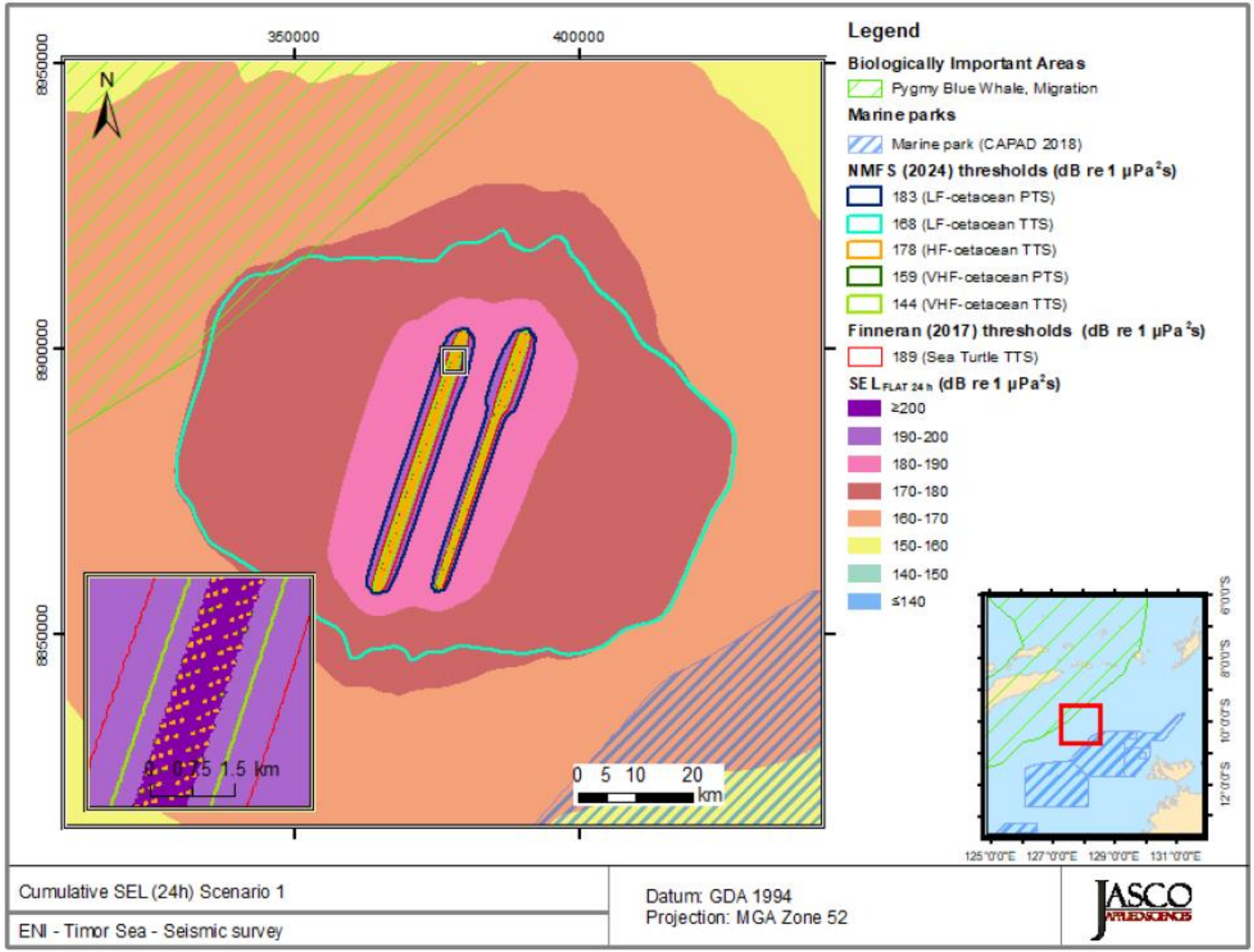


Figure 6-2: Scenario 1, SEL_{24h} sound contour map for cetaceans and turtles

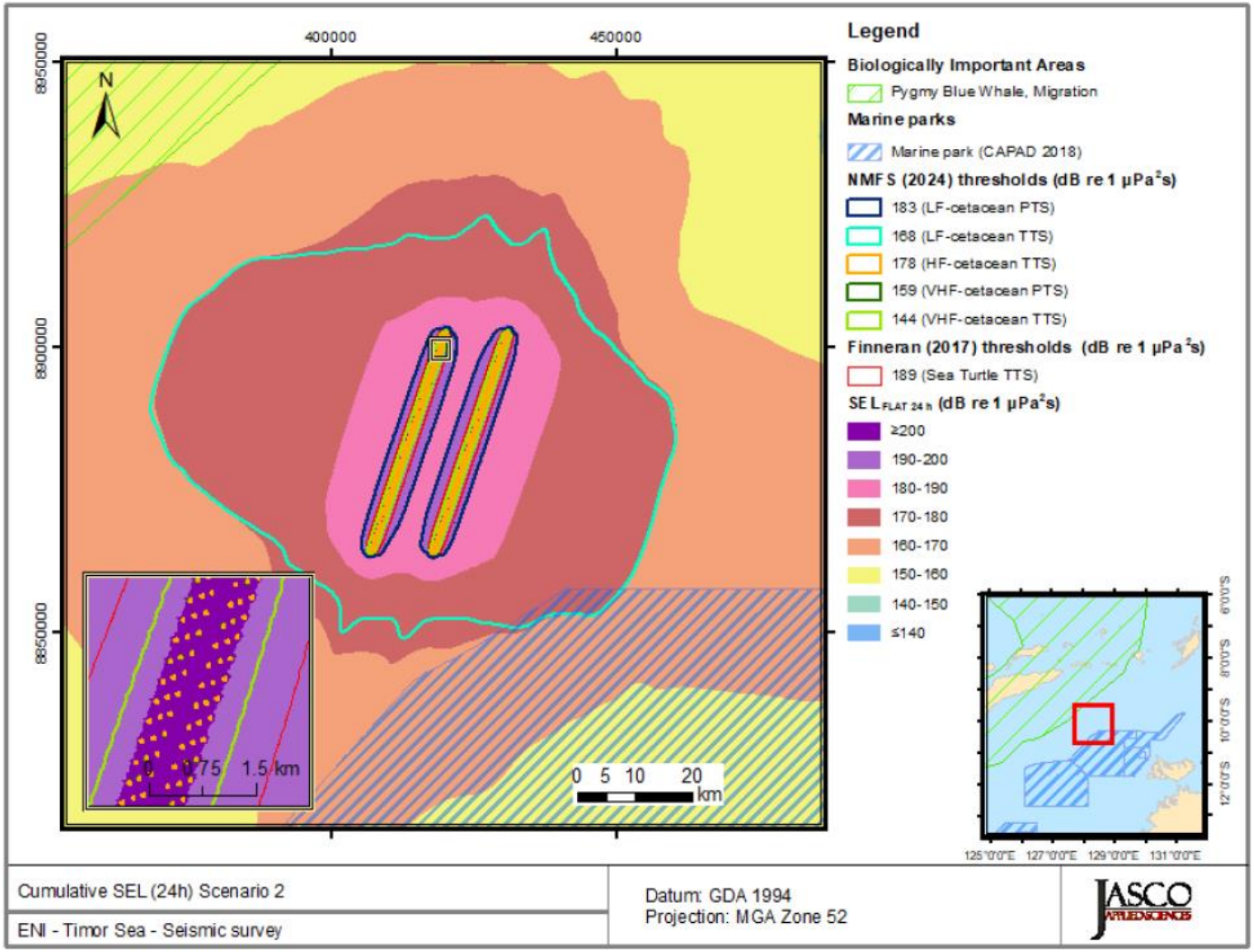


Figure 6-3: Scenario 2, SEL_{24h} sound contour map for cetaceans and turtles

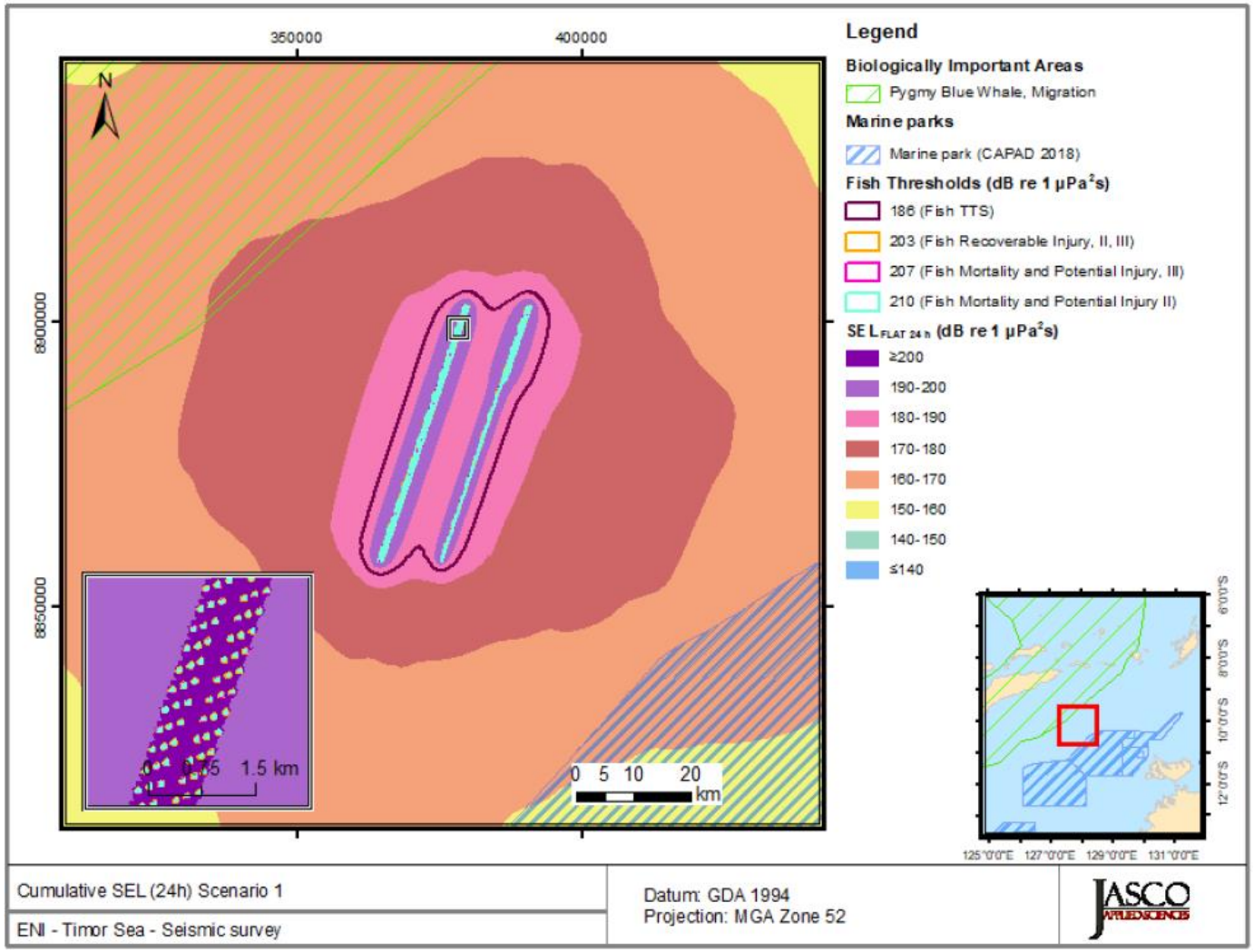


Figure 6-4: Scenario 1, SEL_{24h} sound contour map for fish

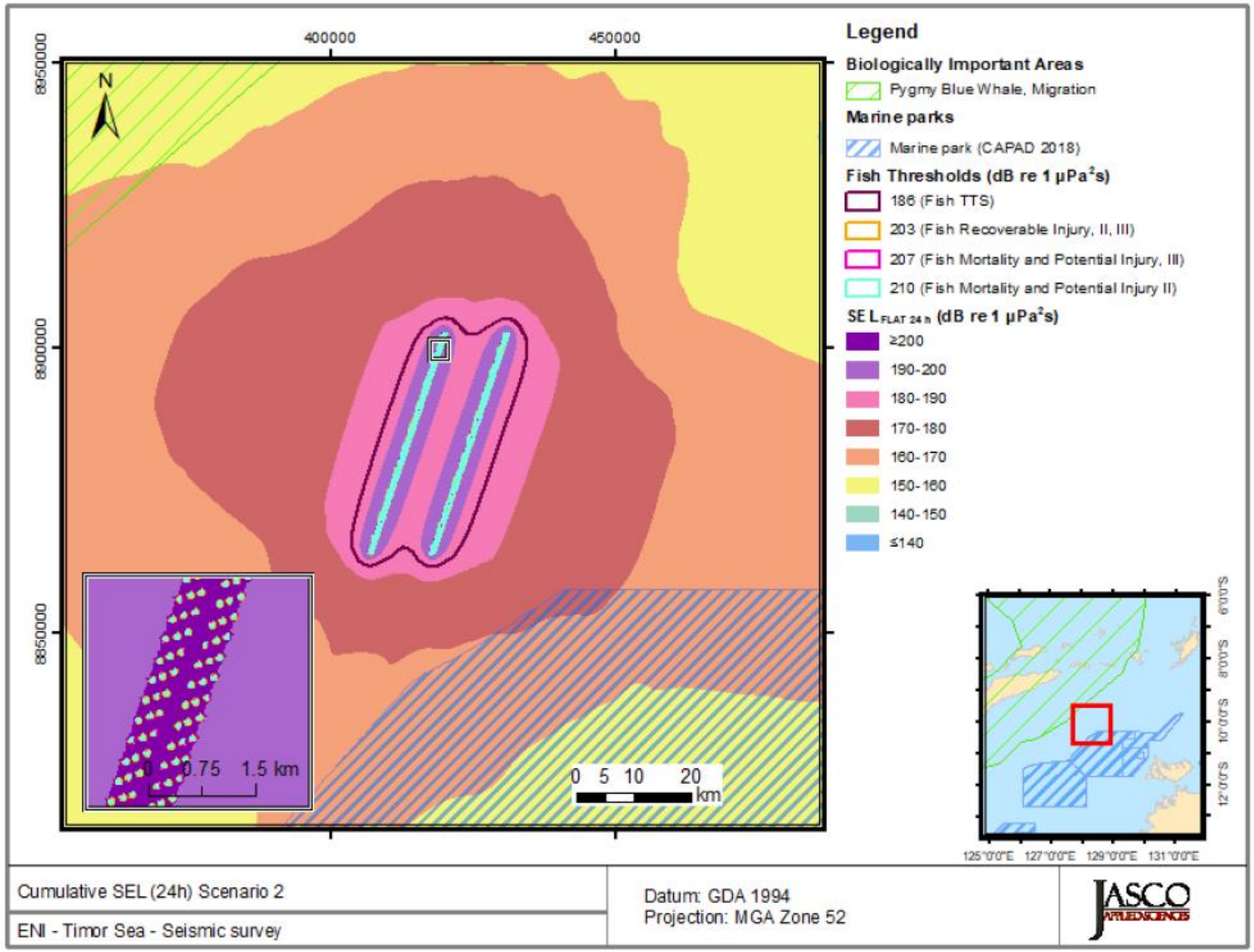


Figure 6-5: Scenario 2, SEL_{24h} sound contour map for fish

6.2.3 Potential Environmental Impact

Underwater noise that is produced from seismic surveys can cause lethal and non-lethal physiological injury to marine organisms (Gordon et al., 2003).

Seismic sound is characterised by high energy pulses of low frequency sound. The frequency of the sound produced from each seismic pulse is primarily less than 2kHz, with the highest levels at frequencies in the range of 10-500Hz (McCauley, 1994). While seismic pulses can travel long distances due to their high intensity and low frequency, the rate of sound attenuation from the seismic source depends on local characteristics like water temperature, salinity, depth, bathymetry and benthic community (McCauley, 1994).

The area over which seismic sound may adversely impact marine species depends upon multiple factors, including the extent of sound propagation relative to the location of receptors, and the sensitivity and range of spectral hearing of different species (Slabbekoorn et al., 2010; Popper and Hawkins, 2012).

The potential impacts and risks of seismic noise has been assessed, with controls proposed to reduce the impacts and risks, for the receptor categories of:

- marine mammals
- marine turtles
- sharks, rays and fish
- plankton, fish eggs and larvae
- benthic invertebrates
- cross-border impacts
- potential cumulative impacts.

6.2.3.1 Marine Mammals

Marine mammals, particularly cetaceans, rely heavily on sound for essential life functions such as individual recognition, socialising, detecting predators and prey, navigation, and reproduction (Weilgart, 2007; Erbe et al., 2015; Erbe et al., 2018). Underwater noise from seismic surveys can significantly impact these animals by interfering with their communication (masking), causing behavioural changes, shifting hearing thresholds, and inducing physical damage and stress (Erbe, 2012; Rolland et al., 2012). Exposure to high-intensity underwater noise at close range can lead to both lethal and sublethal physiological effects, including tissue damage similar to decompression sickness, hearing impairment and chronic stress (Gordon et al., 2003).

Thirteen cetaceans were identified as potentially occurring within the survey area, as presented in Table 4-2. Among these species, the pygmy killer whale (*Feresa attenuata*), common dolphin (*Delphinus delphis*) and the bottlenose dolphin (*Tursiops truncatus*) were identified as likely to occur near the survey area. These species fall within the high-frequency hearing group (Southall et al., 2019). The maximum horizontal distance (R_{max}), the distance to which the TTS or PTS thresholds could be met for each cetacean hearing group, are summarised within Table 6-8.

Table 6-8: Summary of maximum horizontal distance (R_{max}) for behavioural response thresholds, and thresholds for permanent and temporary threshold shift for marine mammals

Hearing Group	Maximum Modelled Distance to Effect Threshold (R_{max})		
	Behavioural Response (km)[1]	Impairment (km): PTS	Impairment (km): TTS
Low frequency cetaceans	10.60	3.08 (SEL_{24h})	44.99 (SEL_{24h})
High frequency cetaceans		-	0.16 (SEL_{24h})
Very high frequency cetaceans		0.54 (SEL_{24h})	0.90 (SEL_{24h})
Pinnipeds		0.18 (SEL_{24h})	3.07 (SEL_{24h})
Otariids		0.15 (SEL_{24h})	0.18 (SEL_{24h})

Noise exposure criteria: [1] NMFS (2024)

Dash (-) indicates the sound threshold was not reached within the limits of the modelling resolution (20m).

For high-frequency cetaceans, the modelling results indicate that while TTS may occur within 0.16km of the seismic source, the risk of PTS is minimal due to the noise levels not exceeding the PTS threshold within the modelled area (Table 6-6). This suggests high-frequency cetaceans are unlikely to suffer permanent hearing damage from the survey activity. However, the predicted behavioural impacts at distances up to 10.6km highlight the potential for disturbance to these species, which could affect their foraging, communication and other critical behaviours.

Low-frequency cetaceans, such as blue whales and other baleen whales, are at risk of PTS within 3.08km of the seismic noise source, and TTS could occur within 44.99km (Table 6-6 and Table 6-8). Pygmy blue whales, which are known to migrate within 32km of the survey area, are therefore at risk of TTS and PTS (Figure 6-2 and Figure 6-3).

Seismic noise could cause disruptions to their migration routes, feeding and communication behaviours. Exposure to high levels of noise can impair their hearing, affecting their ability to communicate and navigate. However, low-frequency cetaceans are highly mobile and capable of moving away from the noise source, reducing the likelihood of prolonged exposure and significant impacts.

Given the proposed controls, including observation, soft-start and shutdown procedures implemented in accordance with JNCC Guidelines (Section 0), the risk of TTS and PTS is reduced. Additional mitigation and management control measures to further reduce potential impacts are presented in Section 0. These strategies significantly reduce the likelihood of use of the seismic source close to marine mammals.

Based on the absence of critical habitats for any species of cetacean (as in, feeding, breeding, calving) or a constricted migratory pathway within the survey area, and the control measures in place, predicted noise levels from seismic acquisition are not considered likely to cause injury (PTS/TTS) effects to cetaceans that may be transiting through the survey area. The potential impacts of noise emissions from the seismic source on cetaceans during acquisition of survey data are considered to be unlikely and most likely limited to temporary behavioural changes (avoidance) in individuals, therefore residual risk has been rated as Medium.

6.2.3.2 Marine Turtles

High-intensity impulsive sounds emitted from seismic sources have the potential to impact marine turtles in several ways. These impacts include mortal or potential mortal injury to marine turtles at very close range to the seismic source, permanent or

temporary hearing impairment (recoverable injury, TTS, or masking) at close range, and behavioural disturbances. Marine turtles, while less sensitive to noise than marine mammals due to the absence of an external hearing organ, can detect sound through bone-conducted vibrations in the skull, with their shell acting as a receiving surface (Lenhardt et al., 1985). The threshold criteria for assessing the impact of noise on sea turtles has been derived from the widely accepted studies conducted by McCauley et al. (2000) and Finneran et al. (2017).

Six sea turtle species or species habitat were identified as potentially occurring within the survey area (Table 4-2). However, no biologically important areas or nearby island nesting sites have been identified. Five of these species generally inhabit shallower coastal waters, making their presence in the deeper offshore waters of the survey area improbable (Whiting et al., 2008; Limpus et al., 2008). The leatherback turtle, which is adapted to deeper pelagic environments, may occasionally be encountered due to its ability to dive to significant depths. However, a recent study by Hazel et al. (2024) reported few observations of leatherbacks in the Timor Sea, indicating their presence in the survey area is infrequent.

Modelling results indicate the high-intensity impulsive noise from the seismic airgun array may have significant impact to marine turtles. Behaviour responses, such as changing swimming patterns or avoidance behaviours, can occur up to 5.01km from the seismic source (Table 6-9). More pronounced behaviours are expected within 1.99km at an SPL of 175dB re 1uPa. These disturbances can disrupt normal activities, such as foraging and migration, potentially affecting the turtles' overall health and survival.

Modelling predicts that turtles could experience TTS within 1.23km SEL_{24h}. This temporary impairment may hinder the turtles' ability to detect predators, prey, and navigate their environment. The potential for PTS, a lasting injury to hearing, is predicted within 0.16km based on SEL_{24h} (Table 6-9). This irreversible damage can have long-term consequences on the turtles' ability to survive. Despite these risks, turtles are highly mobile and likely to move away from the noise source, which would reduce their exposure and the severity of these impacts. Therefore, while the potential for hearing impairment exists, the actual impact on turtles is expected to be less severe due to their natural avoidance behaviour and mobility.

Table 6-9: Summary of maximum horizontal distance (R_{max}) for behavioural response thresholds, and thresholds for permanent and temporary shift for sea turtles

Hearing Group	Maximum Modelled Distance to Effect Threshold (R_{max})			
	Behavioural Response[1]	Behavioural Disturbance[1]	Impairment (km): TTS[2]	Impairment (km): PTS[2]
Sea turtles	5.01 (166dB re 1µPa - SPL)	1.99 (175dB re 1µPa - SPL)	1.23 (SEL_{24h})	0.16 (SEL_{24h})

Noise exposure criteria: [1] McCauley et al. (2000) and [2] Finneran et al. (2017).

Significant aggregations of marine turtles are not anticipated within the survey area, and their presence is expected to be transient. Therefore, significant impacts to marine turtles are not expected. Consequently, the residual risk to marine turtles from the survey activity is considered to be low, with any potential impacts likely to be temporary.

6.2.3.3 Sharks, Rays and Fish

Given the survey area is situated in oceanic waters, with the nearest shoal located approximately 26km away, key pelagic fish species in the survey area may include tuna, mackerel and billfish. Additionally, there are three listed Threatened or Migratory shark

and ray species that may be present within the survey area, including the oceanic manta ray, oceanic whitetip and whale shark (Table 4-2).

These species either do not possess a swim bladder or it is poorly developed and not directly connected to hearing (Popper et al., 2014), indicating they are sensitive only to the particle motion component of sound at close range to a sound source. These species are also generally free roaming, with naturally large ranges spanning hundreds to thousands of kilometres. Whale sharks, for instance, are known to travel thousands of kilometres in search of food and suitable breeding grounds (Hueter et al., 2013). Tuna, including bluefin, undertake impressive migrations across entire oceans, often covering distances of over 5,000km (Aranda et al., 2013). Similarly, many shark species migrate for feeding, mating and birthing, often traveling vast distances to find optimal conditions.

Modelling results predict sharks, rays and pelagic fish are at risk of TTS at 4.98km SEL_{24h} (Table 6-10). Expected impacts are likely to include temporary behavioural changes such as changes in orientation, swim speed, tightening of school structure, and changes in position within the water column several kilometres from the source (Pearson et al., 1992; Santulli et al., 1999; McCauley et al., 2000; Simmonds and MacLennan, 2005; Fewtrell and McCauley, 2012; Peña et al., 2013; Popper et al., 2014). Fish may exhibit stronger startle and flee responses, with normal behaviours resuming shortly after the seismic source has passed, typically within an hour (Pearson et al., 1992; Santulli et al., 1999; McCauley et al., 2000; Simmonds and MacLennan, 2005; Fewtrell and McCauley, 2012; Peña et al., 2013; Popper et al., 2014). These temporary behavioural changes are not expected to have long-term impacts on fish populations.

At close range, predicted from modelling at 0.15 to 0.16km, fish may experience lasting impacts, such as swim bladder rupture, internal organ damage, and increased vulnerability to predation (Table 6-10). The rapid pressure changes from seismic blasts can cause the swim bladder to rupture, leading to internal injuries and potentially fatal consequences. Additionally, the shock waves can damage other internal organs, such as the kidneys and liver, due to their proximity to the swim bladder. These injuries can result in altered swimming behaviours, reduced ability to maintain buoyancy, and increased vulnerability to predators. However, these impacts are unlikely as fish are expected to move away from the noise source, reducing their exposure duration.

Localised and temporary disruptions to fishing activities from the survey activity are anticipated. However, the behavioural impacts on target fish species are expected to be confined to a few hundred metres from the seismic source, with normal behaviours and distributions resuming within minutes to hours, or at most, days. Consequently, the acoustic disturbance to commercial or subsistence fisheries and their target species is unlikely to be significant, with fish behaviours and distributions expected to normalise within hours to days after completing the survey activity.

Additionally, the waters of the survey area are not expected to support significant fish assemblages, as they are distant from reefs, shoals or banks that typically attract fish aggregations. Therefore, the impact on commercial or subsistence fisheries is expected to be minimal, and the overall assessment indicates the survey activity is unlikely to substantially affect fishing operations in the survey area.

Table 6-10: Summary of maximum onset distance for single impulse and 24-hour sound exposure for fish with and without swim bladders

Hearing Group	Effect Criteria	R_{max} (km)
No swim bladder	Mortality/potential mortal injury	0.15 SEL_{24h}
	Recoverable injury	0.16 SEL_{24h}
	TTS	4.98 SEL_{24h}
Swim bladder (involved and not involved in hearing)	Mortality/potential mortal injury	0.16 SEL_{24h}
	Recoverable injury	0.23 PK
	TTS	4.98 SEL_{24h}

6.2.3.4 Plankton, Fish Eggs and Larvae

Plankton is a collective term for all marine organisms that cannot swim against a current. This group is diverse and includes phytoplankton (plants) and zooplankton (animals), as well as fish eggs and larvae, invertebrate eggs and larvae, and coral spawn.

Modelling results indicated mortality to plankton could occur up to 0.23km from the seismic source (RPS, 2024). Despite this, the constant movement of the vessel and replenishment of zooplankton populations by currents suggest mortality rates are detectable only close to the survey area and not at a regional scale (Richardson et al., 2017). Zooplankton biomass has been shown to recover within a few days, reflecting the natural movement and replenishment of populations (Richardson et al., 2017). Consequently, the overall risk to plankton is considered low, with impacts being localised and temporary.

Table 6-11: Summary of maximum onset distance for single impulse sound exposure to plankton, fish eggs and larvae

Hearing Group	Effect Criteria	R_{max} (km)
Fish eggs and larvae (relevant to plankton)	Mortality/potential mortal injury	0.23 PK

6.2.3.5 Benthic Invertebrates

The survey activity may impact benthic invertebrates within the survey area. In deeper waters, benthic invertebrates are not expected to be abundant, but may include polychaetes (burrowing worms) and crustaceans (such as prawns, shrimp, and crabs), echinoderms, molluscs, nemerteans and sponges.

Research indicates benthic invertebrates detect sound through particle motion, using structures like sensory hairs and statocysts (Parry and Gason, 2006; Carroll et al., 2017; McCauley, 1994' André et al., 2016; Roberts et al., 2016; Edmonds et al., 2016; Popper and Hawkins, 2018). These organisms are generally less sensitive to sound than fish, lacking gas-filled bladders. Impacts are often sublethal, such as statocyst impairment in crustaceans and impaired reflexes in sessile molluscs, with no long-term ecological implications expected.

Mobile invertebrates like cephalopods may exhibit increased movement and avoidance behaviour. Some macro-invertebrates may experience sublethal effects or a slight increase in mortality rates due to chronic exposure at close range. However, given benthic communities are relatively sparse across most of the survey area, the localised extent of potentially significant impacts, and the potential for subsequent recruitment and recovery (over weeks or months at most), no long-term population and community level impacts are expected.

6.2.3.6 Cross-border Impacts

Cross-border impacts may occur as a result of underwater noise generated from the operation of the seismic source. Underwater noise may travel from the survey area within Timor-Leste waters across the Timor-Leste/Australian border. Cross-border impacts and receptors are expected to be the same as those in Timor-Leste waters. No impacts to habitats from underwater noise in Australian waters are anticipated, with potential impacts expected to be limited to behavioural responses from marine fauna species as detailed in the previous sections.

6.2.3.7 Potential Cumulative Impacts

Potential cumulative impacts may occur if the survey activity is undertaken:

- at the same time as another seismic survey within the survey area and there is an overlap in the areas impacted by each survey and there are noise-sensitive receptors in the overlap zone (concurrent surveys)
- within an area where previous seismic surveys have occurred, the affected marine biota are still in the same area and have not fully recovered (sequential surveys).

Concurrent Surveys

Eni is not aware of any planned concurrent seismic surveys by other operators in the vicinity of the survey area at the time of writing this EMP.

In the event of a survey planned at the same time as the survey activity by another operator, the industry best practice and conservative 40km buffer between seismic vessels will keep sound levels below the level at which physiological impacts could occur. The survey area is remote, with the only operating oil and gas facility in the region being Bayu-Undan, approximately 130km to the southwest; therefore, cumulative noise impacts from concurrent activities are not expected.

Given the very low probability of two seismic surveys occurring simultaneously and the controls that will be implemented to establish and maintain communications before and during the survey activity to ensure such simultaneous activities would maintain an adequate separation distance (40km), there is very little risk of cumulative impacts to marine receptors. No cumulative impacts are predicted from concurrent surveys.

Sequential Surveys

Sequential seismic surveys in the survey area of Timor-Leste waters can lead to cumulative impacts if the interval between activities is shorter than the recovery rate of affected receptors.

NMFS suggests a 'resetting' of cumulative sound exposure levels (SEL_{cum}) after 12 hours of non-exposure, which can mitigate some impacts (Stadler and Woodbury, 2009). Whereby, if there is a 12-hour period between the end of one pile driving operation and the start of the next, the SEL_{cum} for a fish during the pile driving operation is reset to zero for the next set of exposures. Fish have been seen to recover from startle response within minutes, and repeated exposure can lead to habituation within weeks (Bruintjes et al., 2016; Nedelec et al., 2016). Given the lower number of sound pulses in seismic surveys compared to pile driving, and the mobility of most fish, populations are expected to be resilient due to immigration and recruitment of unaffected individuals. Recovery in fish is anticipated within 24 hours after the seismic vessel passes (Popper, 2018).

Zooplankton abundance is expected to return to natural levels within hours to a few days after exposure (McCauley et al., 2017; Richardson et al., 2017). While some benthic invertebrates may experience sublethal and chronic lethal effects for weeks or months, overall changes in benthic community composition are likely negligible. Behavioural changes in marine fauna, such as cetaceans and sea turtles, are expected to normalise within hours or days after the survey activity concludes.

There have been no seismic activities undertaken in the region in recent times; therefore, no cumulative impacts from sequential seismic surveys are predicted for the survey activity.

6.2.4 Management Control Measures

Standard control measures relating to this risk comprise:

- Vessels will adhere to JNCC Guidelines for Minimising the Risk of Injury to Marine Mammals from Geophysical Surveys (2017).
- Vessels will adhere to Eni Minimum HSE Requirements in Geophysical Operations, including requirements for offshore seismic surveys.
- Use of sufficient MMO and PAM operatives on vessels.
- Marine megafauna interaction requirements included in survey activity inductions.
- No equipment testing outside of the survey area.
- Airgun firing (including testing) must not exceed the planned maximum production volumes outlined in the environmental licence application.
- Pre-shooting survey searches and soft starts incorporated into the survey activity.
- Cetacean sighting and compliance reports to be submitted to ANP (End of Activity Report).
- Incorporate JNCC mitigations for night-time and poor visibility conditions, including use of PAM operatives in addition to MMO visual mitigation.
- If an unplanned break in operations occurs during night-time or poor visibility conditions, mitigation zone is to be monitored using PAM procedures.
- If PAM operatives are not available, the survey activity will be delayed until conditions are suitable for visual assessment of the mitigation zone.

No additional control measures were adopted. Evaluation of additional control measures is provided in Table 6-12.

6.2.5 As Low As Reasonably Practicable Demonstration

Completely eliminating noise emissions from the survey activity is not possible, as the acoustic source is essential for obtaining subsurface data. While alternative geological imaging technologies and seismic sound sources were considered, they are not yet commercially available or proven to meet geophysical data quality objectives, operational safety, and reliability requirements (IOGP, 2017).

A range of controls has been adopted to manage noise emissions and reduce the risk to marine fauna to ALARP. Vessels will adhere to JNCC Guidelines for Minimising the Risk of Injury to Marine Mammals from Geophysical Surveys and Eni's Minimum HSE Requirements for Geophysical Operations, ensuring compliance with industry best practices and reducing the risk of noise-related impacts.

To further mitigate noise impacts, sufficient numbers of MMOs and PAM operatives will be deployed on survey vessels. MMOs and PAM operatives monitor for marine mammals and implement mitigation measures as required. PAM will be particularly important for night-time and low-visibility conditions to ensure continuous monitoring. Pre-shooting survey searches and soft starts will also be incorporated into the survey activity to allow marine fauna time to move away before full operations begin.

Administrative controls have been adopted to further reduce noise impacts on marine fauna. Airgun firing (including testing) will not exceed the planned maximum production volumes outlined in the environmental licence application, ensuring noise emissions remain within acceptable limits. If an unplanned break in operations occurs during night-time or poor visibility conditions, the mitigation zone will be monitored using PAM procedures to ensure mitigation continues. If PAM operatives are not available, the survey activity will be delayed until conditions are suitable for visual monitoring, ensuring mitigation measures are applied effectively.

Cetacean sighting and compliance reports will be submitted to the regulator (ANP) as part of the End of Activity Report, ensuring transparency and regulatory oversight. All crew members, including MMOs and PAM operators, will undergo marine megafauna interaction training as part of their survey activity inductions, ensuring they understand their environmental responsibilities and can effectively apply mitigation measures. Furthermore, equipment testing will be limited to the defined survey area, ensuring acoustic disturbances do not extend beyond the operational boundaries.

Several other additional control measures (Table 6-12) were considered but rejected due to cost and limited environmental benefit. Given the controls that have been adopted, the residual risk is considered ALARP.

Table 6-12: 'As low as reasonably practicable' demonstration for underwater noise – seismic source

Control Type	Control/ Management	Evaluation	Adoption?
Eliminate	Eliminate noise emissions from the acoustic source	Eliminating noise entirely is impractical, as the acoustic release of the source is necessary to obtain subsurface data. The survey cannot proceed without noise emissions, but the implementation of precautionary controls will reduce the risks associated with noise emissions. The benefits of the precautionary controls outweigh the costs.	No
	Use of alternative seismic sound sources and alternative geological imaging technology	Alternative technologies are not yet commercially available or have not been proven to meet geophysical data quality objectives, operational safety, and reliability requirements (IOGP, 2017)	No
Substitute	N/A	N/A.	N/A

Control Type	Control/ Management	Evaluation	Adoption?
Engineering	Noise reduction controls for vessels	Noise reduction controls involve significant engineering intervention. Seismic vessels are already designed to limit noise emissions from the vessel to avoid interference with the acoustic release. As such, it is considered that the costs are disproportionate to any potential benefits gained.	No
Isolation	N/A	N/A.	N/A
Administrative	Vessels will adhere to JNCC Guidelines for Minimising the Risk of Injury to Marine Mammals from Geophysical Surveys (2017)	Ensures that proper precautions are taken to minimise the risk to marine mammals during the seismic survey.	Yes (standard CM)
	Vessels will adhere to Eni Minimum HSE Requirements in Geophysical Operations, including requirements for offshore seismic surveys	Complying with Eni's HSE requirements ensures operational safety and mitigates environmental impact, including noise emissions	Yes (standard CM)
	Use of sufficient numbers of MMOs and PAM operatives on vessels	Likely to improve ability to identify marine fauna at risk of impact from noise. MMOs and PAM operatives monitor for marine mammals and implement mitigation measures as required. PAM will be particularly important for night-time and low-visibility conditions to ensure continuous monitoring.	Yes (standard CM)
	Marine megafauna interaction requirements included in survey activity inductions	Vessel crew will be inducted in their responsibilities regarding environmental matters. Minor cost in complying, with benefit in reducing impact to marine fauna from noise impacts.	Yes (standard CM)
	No equipment testing outside of the survey area	Acoustic release will be limited to within the defined boundaries of the seismic survey area, thereby restricting potential effects of acoustic disturbance to within the boundaries of the activity area.	Yes (standard CM)

Control Type	Control/ Management	Evaluation	Adoption?
	Airgun firing (including testing) must not exceed the planned maximum production volumes outlined in the environmental licence application	Ensures airgun firing is kept within regulatory limits, reducing the risk of excess noise emissions.	Yes (standard CM)
	Incorporate pre-shooting survey searches and soft starts into the survey activity	Pre-shooting surveys and soft starts help minimise the initial noise disturbance to marine fauna, allowing animals to move away before full operations begin.	Yes (standard CM)
	Cetacean sighting and compliance reports to be submitted to ANP (End of Activity Report)	Ensures regulatory oversight by documenting cetacean sightings and compliance with mitigation measures.	Yes (standard CM)
	Incorporate JNCC mitigations for night-time and poor visibility conditions, including use of PAM operatives in addition to MMO visual mitigation	PAM operatives during night-time or poor visibility conditions improves the ability to detect marine mammals and implement appropriate mitigation actions.	Yes (standard CM)
	If unplanned break in operations occurs during night-time or poor visibility conditions, mitigation zone is to be monitored using PAM procedures	Ensures that if operations are paused during unfavourable conditions, mitigation continues through PAM monitoring, reducing the risk of unmonitored impacts.	Yes (standard CM)
	If PAM operatives are not available, the survey activity will be delayed until conditions are suitable for visual conditions	Delaying operations when PAM operatives are not available ensures mitigation measures are applied effectively, ensuring compliance with environmental standards.	Yes (standard CM)
	Schedule survey activity outside of sensitive period for marine fauna	The timing of the survey a will be subject to vessel availability and weather conditions. Given the low risk to marine fauna in the region, rescheduling the survey activity would not be proportionate to the cost and schedule implications.	No

6.2.6 Acceptability Demonstration

Demonstration of Acceptability	
Compliance with Legal Requirements, Laws, Standards	Vessels will adhere to JNCC Guidelines for Minimising the Risk of Injury to Marine Mammals from Geophysical Surveys (2017) and Eni Minimum HSE Requirements in Geophysical Operations, including requirements for offshore seismic surveys.
Policy Compliance	The management is aligned with Eni policies and standards.

Demonstration of Acceptability	
Social Acceptability	The survey area is not within an area of known shipping or high fishing activity.
Area Sensitivity/ Biodiversity	There are fauna species that are protected under international agreements that could occur in the survey area. However, these are widely distributed oceanic species and there is no particular seabed, oceanographic or topographic features in or near the survey area that could offer special breeding or feeding habitat for these species. Marine fauna are expected to display avoidance behaviours to the seismic source. Mitigation measures such as MMO, PAM operatives, soft start procedures and mitigation zones will be implemented to ensure impacts to marine fauna are minimised to ALARP.
ESD Principles	The impact assessment presented throughout this section demonstrates compliance with the principles of ESD.
ALARP	The residual risk has been demonstrated to be ALARP.

6.3 Underwater Noise – Vessels and Mechanical Equipment (Risk ID P3)

6.3.1 Summary of Environmental Risk

Hazard	Noise Emissions – Vessels and Mechanical Equipment		
	Frequency	Severity	Risk
Inherent Risk	E	1	L
Residual Risk	B	1	L

6.3.2 Description of Hazard

Noise will be generated by the operation of the seismic vessel, support vessel, helicopter and chase vessels during the survey activity. Vessel noise will comprise noise from the vessel engines and machinery, including equipment used to deploy and retrieve the seismic streamers.

Noises emitted from vessel operations will be continuous during the survey activity, with noise emitted from mechanical equipment associated with streamer deployment and retrieval to be short-term (hours). Typically, vessels are the noisiest during dynamic positioning, when the vessel maintains position and heading by using its own propellers and thrusters. Vessels in the 50-100m size class typically have broadband source levels in the 165-180dB re 1µPa SPL range (Gotz et al., 2009). McCauley (1998) measured underwater broadband noise equivalent to approximately 182dB re 1µPa SPL @ 1m with a frequency range of 20Hz to 10kHz from a vessel using dynamic positioning in the Timor Sea. It is expected that similar noise levels will be generated by support vessels used during the activities. The thruster noise dropped below 120dB re 1µPa within 3 to 4km and was audible above ambient noise up to 20km away (McCauley, 1998). This has been taken as the greatest noise-generating activity for assessment purposes, as other vessel activities will require the vessel to be idle or moving.

Noise from helicopters will be limited to crew transfer during operations or medical evacuations. The level of noise received underwater from helicopter engines depends largely on the source's altitude and lateral distance, receiver depth in the water column, and other variables such as wind and wave speed. Sound pressure in the water directly below a helicopter is greatest at the surface and diminishes with increasing receiver depth. Noise also reduces with increasing helicopter altitude. Noise levels for typical helicopters used in offshore operations (Eurocopter Super Puma AS332) at 150m

separation distance have been measured at up to a maximum of 90.6dB (BMT Asia Pacific, 2005). Noise levels reported for a Bell 212 helicopter during fly-over was reported at 162dB re 1µPa and for Sikorsky-61 is 108dB re 1µPa at 305m (Simmonds et al., 2004).

6.3.3 Potential Environmental Impact

Potential receptors associated with underwater sound emissions from mechanical and vessel noise include:

- cetaceans
- marine turtles
- sharks, rays and fish
- seabirds.

Elevated non-impulsive underwater noise can affect marine fauna in three main ways:

- by direct physical effects on hearing or other organs
- by masking or interfering with biologically important sounds/vocalisations
- through disturbance leading to behavioural changes or displacement from important areas.

Noise from vessels (as in, machinery and propellers) is the dominant anthropogenic sound in marine environments that influences ambient noise levels. Commercial vessels produce relatively loud, low-frequency sounds. However, the underwater noise generated by their movement lacks the intensity and characteristics necessary to cause physiological damage to marine fauna (Nedwell and Edwards, 2004; Hatch and Southall, 2009).

In the survey area, marine fauna most at risk from acoustic disturbance are cetaceans, particularly baleen whales, as the auditory bandwidth of these large whales overlaps with the low-frequency broadband noise produced by thrusters during vessel positioning and movement. Given there are no high-energy impulsive sound sources associated with the routine operation of vessels, there may be some localised behavioural disturbance of marine fauna in the immediate vicinity of vessels during the survey activity, but physiological effects on fauna are not anticipated. Permanent injury would be expected to occur at 230dB re 1uPa (peak) for cetaceans (Southall et al., 2007). Noise from vessels is unlikely to exceed that level; therefore, PTS or TTS is not anticipated.

Additionally, noise emissions from the vessels are expected to be similar in level, frequency range, and character to those from general shipping traffic already present in the survey area. Therefore, they are not considered to represent a significant additional environmental impact beyond the noise from normal shipping activities.

In general, exposure to helicopter sound emissions is of short duration, peaking as the helicopter passes directly overhead. Received levels are expected to be low during transit, when helicopter altitude is greatest and disturbance to marine fauna is not expected. The highest received levels will occur at lower altitudes on approach to landing. Some minor behavioural disturbance may occur for short periods if marine fauna are present near the surface in the vicinity of landing helicopters. This would be limited to temporary behavioural changes (avoidance) but are not expected to have any long-term impacts. Seabirds are expected to avoid the immediate vicinity of a helicopter, but again no long-term impacts are anticipated.

Cumulative impact from the use of multiple support vessels, the seismic vessel and helicopter operations are not considered to present significant impacts to marine fauna, given their mobility and ability to avoid the sound source. Impacts are anticipated to comprise behavioural disturbance and avoidance only. The survey area is within a remote offshore environment with low levels of shipping and fishing activities. Therefore, should avoidance behaviour occur, it is anticipated the marine fauna would be able to move freely to an area below the behavioural threshold. Noise levels from vessels operating on dynamic positioning, the noisiest activity in the survey activity, are expected to be below 120dB re 1µPa (as in, the behavioural response thresholds for cetaceans) within 3 to 4km (McCauley, 1998). Potential impacts would be expected to be limited to behavioural response from transitory and mobile marine fauna such as cetaceans, as described above.

Based on the assessment presented above and the implementation of controls and mitigations presented within Section 6.3.4, the consequence of occasional short-term and localised disturbance to marine fauna is low and no long-term impacts are anticipated.

6.3.4 Management Control Measures

Standard control measures relating to this risk comprise:

- Vessels to be maintained in accordance with the applicable PMS.
- Marine megafauna interaction requirements included in survey activity inductions.

No additional control measures were adopted. Evaluation of additional control measures is provided in Table 6-13.

6.3.5 As Low As Reasonably Practicable Demonstration

Completely eliminating noise emissions from vessel operations is not possible, as the use of vessels is essential to complete the survey activity. Eliminating the use of vessels would prevent the survey activity from proceeding altogether, as they are integral to the operation.

Further considerations for substitution of vessels were evaluated, but as the vessels are contracted to meet the specific requirements of the survey activity, substituting vessels is not possible. These vessels are specialised to support seismic operations, and any attempt to substitute them would result in operational inefficiency. As a result, this control has also been rejected.

Adopted controls such as PMS ensure all equipment generating noise on the vessel is functioning optimally. Additionally, the vessels are expected to emit enough noise to prompt avoidance behaviour in sensitive marine fauna, encouraging them to move away from the survey activity and avoid physical impact zones. Any behavioural impacts caused by vessel noise are expected to be localised and temporary, with marine species likely resuming normal behaviour in nearby open ocean areas shortly after exposure. Environmental inductions will be provided to all crew members before starting the survey activity. This ensures they are fully aware of their responsibilities regarding noise impacts on marine fauna and the measures to mitigate those impacts.

Other additional control measures (Table 6-13) were considered but rejected due to cost and limited environmental benefit. Given the controls that have been adopted, the residual risk is considered ALARP.

Table 6-13: 'As low as reasonably practicable' demonstration for underwater noise – vessel and mechanical equipment

Control Type	Control/ Management	Evaluation	Adoption?
Eliminate	Eliminate use of vessels	The noise associated with the use of vessels cannot be eliminated. Elimination of vessels would mean the survey activity cannot be completed.	No
Substitute	Substitute vessels	The vessels will be contracted to meet the specifications of the scheduled work and cannot be substituted.	No
Engineering	Noise reduction controls for vessels	Noise reduction controls involve significant engineering intervention. Seismic vessels are already designed to limit noise emissions from the vessel to avoid interference with the acoustic release. As such, it is considered that the costs are disproportionate to any potential benefits gained.	No
Isolation	N/A	N/A.	N/A
Administrative	Planned maintenance system	Ensures equipment which generates noise on the vessel is operating optimally and sound sources levels are appropriately verified and within desired operating range. PMS is routine and there are no additional costs.	Yes (standard CM)
	Scheduling survey activity outside of sensitive period for marine fauna	Given the low risk to marine fauna in the region, rescheduling the survey activity will not result in a significant environmental benefit.	No
	Marine megafauna interaction requirements included in survey activity inductions	All crew members will be inducted in their responsibilities regarding environmental matters. Minor cost in complying, with benefit in reducing impact to marine fauna from noise.	Yes (standard CM)

6.3.6 Acceptability Demonstration

Demonstration of Acceptability	
Compliance with Legal Requirements, Laws, Standards	Vessel to be maintained in accordance with the applicable PMS.
Policy Compliance	The management is aligned with Eni policies and standards.
Social Acceptability	The survey area is not within an area of known shipping or high fishing activity.

Demonstration of Acceptability	
Area Sensitivity/ Biodiversity	There are fauna species that are protected under international agreements that could occur in the survey area. However, these are widely distributed oceanic species and there is no particular seabed, oceanographic or topographic features in or near the survey area that could offer special breeding or feeding habitat for these species. Additionally, sensitive fauna is expected to display avoidance behaviours due to the vessel sound.
ESD Principles	The impact assessment presented throughout this section demonstrates compliance with the principles of ESD.
ALARP	The residual risk has been demonstrated to be ALARP.

6.4 Atmospheric Emissions (Risk ID P4)

6.4.1 Summary of the Environmental Risk

Hazard	Atmospheric Emissions		
	Frequency	Severity	Risk
Inherent Risk	E	1	L
Residual Risk	E	1	L

6.4.2 Description of Hazard

Exhaust gases are produced from combustion hydrocarbons for power generation on board the seismic, support and chase vessels and are ultimately released into the atmosphere.

Products of hydrocarbon combustion emitted to the atmosphere include emissions of GHG, such as carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O), along with non-GHG emissions such as sulphur oxides and nitrogen oxides. There may also be emissions of particulate matter and hydrocarbons, including BTEX.

Emissions of GHG are expressed in terms of tonnes of CO_2 equivalent (t CO_2-e). This universal unit of measurement indicates the global warming potential of each specific GHG, by expressing their warming potential in terms of the global warming potential of one tonne of CO_2. The forecast volumes of GHG emissions from completing the seismic survey are provided in Table 6-14. The forecast GHG emissions have been calculated based on conservative assumptions regarding vessel allocation and activity duration for the seismic survey. Consequently, the actual GHG emissions arising from the seismic survey may be below the forecast provided in Table 6-14.

Before starting the survey activity, two chase vessels will complete a reconnaissance campaign to ensure the survey area's conditions are suitable to undertake the survey activity. The GHG emissions forecast is based on all vessels completing the survey activity with a duration of ten weeks. This duration is conservative in nature, with the survey activity expected to have a duration of between six and eight weeks.

While no crew changes or medical evacuations are expected to be necessary during the survey activity, the GHG emissions forecast includes five helicopter flights as a contingency to account for these potential helicopter movements.

The survey activity is expected to result in up to 17,607t CO_2-e (tonnes of carbon dioxide equivalent) of GHG emissions (Table 6-14). As shown in Figure 6-6, most of these emissions arise from operating the seismic and support vessels, with operation of the chase vessels contributing less than 10% of the forecast GHG emissions. As shown within Figure 6-6, the helicopter movements represent an insignificant contribution to the forecast GHG emissions.

The GHG emissions forecast was developed using methods and emission factors contained within the latest update to the National Greenhouse and Energy Reporting (Measurement) Determination 2008, published by the Commonwealth of Australia on 31 August 2024.

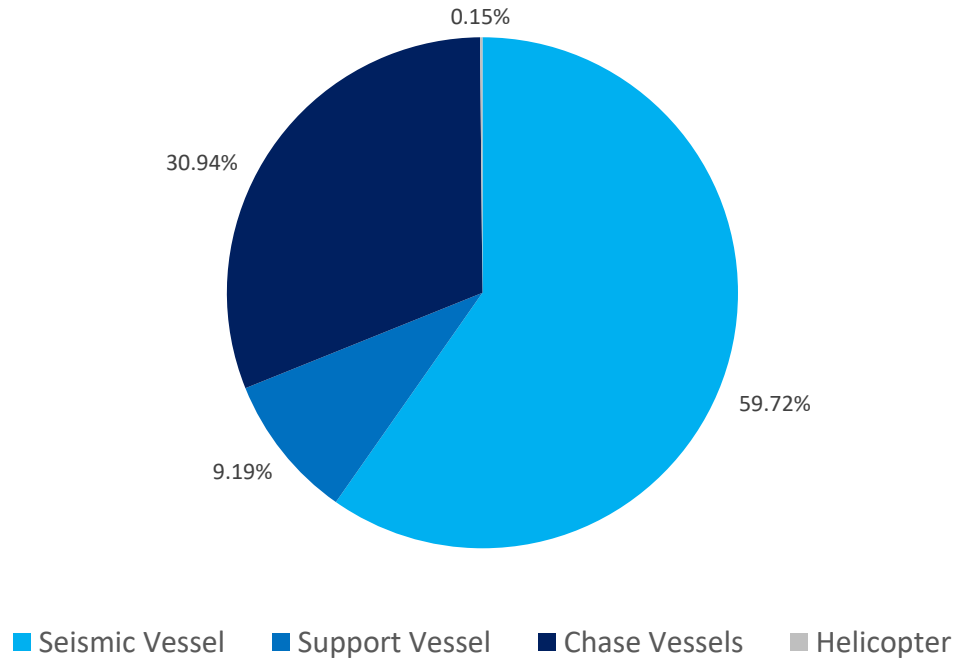


Figure 6-6: Forecast contribution of greenhouse gas emissions by vessel type

Table 6-14: Forecast greenhouse gas emissions from the survey activity

Vessel	Daily Fuel Consumption (kilolitres)	Mobilisation (days)	Pre-campaign Reconnaissance (days)	Survey Activity (days)	Total Fuel Consumption (kilolitres)	CO_2 Emissions (t CO_2-e)	CH_4 Emissions (t CO_2-e)	N_2O Emissions (t CO2-e)	Total GHG Emissions (t CO_2-e)
Seismic vessel	41.17	38	0	56	3,869.61	10,440.75	14.94	59.75	10,515.43
Support vessel	6.33	38	0	56	595.32	1,606.27	2.30	9.19	1,617.76
Chase vessel 1	9.50	5	14	56	712.49	1,922.40	2.75	11.00	1,936.15
Chase vessel 2	9.50	5	14	56	712.49	1,922.40	2.75	11.00	1,936.15
Chase vessel 3	9.50	5	0	56	579.49	1,563.55	2.24	8.95	1,574.73
Helicopter	2.07	0	0	5	10.34	26.48	0.00	0.23	26.71
Total		**91.00**	**28.00**	**285.00**	**6,479.74**	**17,481.84**	**24.98**	**100.12**	**17,606.93**

6.4.3 Potential Environmental Impact

Hydrocarbon combustion to power the survey vessels may result in a temporary, localised reduction of air quality immediately surrounding the discharge point, due to the release of both non-GHG emissions (such as nitrogen oxides and sulphur oxides) and GHG emissions. Given the quantities of emissions released are relatively small, and the location of the survey area is remote, these emissions will quickly dissipate into the surrounding atmosphere.

Reductions in air quality have the potential to result in health impacts to humans and marine fauna within the survey area. Non-GHG emissions could particularly impact sensitive receptors, including humans and communities, as well as seabirds located in the immediate vicinity of discharges. The key impact of GHG emissions is their propensity to accumulate in the atmosphere over varying time scales, where their increasing concentration leads to a warming or 'greenhouse' effect.

Local impacts typically associated with the emissions are mitigated by the dispersive nature of the offshore environment. Any potential local elevated concentrations of emissions will be short lived and unlikely to be detectable except in the near vicinity of the release.

The survey area is remote from any land mass and far from sensitive receptors. Atmospheric emissions will not impact on air quality for any social receptors, with the nearest community approximately 170km northwest on the southern Timor-Leste coast.

Due to the dispersive nature of the offshore environment, atmospheric emissions from the survey activity are not anticipated to contribute to cumulative impacts on local air quality from existing emissions from vessels in the Timor Sea. Transboundary impacts to air quality may occur while the survey vessels are immediately adjacent to the border of Timor-Leste and Australian waters. However, emissions will be quickly dispersed and highly localised and any transboundary impacts are expected to be negligible. The survey activity's contribution of GHG emissions to global GHG levels and the associated global warming effects to the other nations will be indiscernible.

6.4.4 Management Control Measures

Standard control measures relating to this risk comprise:

- International Air Pollution Prevention Certificate – in accordance with MARPOL 73/78 Annex VI.
- Fuel type used (marine diesel) – in accordance with MARPOL 73/78 Annex VI.
- Equipment (engines, thrusters, generators, etc) is maintained in accordance with the applicable PMS.
- Vessel incinerators will be maintained to manufacturer's specification and operated in accordance with MARPOL 73/78 Annex VI.
- Ozone depleting substances shall not be deliberately released – in accordance with MARPOL 73/78 Annex VI.

Additional control measures (Table 6-15) considered and adopted include:

- Fuel consumption will be recorded and monitored for abnormal consumption, with corrective action taken if necessary.

6.4.5 As Low As Reasonably Practicable Demonstration

The combustion of hydrocarbons is essential for powering the vessels required to undertake the survey activity. Currently, no practical or reliable alternative energy sources exist for these vessels. Adopting a zero-incineration policy on the seismic vessel would increase atmospheric emissions due to the need for additional vessel movements to send waste to shore for disposal, while increasing collision risks due to additional vessel movements. Since incineration is a permitted and regulated maritime operation under MARPOL 73/78 Annex VI, it meets ALARP standards.

The PMS ensures the vessel's engine and equipment are kept in optimal working condition, minimising emissions. This routine practice ensures environmental impacts remain ALARP. Routine maintenance is a standard industry practice and is necessary to keep vessels operating at peak efficiency, thereby reducing unnecessary emissions.

Given the remote offshore location, atmospheric emissions will be expected to dissipate rapidly in the open environment. When the above is considered alongside the absence of sensitive environmental receptors in the survey area, residual impacts from air emissions are assessed as minor.

An additional control measure – fuel consumption monitoring – was adopted to further reduce emissions. Vessel fuel consumption will be recorded and monitored for abnormal consumption, with corrective action taken if necessary to minimise emissions. Other additional control measures were considered (Table 6-15), such as using green energy sources or shutting down non-essential machinery; however, it was rejected since associated costs and efforts were deemed grossly disproportionate to the minimal environmental benefit. Renewable energy alternatives, such as wind or solar, cannot provide continuous baseload power and are weather-dependent. Shutting down non-essential machinery, given the minimal emissions and risks, would not yield significant environmental benefits and would introduce unnecessary operational complexity and potentially create human health and safety risks.

Control measures such as adhering to MARPOL 73/78 Annex VI regulations, maintaining the vessels' efficiency, and monitoring fuel consumption, are cost-effective and comply with international standards. These measures significantly reduce emissions and are already incorporated into standard operating practices, ensuring environmental impacts are kept to a minimum.

Therefore, the activities associated with the survey activity, including use of the vessels and management of air emissions, are considered ALARP.

Table 6-15: Demonstration of 'as low as reasonably practicable' for atmospheric emissions

Control Type	Control/ Management	Evaluation	Adoption?
Eliminate	Eliminating the use of survey vessels	Vessels are required for the survey activity and cannot be eliminated.	No
	No incineration of waste on the vessels	Incineration of wastes on vessels is a standard industry practice and negates the need for additional visits from supply vessels to remove waste. The storage of wastes onboard the survey vessels have added risks to human health.	No

Control Type	Control/ Management	Evaluation	Adoption?
Substitute	Use green energy sources on the survey vessels	Alternatives such as renewable energy generators (wind or sun) are not viable options as they are weather-dependent and do not supply continuous baseload power.	No
	Vessel fuel quality in accordance with MARPOL 73/78 Annex VI	Reduces emissions through use of low-sulphur fuel in accordance with MARPOL 73/78 Annex VI. Minimal cost as vessels required to comply with MARPOL 73/78.	Yes (standard CM)
Engineering	N/A	N/A.	N/A
Isolation	N/A	N/A.	N/A
Administrative	Vessel air pollution prevention certificate in compliance with MARPOL 73/78 Annex VI	Reduces the probability of potential impacts to air quality. Minimal cost, as vessels are required to comply with MARPOL 73/78.	Yes standard CM)
	Planned maintenance system for equipment (engines, thrusters, generators, etc)	Ensures vessels are running efficiently and are as per manufacturer specifications. Routine maintenance endeavours to ensure emissions are minimal and is industry best practice. No additional costs to implement.	Yes (standard CM)
	Fuel consumption will be recorded and monitored for abnormal consumption, with corrective action taken if necessary	Corrective actions can be taken in case of abnormal consumption, minimising emissions.	Yes
	Non-essential machinery will be routinely shutdown on survey vessels	Due to the limited benefit gained from shutting down non-essential machinery, and the limited risk associated with atmospheric emissions, this control was determined to be unnecessary.	No
	Vessel incinerators will be maintained to manufacturer's specification and operated in accordance with MARPOL 73/78 Annex VI	Routine maintenance ensures machinery is running in accordance with the manufacturer's specifications, reducing excess emissions.	Yes (standard CM)
	Ozone depleting substances shall not be deliberately released - in accordance with MARPOL 73/78 Annex VI	Vessels will be using MDO to reduce pollutants from the combustion engines.	Yes (Standard CM)

6.4.6 Acceptability Demonstration

Demonstration of Acceptability	
Compliance with Legal Requirements, Laws, Standards	Vessels will comply with the requirements of MARPOL 73/78 Annex VI.
Policy Compliance	The management is aligned with Eni policies and standards.
Social Acceptability	The survey area is not within an area of known shipping or high fishing activity.
Area Sensitivity/ Biodiversity	Offshore location means winds will disperse and dilute emissions rapidly.
ESD Principles	The impact assessment presented throughout this section demonstrates compliance with the principles of ESD.
ALARP	The residual risk has been demonstrated to be ALARP.

6.5 Light Emissions (Risk ID P5)

6.5.1 Summary of Environmental Risk

Hazard	Light Emissions		
	Frequency	Severity	Risk
Inherent Risk	E	1	L
Residual Risk	B	1	L

6.5.2 Description of the Hazard

Artificial lighting is required on the survey vessels for the health and safety of crew onboard (for example, deck lighting for night operations) and for safe navigation of vessels underway at sea. This is in accordance with the requirements of the COLREGS and Chapter V of SOLAS. The primary source of artificial lighting will result from deck and navigational lights onboard the survey, chase and support vessels.

External deck lighting will predominantly be directed towards working areas, limiting the light spill area to sea. The distance at which direct light and sky glow may be visible from the source depends on the vessel lighting and environmental conditions. The light glow from vessel lights will be transitory throughout the survey area due to the constant movement of this vessel.

6.5.3 Potential Environmental Impact

Artificial lighting can cause a change in the behaviour of fauna. Potential impacts to marine fauna from artificial lighting may include:

- disorientation, attraction, or repulsion to the light
- disruption to natural behaviour patterns and cycles
- indirect impacts such as increased predation risks through attraction of predators.

Artificially lit installations, vessels or structures attract seabirds, especially in dark areas and during nighttime migrations (Marquenie et al., 2008). Both seabirds and migratory shorebirds may be drawn to artificial lighting that coincides with their migratory paths. Seabirds are expected to occasionally migrate across and forage within the survey area, while migratory shorebirds may also be encountered. Artificial light can negatively

impact seabirds, causing collisions, entrapment, stranding, grounding, disorientation, navigation interference and altered foraging behaviour. Migrating shorebirds may be attracted to foraging areas with increased artificial lighting (Poot et al., 2008). Observations at the Tristan da Cunha Islands show the commercial rock-lobster fishery significantly impacts seabird populations, with thousands of birds from eight or more species killed annually due to night-strikes caused by ships' lights, especially on vessels with exposed rigging and lines (Ryan, 1991). Offshore artificial lights have been confirmed to attract birds to offshore infrastructure (Marquenie et al., 2008), potentially disorienting migratory birds, affecting stopover selection, and disrupting feeding (McLaren et al., 2018).

Internationally protected marine turtles may occur within the survey area (Table 4-2). Marine turtle behavioural responses to artificial light depend on the life stage or behaviours being undertaken at the time and the artificial light characteristics. Potential impacts include attraction of prey species attracted to light, hatchling disorientation and misorientation, and disruption to nesting. Given the offshore location and the distance to the nearest beach (approximately 175km), potential impacts to turtles are expected to be limited to foraging adult turtles. If impacts were to occur, these would be temporary and slight, and limited to local attraction to prey species attracted to light (Kebodeaux, 1994).

Certain pelagic species, such as fish and plankton, may be attracted to vessel lighting. Experiments that use light traps have found that some fish species and zooplankton species are attracted to artificial light sources (Meekan et al., 2001). Although this effect is expected to be greater for stationary vessels, plankton and fish can aggregate directly under downward-facing lights on the water, which can in turn attract predatory fauna. However, the constant movement of survey vessels ensures disruption of light patterns and light intensity, thereby significantly reducing the potential attraction of plankton and fish species, and minimising the impacts of increased predation.

IUCN-listed cetacean species could occur within the survey area. Potential behavioural impacts to cetaceans may include increased foraging in response to the increased prey abundance (as in, fish and plankton) around artificial light sources.

Overall, impacts from light generated by seismic survey vessels will be temporary and short-term in nature. Light glow will be transitory as the survey vessels acquire data and because marine fauna are also transitory and highly mobile. Given the limited area over which light emissions are likely to extend, impacts to marine fauna are unlikely.

The nearest social receptor is the coastal community of Loré in Lautém district, located on the south coast of Timor-Leste, approximately 168km to the northwest. Given the distance offshore from any human receptors, no communities or populations will be impacted by light emissions from the survey activity.

The survey area is remote from other existing light sources, with the only operating oil and gas facility in the region being Bayu-Undan, approximately 150km to the southwest. As such, cumulative impacts from light emissions are not expected. Transboundary impacts from light to transitory marine fauna may occur as the survey area is immediately adjacent to the Australian/Timor-Leste border. However, given light emissions are expected to be slight, temporary and localised, and marine fauna are transitory and mobile, transboundary impacts from light will be inconsequential.

6.5.4 Management Control Measures

Standard control measures relating to this risk comprise:

- Management of lighting in accordance with the COLREGS and Chapter V of SOLAS.

No additional control measures were adopted. Evaluation of additional control measures is provided in Table 6-16.

6.5.5 As Low As Reasonably Practicable Demonstration

A minimum level of artificial lighting is essential for operational and navigational safety during the survey activity, including signalling presence to other marine users. Reducing lighting levels at night would shorten working hours and extend the time required to complete the survey activity. Given the low levels of lighting already used on the vessels, further reduction would have minimal environmental benefits while increasing the duration of the survey activity and consequent emissions and discharges. The risks and potential consequences of reduced lighting far outweigh any environmental advantages. Due to the offshore location and the water depth in the survey area, potential impacts on turtles are expected to be slight and limited to foraging adults. Artificial light from the survey activity will not reach shorelines or nearshore waters. Any impacts to marine fauna would be temporary, minor, localised, and likely limited to prey species attracted to the light. Overall, light emissions from the survey activity are temporary, short-term, and restricted to a limited area, making significant impacts on marine fauna unlikely.

Control measures, such as those designed to minimise impacts on marine turtles based on the National Light Pollution Guidelines for Wildlife, were considered. However, implementing these would involve significant cost and time with little additional environmental benefit, given the survey activity's distance from nesting sites and the already minimal anticipated impacts on turtles.

The lighting on vessels will comply with industry standards, including the COLREGS and Chapter V of SOLAS. Vessels will also adhere to International Association of Marine Aids to Navigation and Lighthouse Authorities' recommendations for marking offshore structures, ensuring compliance with navigational lighting requirements and the safety of other marine users.

Additional control measures were considered (Table 6-16) but rejected due to their disproportionate cost or effort compared to the minimal benefits. Therefore, maintaining 24-hour artificial lighting in accordance with the COLREGS and Chapter V of SOLAS is considered ALARP.

Table 6-16: Demonstration of 'as low as reasonably practicable' for light emissions

Control Type	Control/ Management	Evaluation	Adoption?
Eliminate	Eliminating support vessels	Eliminating support vessels would impact both the safety and viability of the survey activity by preventing resupply of the seismic vessel and by removing the chase vessels whose purpose is to ensure other marine users remain clear of the seismic vessels and streamers.	No
	No night-time operations	Reducing lighting at night would restrict the survey activity to during the daytime, resulting in the survey activity taking approximately twice as long to complete. Given the low levels of lighting already on the vessels, there would be little environmental benefit.	No
Substitute	N/A	N/A.	N/A

Control Type	Control/ Management	Evaluation	Adoption?
Engineering	N/A	N/A.	N/A
Isolation	N/A	N/A.	N/A
Administrative	Management of lighting in accordance with the COLREGS) and Chapter V of SOLAS	Vessels to use lighting required for safe operation and navigational requirements while complying with navigational lighting requirements to satisfy the COLREGS and Chapter V of SOLAS. Vessels to comply with International Association of Marine Aids Navigation and Lighthouse Authorities' recommendations 0-139 – The marking of man-made offshore structures including appropriate lighting and night signals, navigation systems/equipment and communication to inform other marine users.	Yes (standard CM)
	Manage the timing of the survey activity to avoid sensitive periods	The timing of the survey activity will be subject to vessel availability and weather conditions. Given the low risk to marine fauna, rescheduling the survey activity would not be proportionate to the cost and schedule implications.	No

6.5.6 Acceptability Demonstration

Demonstration of Acceptability	
Compliance with Legal Requirements, Laws, Standards	Management of lighting in accordance with the COLREGS and Chapter V of SOLAS.
Policy Compliance	The management is aligned with Eni policies and standards.
Social Acceptability	The survey area is not within an area of known shipping or high fishing activity.
Area Sensitivity/ Biodiversity	The survey area does not have any particular seabed, oceanographic or topographic features that could offer special breeding or feeding habitat for marine fauna. Only very low numbers of marine fauna are expected to transit the field and, considering the relatively short duration of the planned survey activity, impacts from lighting will be minimal.
ESD Principles	The impact assessment presented throughout this section demonstrates compliance with the principles of ESD.
ALARP	The residual risk has been demonstrated to be ALARP.

6.6 Planned Vessel Discharges (Risk ID P6)

6.6.1 Summary of Environmental Impact

Hazard	Planned Vessel Discharges		
	Frequency	Severity	Risk
Inherent Risk	E	1	L
Residual Risk	B	1	L

6.6.2 Description of Hazard

The seismic, support and chase vessels will produce planned vessel discharges, including putrescible wastes such as greywater, sewage and food scraps, and contaminated water such as deck drainage, bilge water, cooling water and brine.

6.6.2.1 Sewage, Greywater and Food Scraps

Combined sewage and grey water from the survey vessels will be treated by onboard sewage treatment facilities, certified to meet MARPOL 73/78 Annex IV requirements.

6.6.2.2 Contaminated Water

On the vessels, under normal operating conditions, scupper plugs are fitted at open deck drainage points, to direct drainage to the bilge water tank for processing. However, if clean water builds up after, for example, after heavy rain, these plugs are manually removed, allowing the clean water to drain to sea. Bilge water is generated on the vessels and consists of deck drainage and machinery space water that has been directed to a bilge water tank. Sources of contamination include chemical spills on deck. Bilge water shall be diverted to a holding tank either for onshore disposal at an appropriately licenced facility, or for discharge with an oil content of less than 15ppm in accordance with MARPOL 73/78 Annex I.

6.6.2.3 Cooling Water and Brine

Cooling water is used as a heat exchange medium for cooling the machinery engines on the vessels. Seawater is drawn from the ocean and flows counter-current through closed-circuit heat exchangers, transferring heat from engines and machinery to the seawater. The seawater is then discharged to the ocean. Cooling water temperatures vary depending upon the vessel engine's workload and activity; however, may be in the vicinity of 32°C.

The survey vessels may be required to produce potable water through reverse osmosis, with the process producing hypersaline brine as a byproduct. On average, seawater has a salt concentration of 35,000ppm. Brine will be discharged to the ocean at a salinity of approximately 10% higher than seawater. Brine may also contain scale inhibitors used in the reverse osmosis process to control inorganic scale formation in water supply systems. The volume of brine discharge will depend on the requirements for potable water and will vary between the vessels and the number of people on board. Brine discharges will be intermittent and as required.

6.6.3 Potential Environmental Impact

6.6.3.1 Sewage, Greywater and Food Waste

Sewage, greywater and food waste discharge has the potential to increase nutrient availability and biological oxygen demand in the marine environment. However, in the open oceanic environment, the impact of biological oxygen demand on seawater oxygen concentrations is expected to be negligible (Black et al., 1994).

Some fish and marine seabirds may be attracted to the vessels by the discharge of food waste. However, given the small quantities, intermittent nature of discharge and movement of currents, any attraction is likely to be slight and is not anticipated to result in adverse impacts at an ecosystem or population level.

Given the temporary and highly localised nature of the potential impacts to water quality from these discharges, as well as the transient nature of marine fauna, impacts are not expected, but at worst, would be limited to behavioural change to a small number of individuals. Overall, the discharge of sewage, grey water and putrescible wastes is not expected to have any significant negative effects on the marine environment.

6.6.3.2 Contaminated Water

Discharges of contaminated water can result in injury or mortality to marine fauna as a result of toxicity or changes in water quality. Marine fauna with the most potential to be impacted by contaminated water include plankton and fish, in particular fish at earlier life stages.

Oil-contaminated water on the survey vessels shall be diverted to a holding tank either for onshore disposal at an appropriately licenced facility, or for discharge with an oil content of less than 15ppm (MARPOL 73/78 Annex I). The environmental impacts associated with a discharge are likely to be highly localised and temporary, due to the low volumes and the high dilution rates expected at the open ocean environment.

When discharged into the marine environment, the small volumes of contaminated water from deck drainage are anticipated to quickly disperse in the offshore waters. These discharges will occur intermittently and may cause a localised and temporary (lasting a few hours) reduction in water quality near the release point. The strong ocean currents in the survey area are expected to further dilute the deck drainage, minimising the duration of chemical exposure to marine fauna. Additionally, deck cleaning products will comply with MARPOL 73/78 Annex V standards, ensuring they are not harmful to the marine environment. Consequently, the release of chemicals in contaminated water is not expected to have toxic effects on marine fauna.

Cooling water will remain in the surface layer, where turbulent mixing and heat transfer with surrounding waters will occur. This will cause localised increases in water temperature. The potential impacts of increased seawater temperatures downstream of the cooling water discharge are localised changes to the physiological processes of marine organisms (particularly plankton), including attraction or avoidance behaviour. It is expected that most pelagic species could tolerate short-term exposure to small increases in temperature and salinity resulting from discharge. Given the temperature of the discharge is only marginally higher than that of the receiving waters and the receiving environment is subject to strong currents, the impacts of cooling water discharges are considered minor and will be temporary and localised.

6.6.3.3 Brine Impacts

Brine generated from onboard reverse osmosis systems will be discharged directly to the open ocean intermittently in small quantities. Elevated salinity from brine discharges can impact plankton, with early life stages of fish and other plankton being most vulnerable to the toxicity of residual chemicals in brine. However, most marine species can tolerate short-term salinity fluctuations of 20% to 30% (Walker and McComb, 1990). Therefore, it is expected that most pelagic species can endure brief exposure to slight increases in salinity resulting from the discharge. The brine will be rapidly mixed and diluted in the open offshore waters and dispersed by the strong currents in the region. As a result, potential impacts are expected to be minor, localised to the discharge point, and temporary in duration.

Chemicals used in the production of potable water will be significantly diluted before being discharged and low in toxicity. Upon the brine discharge, these chemicals will dilute further in the marine environment.

No transboundary impacts are expected from contaminated water, as discharges are anticipated to be localised to discharge points and rapidly dispersed.

6.6.4 Management Control Measures

Standard control measures relating to this risk comprise:

- Sewage treatment system in accordance with MARPOL 73/78 Annex IV.
- Waste management procedure in accordance with MARPOL 73/78 Annex V.
- Oily water treatment system in accordance with MARPOL 73/78 Annex I.
- Oily water prevention in accordance with MARPOL 73/78 Annex I.
- Valid International Oil Pollution Prevention Certificate, which confirms that required measures to reduce impacts of planned oil discharges are in place on vessels.
- Vessels will have and be compliant with a Garbage Management Plan in accordance with MARPOL 73/78 Annex V, as appropriate to vessel class.
- Equipment/machinery involved in the treatment of wastes will be routinely maintained.
- All crew will participate in the vessel and environmental induction prior to the commencement of the survey activity.
- Chemical selection process in Eni is followed and all chemicals to be used must be submitted for approval to ANP before use.

No additional control measures were adopted. Evaluation of additional control measures is provided in Table 6-17.

6.6.5 As Low As Reasonably Practicable Demonstration

Discharges from vessels cannot be eliminated as the vessel must be crewed. Although the alternative of storing and transporting waste to shore was considered, it is deemed excessively costly and impractical. It would also require increased vessel transits for ship-to-shore services, resulting in higher fuel consumption, atmospheric emissions, increased exposure to biological health hazards by the crew and safety risks. As a result, this alternative is not considered beneficial, and the discharge of waste into the marine environment is viewed as the more practical option.

The discharge of these waste materials is permitted under MARPOL 73/78 Annex IV (sewage) and Annex V (garbage). This method of disposal is not expected to cause significant environmental impacts. The localised nature of any water quality changes, coupled with the transient behaviour of marine fauna, ensures the impact remains minimal, with only limited behavioural changes to a small number of individuals. No significant harm to marine life or social receptors, such as fishers, is anticipated. Compliance with MARPOL 73/78 ensures discharges are managed in a way that minimises environmental risks.

Implementing an oily water treatment system in accordance with MARPOL 73/78 Annex I ensures proper management of oily water discharges, significantly reducing the potential for environmental harm. Routine maintenance of the equipment involved in waste treatment ensures compliance with MARPOL standards and minimises emissions associated with the discharge.

To further mitigate risks, all crew members will undergo an environmental induction before mobilising for the survey. This ensures they are fully aware of their responsibilities regarding waste discharge and the environmental impacts of their actions.

Additional control measures (Table 6-17) were considered but rejected since the associated cost and effort were grossly disproportionate to any potential benefit. Accordingly, the impact is considered to be ALARP.

Table 6-17: Demonstration of 'as low as reasonably practicable' for planned discharges

Control Type	Control/ Management	Evaluation	Adoption?
Eliminate	Eliminating discharge on vessels	As the vessel is required to be crewed, generation of sewage, greywater and galley waste is unavoidable. Although this would reduce the impact of discharges, the storage of this waste on board the survey vessels and subsequent transfer to shore will add significant operational costs (fuel, etc), and increase the environmental risk and impact due to the additional journeys to port. It is considered that the costs associated with this control measure are disproportionate to the benefits gained, as additional risks and impacts could occur from implementing this measure.	No
Substitute	N/A	N/A.	N/A
Engineering	Sewage treatment system	Reduces potential impacts of inappropriate discharge of sewage at sea or additional emissions associated with ship to shore of waste.	Yes (standard CM)

Control Type	Control/ Management	Evaluation	Adoption?
	Equipment/machinery involved in the treatment of wastes will be routinely maintained	Routine maintenance ensures that the requirements of MARPOL are met.	Yes (standard CM)
Isolation	N/A	N/A	N/A
Administrative	Implementation of MARPOL 73/78 Annex IV (sewage) and V (garbage)	MARPOL 73/78 Annex IV reduces potential impacts of inappropriate discharge of sewage. MARPOL 73/78 Annex V stipulates putrescible (food) waste disposal conditions and limitations. Environmental benefit outweighs the minor administrative costs in implementing MARPOL 73/78.	Yes (standard CM)
	Oily water treatment system in accordance with MARPOL 73/78 Annex I	MARPOL 73/78 Annex I stipulates the oily water prevention system and treatment requirements for oil in water discharge from vessels. Ensures proper management of oily water discharges. Environmental benefit outweighs the minor administrative cost of implementation.	Yes (standard CM)
	Oily water prevention in accordance with MARPOL 73/78 Annex I		Yes (standard CM)
	Vessels have an International Oil Pollution Prevention Certificate	Vessels will have an International Oil Pollution Prevention Certificate in compliance with MARPOL 73/78. Environmental benefit outweighs the minor administrative costs.	Yes (standard CM)
	All crew will participate in the vessel and environmental induction before survey mobilisation	During inductions, crew will be made aware of their responsibilities with regard to effects of the discharge of wastes to the marine environment and restrictions around the overboard discharge of waste materials. This ensures they are fully aware of their responsibilities regarding waste discharge and the environmental impacts of their actions.	Yes (standard CM)
	Chemical selection process in Eni is followed and all chemicals to be used must be submitted for approval to ANP before use	The chemical risk assessment process will ensure any new chemicals are assessed before use in accordance with the procedure to reduce impact to ALARP. Will ensure that chemicals will only be used if approved by ANP.	Yes (standard CM)

6.6.6 Acceptability Demonstration

Demonstration of Acceptability	
Compliance with Legal Requirements, Laws, Standards	Vessels compliant with MARPOL requirements.
Policy Compliance	The management is aligned with Eni policies and standards.
Social Acceptability	The survey area is not within an area of known shipping or high fishing activity.
Area Sensitivity/ Biodiversity	There are no resident sensitive water column environmental receptors in the survey area. The volumes of planned vessel discharges will be small and will be rapidly broken down.
ESD Principles	The impact assessment presented throughout this section demonstrates compliance with the principles of ESD.
ALARP	The residual risk has been demonstrated to be ALARP.

7 NON-ROUTINE ACTIVITIES

7.1 Vessel Collision or Entanglement with Marine Fauna (Risk ID U1)

7.1.1 Summary of Environmental Impact

Hazard	Vessel Collision or Entanglement with Marine Fauna		
	Frequency	Severity	Risk
Inherent Risk	B	2	L
Residual Risk	A	2	L

7.1.2 Description of Hazard

There is the potential for the vessels to collide with marine fauna, including whale sharks, migratory pygmy blue whales, and marine turtles, during the survey activity. The main collision risk is vessel collision with large, slow-moving cetaceans, potentially resulting in severe injury or mortality.

There is also the potential for marine fauna to become entangled in the seismic streamers and the associated equipment, particularly marine turtles and cetaceans, also resulting in injury or mortality.

7.1.3 Potential Environmental Impact

Vessel collision with marine fauna, or marine fauna entanglement with seismic survey equipment, may result in injury or death of marine fauna. Marine fauna that are present in surface waters, such as turtles and cetaceans, are most susceptible to vessel strikes and entanglement due to their proximity to the vessels (hull, propeller or equipment) and deployed seismic equipment (streamers, cables and attached equipment).

The survey area is not within any known aggregation, foraging or biologically important areas. Therefore, their presence is limited to individuals traversing through the survey area. Vessels supporting the survey activity will also generally travel at speeds of less than five knots. Cetaceans, marine turtles and other marine fauna are expected to exhibit avoidance behaviour, due to the noise of the seismic airguns; therefore, close-range encounters are expected to be infrequent and limited to isolated individuals in the immediate vicinity of the survey vessels and survey array. Additionally, management control measures presented in Section 7.1.4, including MMO and PAM operatives on vessels, will further reduce the potential for collision or entanglement. As a result, marine fauna injury or mortality as a result of collision or entanglement is highly unlikely and there is no risk of population-level impacts or threats of serious or irreversible environmental damage.

7.1.4 Management Control Measures

Standard control measures for this risk comprise:

- Vessels will adhere to the JNCC Guidelines for Minimising the Risk of Injury to Marine Mammals from Geophysical Surveys (2017).
- Vessels will adhere to Eni Minimum HSE Requirements in Geophysical Operations, including requirements for offshore seismic surveys.
- Use of sufficient MMOs and PAM operatives on vessels.
- Marine megafauna interaction requirements included in survey activity inductions.

- Any vessel strike incident to marine mammals shall be reported to ANP as soon as possible.
- Turtle guards on streamers

No additional control measures were adopted. Evaluation of additional control measures is provided in Table 7-1.

7.1.5 As Low As Reasonably Practicable Demonstration

The use of vessels during the survey activity cannot be eliminated, as they are essential for undertaking the survey activity. Similarly, scheduling vessel movements outside of sensitive marine fauna periods was considered but was not adopted, as it would introduce safety, environmental and scheduling risks, including potential delays due to vessel availability and increased exposure to inclement weather.

Administrative controls have been adopted to manage the residual risk of vessel collisions with marine fauna. Marine megafauna interaction requirements will be included in survey activity inductions to ensure all vessel crew are aware of the necessary procedures for minimising interactions with marine fauna. Vessels will adhere to the JNCC Guidelines for Minimising the Risk of Injury to Marine Mammals from Geophysical Surveys (2017) and Eni Minimum HSE Requirements in Geophysical Operations. These measures ensure proper precautions are taken to minimise risks to marine mammals during the survey activity and ensure compliance with operational safety standards.

The use of dedicated MMOs and PAM operatives has been adopted to improve the ability to identify marine fauna at risk of collision and ensure compliance with marine fauna interaction procedures. MMOs will assist in implementing mitigation measures and advising vessel crew about appropriate responses when marine fauna are observed near the vessels. Any vessel strike incidents to the marine mammal will be reported to ANP as soon as possible, to ensure regulatory oversight and to enable timely assessment of the impact. The use of spotter planes to detect marine fauna was considered but rejected, as the costs associated with implementing this measure were grossly disproportionate to the environmental benefit, given the low risk of vessel interactions with marine fauna in the survey area.

Additional controls were considered (Table 7-1) for managing the risk of marine fauna interaction but were not adopted, because their cost and effort were disproportionate to the potential benefits. Given the short duration of the survey activity, the low potential risk, and the implementation of effective controls, Eni considers the risks associated with vessel collisions or entanglement with marine fauna to be managed to ALARP.

Table 7-1: Demonstration of 'as low as reasonably practicable' for marine fauna interaction

Control Type	Control/ Management	Evaluation	Adoption?
Eliminate	Eliminate vessel use	Would eliminate risk. However, vessel movements cannot be eliminated as the vessels are required to undertake the survey activity.	No
Substitute	N/A	N/A.	N/A

Control Type	Control/ Management	Evaluation	Adoption?
Engineering	Turtle guards on seismic tail-buoys	Turtle guards are a structure welded to the underside of tail buoy designs, with the aim of avoiding sea turtles from becoming entrapped in the trailing tail buoys	Yes
Isolation	N/A	N/A.	N/A
Administrative	Marine megafauna interaction requirements included in survey activity inductions	Vessel crew inductions will include the requirements for interaction with marine fauna. Ensures vessel crew are aware of obligations and controls relating to marine fauna interaction. Negligible cost of adopting the control measure.	Yes (standard CM)
	Vessels will adhere to the JNCC Guidelines for Minimising the Risk of Injury to Marine Mammals from Geophysical Surveys (2017)	Ensures proper precautions are taken to minimise the risk to marine mammals during the survey activity.	Yes (standard CM)
	Vessel will adhere to Eni Minimum HSE Requirements in Geophysical Operations, including requirements for offshore seismic surveys	Complying with Eni's HSE requirements ensures operational safety and mitigates environmental impact, including risks associated with vessel collision or marine fauna interaction.	Yes (standard CM)
	Use of sufficient MMOs and PAM operatives on vessels	Improves ability to spot and identify marine fauna at risk of collision.	Yes (standard CM)
	Use of spotter planes to identify marine fauna in the region	Improves ability to spot and identify marine fauna at risk of collision. However, costs involved with implementing this control is grossly disproportional to the environmental benefit, given the low risk of occurrence.	No
	Plan vessels movements during periods when sensitive marine fauna are not present	This control is impractical to implement due to the need to schedule seismic surveys around vessel and crew availability.	No
	Any vessel strike incident to marine fauna shall be reported to ANP as soon as possible	Ensures regulatory oversight and accountability. Enhances transparency and enables timely assessment of potential environmental impact.	Yes (standard CM)

7.1.6 Acceptability Demonstration

Demonstration of Acceptability	
Compliance with Legal Requirements, Laws, Standards	Marine fauna interaction requirements included in survey activity inductions. Vessels will adhere to the JNCC Guidelines for Minimising the Risk of Injury to Marine Mammals from Geophysical Surveys (2017) and Eni Minimum HSE Requirements in Geophysical Operations, including requirements for offshore seismic surveys.
Policy Compliance	The management is aligned with Eni policies and standards.
Social Acceptability	The survey area is not within an area of known shipping or high fishing activity.
Area Sensitivity/ Biodiversity	Pelagic marine megafauna, including cetaceans and marine turtles, at most risk. However, no turtle nesting beaches or feeding or breeding areas are located near the survey area and cetaceans and marine turtles exhibit avoidance behaviour. Control measures implemented will minimise the potential risks and impacts from the survey activity to the relevant species identified.
ESD Principles	The impact assessment presented throughout this section demonstrates compliance with the principles of ESD.
ALARP	The residual risk has been demonstrated to be ALARP.

7.2 Loss of Equipment and Dropped Objects (Risk ID U2)

7.2.1 Summary of Environmental Impact

Hazard	Loss of Equipment and Dropped Objects		
	Frequency	Severity	Risk
Inherent Risk	B	1	L
Residual Risk	A	1	L

7.2.2 Description of Hazard

During the survey activity, there is the potential for dropped objects (such as personal protective equipment, small tools or domestic waste) to occur as a result of human error or incorrect storage, equipment failure and accidental loss during transfer of materials.

In addition to accidental dropped objects, there is potential for loss of seismic streamers to occur due to snagging with floating debris, rupture from abrasions or shark bites, or loss from severance during a collision (for example, if another vessel were to accidentally cross the streamer). Solid streamers, such as those proposed to be used during the survey activity, are negatively buoyant and sink quickly if severed.

7.2.3 Potential Environmental Impact

If equipment is lost, other users of the survey area may be required to make minor diversions to avoid the equipment, until it can be retrieved. The potential for such interactions will be limited to a short period of time while equipment is retrieved. Should disruption occur, it is only expected to affect individual users and cause temporary disruption through avoidance of a highly localised area. Given the nature and size of the equipment to be used during the survey activity, lost equipment is not expected to result in a navigational hazard.

If a streamer or dropped object is irretrievably lost, it will make direct contact with the seabed, causing physical damage to the benthic habitat and any sensitive communities

in the survey area. The seabed within the survey area likely consists of soft sediments with varying amounts of silt and sand, and sparse hard substrates inhabited by sponges, soft corals and filter feeders. These habitats are well represented through the region. A lost object may disturb the seabed upon landing, causing local physical damage or resuspension of fine sediments. This could affect benthic faunal communities in the immediate area. Over time, natural sediment settling and redistribution would aid recovery. These impacts, both direct and indirect, would be limited in scope and relative to the size of the streamer(s) or object. Consequently, no long-term impacts are anticipated.

Additionally, dropped objects could contaminate or impact local water quality; see Sections 7.3 and 7.4 for further details.

7.2.4 Management Control Measures

Standard control measures for this risk comprise:

- Hazardous and non-hazardous waste management process will be in place in accordance with MARPOL 73/78 Annex V:
  - All wastes will be collected and segregated into clearly marked containers before onshore disposal by a licenced waste management contractor.
  - All bins on deck will be covered to prevent rubbish blowing overboard.
  - Records will be maintained of solid and hazardous waste volumes generated and transferred for onshore recycling or disposal.
  - Waste management procedure will be implemented, including safe handling, treatment, transportation and appropriate segregation and storage of all waste generated.
  - Lost waste materials will be recovered when safe and practicable to do so.
- Streamer related controls:
  - Approved procedures for streamer deployment.
  - Routine maintenance and inspection of streamer equipment.
  - Streamers will be fitted with:
    - streamer recovery devices (self-inflating)
    - surface marker buoys
    - secondary retaining devices
    - tail buoys.
  - Support and chase vessels will search for and recover lost in-water equipment where possible and safe to do so.
  - Relevant persons will be notified via radio in the event of a loss of in-water equipment.

No additional control measures were adopted. Evaluation of additional control measures is provided in Table 7-2.

7.2.5 As Low As Reasonably Practicable Demonstration

To manage the risk of equipment loss and dropped objects during the survey activity, several control measures have been implemented. The option of laying the streamer on the seafloor was considered; however, it was considered impractical due to significant cost, seabed disturbance, safety concerns, and the additional time required, especially in deep water. Alternative data acquisition methods were also ruled out, as they would render the survey activity inoperable.

Routine maintenance and inspection of streamers, cables and attachment points help identify and address any wear and tear, reducing the risk of failure and equipment loss. Approved procedures for streamer deployment further ensure the safe handling and operation of equipment, minimising the risk of damage during deployment. In addition, streamer recovery devices are fitted along the streamer and programmed to deploy automatically, ensuring any damaged or severed streamers are retrieved before reaching the seabed, thus preventing environmental impacts. Hazardous and non-hazardous waste segregation, in accordance with MARPOL 73/78 Annex V, also reduces the likelihood of waste being lost to the marine environment. Finally, the practice of recording and reporting all incidents of lost equipment ensures lessons are learned and continuous improvement is made in future operations.

Additional control measures (Table 7-2) were considered but rejected, as the associated costs and effort were disproportionate to the potential environmental benefits. The combination of the adopted measures effectively reduces the risk of dropped objects and equipment loss, while the associated costs are reasonable relative to the environmental and safety benefits, ensuring the risk is ALARP.

Table 7-2: 'As low as reasonably practicable' demonstration for loss of equipment and dropped objects

Control Type	Control/ Management	Evaluation	Adoption?
Eliminate	Laying the streamer on the seafloor, also known as ocean bottom cable, as opposed to towing the streamer	Using this methodology for the survey activity would effectively eliminate the risk associated with the potential loss of a streamer, but it still requires an acoustic source to be towed behind a source vessel. The towed recording device will not pose a significant risk to marine life within the water column and would require less source locations to deliver an equivalent dataset and achieve the survey activity objectives. Deploying the recording array on the seabed takes significantly more time and will introduce additional health and safety risks. The costs would be prohibitively expensive and impracticable for a survey of this size, especially given the water depths. The proposed methodology is the most efficient way of conducting the survey activity in the shortest amount of time and will reduce the time the seismic vessel is in the survey area.	No
Substitute	Alternative data acquisition method	The survey activity cannot acquire seismic data without the use of a streamer and its associated equipment. Implementation of this control measure would render the survey activity inoperable.	No

Control Type	Control/ Management	Evaluation	Adoption?
Engineering	Routine maintenance and inspection of streamer and associated equipment	Regular inspections and maintenance of streamers and associated equipment (such as cables and attachment points) ensures any 'wear and tear' is identified and fixed, reducing the potential for the breaking (and subsequent loss) of equipment.	Yes (standard CM)
Isolation	Hazardous and non-hazardous processes (waste segregation in accordance with MARPOL 73/78 Annex V)	Securely segregating and isolating the hazardous and non-hazardous waste in accordance with MARPOL 73/78 Annex V will reduce the likelihood of it being lost to the marine environment. Minor cost involved in segregating the hazardous and non-hazardous waste.	Yes (standard CM)
Administrative	Waste management procedure in accordance with MARPOL 73/78 Annex V	Reduces the risk of impact to the environment from loss of hazardous and non-hazardous waste. Outweighs the personnel cost associated with implementing procedures.	Yes (standard CM)
	Dropped objects will be retrieved where possible	Reduces the likelihood of the objects either impacting benthic habitat in the longer-term; or being ingested by marine fauna.	Yes (standard CM)
	Approved procedures for streamer deployment	Approved procedures relating to preparation and deployment of the seismic equipment will reduce the risk of streamer damage and potential loss.	Yes (standard CM)
	Streamer recovery devices	Streamer recovery devices will be fitted at intervals along the streamer and programmed to automatically deploy at water depths that are shallower than the depth of the ocean where seismic data acquisition is occurring. This will allow a damaged or severed streamer to return to the sea surface before impacting the seabed.	Yes (standard CM)
	Reporting of all incidents of lost equipment	The recording and reporting of incidents, including those associated with lost equipment, is standard in the industry.	Yes (standard CM)

7.2.6 Acceptability Demonstration

Demonstration of Acceptability	
Compliance with Legal Requirements, Laws, Standards	Compliance with MARPOL 73/78 Annex V.
Policy Compliance	The management is aligned with Eni policies and standards.
Social Acceptability	The survey area is not within an area of known shipping or high fishing activity.
Area Sensitivity/ Biodiversity	Controls adopted will reduced the risk of dropped objects and impact to the seabed (including benthic fauna).
ESD Principles	The impact assessment presented throughout this section demonstrates compliance with the principles of ESD.
ALARP	The residual risk has been demonstrated to be ALARP.

7.3 Non-Hazardous and Hazardous Waste Loss to Marine Environment (Risk ID U3)

7.3.1 Summary of Environmental Impact

Hazard	Non-hazardous and Hazardous Waste Loss to Marine Environment		
	Frequency	Severity	Risk
Inherent Risk	B	1	L
Residual Risk	A	1	L

7.3.2 Description of Hazard

The survey activity will generate various solid and liquid wastes, including packaging, domestic wastes such as paper, plastic, bottles and scrap materials, and industrial wastes such as chemicals, waste oil and consumables.

Non-hazardous solid waste, such as scrap metal, packaging and paper, will be stored on board in suitable containers (segregated from hazardous waste materials) for transport back to shore for disposal/recycling in accordance with local regulations.

All hazardous waste generated will be documented and tracked, segregated from other waste streams, and stored in suitable containers. Recyclable hazardous wastes, such as oils and batteries, will be stored separately from non-recyclable materials. All hazardous waste materials will be transported to shore for disposal or recycled at an approved facility in accordance with local requirements.

Chemicals and other hazardous materials that will be stored on the vessels include:

- lubricating oils, cleaning and cooling agents
- oil filters and batteries
- oily rags
- paint, aerosol cans
- acids/caustics and solvents.

No discharge of non-hazardous or hazardous solid waste to sea is expected during the survey activity. All waste generated will be transported to licenced onshore facilities and managed appropriately by third parties.

7.3.3 Potential Environmental Impact

Potential impacts from the loss of hazardous and non-hazardous waste to the marine environment include:

- localised and temporary reduction in water quality
- pollution or contamination of the marine environment
- injury or mortality to marine fauna through ingestion or entanglement.

Potential impacts of accidental non-hazardous and hazardous waste discharge to sea may result in physical harm to marine fauna resulting from ingestion or entanglement with waste.

It is considered highly unlikely that any unplanned discharges of waste will result in significant impacts to the marine environment. The survey area does not contain any significant feeding, breeding or aggregation areas for marine fauna. Any potential impacts from unplanned discharges of waste are expected to be limited to a small number of individuals that may be transiting the survey area. The potential impacts to water quality from unplanned liquid waste discharges are likely to be for a short duration only, due to the rapid dispersion of the fluids as a result of ocean currents.

7.3.4 Management Control Measures

Standard control measures for this risk comprise:

- Hazardous and non-hazardous waste management process will be in place in accordance with MARPOL 73/78 Annex V:
  - All wastes will be collected and segregated into clearly marked containers before onshore disposal by a licenced waste management contractor.
  - All bins on deck will be covered to prevent rubbish blowing overboard.
  - Records will be maintained of solid and hazardous waste volumes generated and transferred for onshore recycling or disposal.
  - Waste management procedure will be implemented, including safe handling, treatment, transportation and appropriate segregation and storage of all waste generated.
  - Lost waste materials will be recovered when safe and practicable to do so.

Additional control measures (Table 7-3) considered and adopted comprise:

- All crew will participate in the vessel and environmental induction before the survey activity begins.

7.3.5 As Low As Reasonably Practicable Demonstration

The complete elimination of waste production is not possible, due to the need for consumable products to facilitate the survey activity. While waste generation is unavoidable, implementing segregation and isolation measures in accordance with MARPOL 73/78 Annex V significantly reduces the risk of waste being lost to the marine environment. Proper waste management processes ensure all waste – both hazardous and non-hazardous – is securely contained and handled, minimising the likelihood of accidental discharges. Where safe to do so, dropped objects, including waste materials, will be retrieved to prevent long-term environmental impacts such as habitat damage or ingestion by marine fauna.

Vessel and equipment will be operated by trained and experienced crew to ensure proper handling and operation, minimising the risk of accidental releases. All crew members will participate in the vessel and environmental induction before operations begin, raising awareness of the risks associated with waste discharge and the regulations on overboard disposal. This training ensures crew members understand their responsibilities, comply with established procedures, and contribute to environmental protection.

Other additional control measures (Table 7-3) were considered but rejected, as the associated costs and efforts were disproportionate to the potential environmental benefits. The combination of adopted measures effectively minimises the risk of hazardous and non-hazardous waste loss to the marine environment, and the residual risk is considered ALARP.

Table 7-3: 'As low as reasonably practicable' demonstration for non-hazardous and hazardous waste loss to the marine environment

Control Type	Control/ Management	Evaluation	Adoption?
Eliminate	Eliminate production of non-hazardous and hazardous waste	Eliminates the risk of release of waste materials to the environment; however, eliminating the use of consumable products is not possible due to planned survey activity requirements; waste will therefore be generated. Use of the vessels that generate waste is required to perform the survey activity; therefore, risk cannot be eliminated.	No
Substitute	N/A	N/A.	N/A
Engineering	N/A	N/A.	N/A
Isolation	Waste management procedure in accordance with MARPOL 73/78 Annex V	Securely segregating and isolating the hazardous and non-hazardous waste will reduce the likelihood of it being lost to the marine environment. Minor cost involved in segregating the hazardous and non-hazardous waste.	Yes (standard CM)
Administrative	Implement a hazardous and non-hazardous waste management process	Reducing the risk of impact to the environment from loss of hazardous and non-hazardous waste outweighs the personnel cost associated with implementation of procedures.	Yes (standard CM)
	Dropped objects to be retrieved where possible	Retrieving dropped objects where possible reduces the likelihood of the objects either impacting benthic habitat in the longer-term, or being ingested by marine fauna.	Yes (standard CM)
	All crew will participate in the vessel and environmental induction before operations begin	During inductions, crew will be made aware of their responsibilities regarding the effects of discharge of wastes to the marine environment and restrictions around the overboard discharge of waste materials. This awareness reduces the risk of accidental discharges and ensures compliance with regulations.	Yes
	All packaging, handling, and containers to be made of biodegradable materials	Some materials/substances carried onboard cannot be safely contained within biodegradable containers and attempting to do so may place crew at greater danger and increase risk of incident, which could result in risk to environment.	No

7.3.6 Acceptability Demonstration

Demonstration of Acceptability	
Compliance with Legal Requirements, Laws, Standards	Compliance with MARPOL 73/78 Annex V (Prevention of pollution by garbage) as required by vessel class.
Policy Compliance	The management is aligned with Eni policies and standards.
Social Acceptability	The survey area is not within an area of known shipping or high fishing activity.
Area Sensitivity/Biodiversity	No discharge of non-hazardous and hazardous waste to sea is expected for the planned activities.
ESD Principles	The impact assessment presented throughout this section demonstrates compliance with the principles of ESD.
ALARP	The residual risk has been demonstrated to be ALARP.

7.4 Minor Hydrocarbon or Chemical Leaks (Risk ID U4)

7.4.1 Summary of Environmental Impact

Hazard	Minor Hydrocarbon or Chemical Leaks		
	Frequency	Severity	Risk
Inherent Risk	B	2	L
Residual Risk	B	1	L

7.4.2 Description of Hazard

The fluids stored on the seismic vessel, support vessels and chase vessels range from lubricating fluids to hydraulic fluids, which are used in fittings and connections including those used to operate streamer deployment and retrieval machinery.

Small leaks of these fluids could occur due to a mechanical failure, improper storage or incorrect handling, with the largest release typically being less than $1m^3$.

7.4.3 Potential Environmental Impact

The accidental release of up to $1m^3$ of hydraulic fluids or chemicals to the marine environment may result in a localised reduction in water quality. Hydraulic fluids spilt overboard have the potential to result in toxicity effects to marine fauna and fish in the immediate vicinity of the spill release location, through either direct contact or accidental ingestion. Given the open water dispersive location of the survey area and the extent and duration of potential exposures, impacts to marine fauna and fish are expected to be highly localised and short term, and limited to the vicinity of the point of discharge. Therefore, impacts are considered to result in a minor consequence and the residual risk has been determined to be Low with the proposed preventative controls in place.

7.4.4 Management Control Measures

Standard control measures for this risk comprise:

- Spill response plan in place for vessels.
- Spill response kits located in proximity to hydrocarbon storage/bunkering areas and appropriately stocked and replenished as required.

- Chemical selection process in Eni is followed and all chemicals to be used must be submitted for approval to ANP before use.
- Hydrocarbon or chemical storage containers will be properly stored with lids that are tight and secured to prevent spillage during vessel movement or rough weather.
- Storage containers will be managed in a manner that provides for secondary containment in the event of a spill or leak.
- Storage containers will be labelled with the technical product name as per the Safety Data Sheet (SDS).
- Hazardous substances will be stored, segregated, handled and used in accordance with the product's SDS.
- Vessels to be maintained in accordance with the applicable PMS.
- Refuelling transfer procedures to prevent bunkering spills.

No additional control measures were adopted. Evaluation of additional control measures is provided in Table 7-4.

7.4.5 As Low As Reasonably Practicable Demonstration

The use of vessels cannot be eliminated as it is required for data collection during the survey activity. Several engineering and administrative controls are in place to mitigate the risk of hydrocarbon or chemical leaks. The vessels are equipped with oily water prevention systems in accordance with MARPOL 73/78 Annex I, which reduces the potential impacts of planned oily water discharges. Onboard spill response kits are readily available in proximity to hydrocarbon storage and bunkering areas, ensuring any minor spills are contained quickly.

The vessels operate under a Shipboard Oil Pollution Emergency Plan (SOPEP) that complies with MARPOL Annex I and outlines procedures to prevent spills from reaching the marine environment. To further minimise environmental risk, a chemical selection process is followed to reduce the toxicity of any potential unplanned chemical discharges.

Hazardous substances will be stored, segregated, handled and used in accordance with the product's SDS, ensuring proper identification and handling to minimise risk. Storage containers will be tightly sealed and labelled with the technical product name as per the SDS, and they will be properly managed to provide secondary containment in the event of a spill or leak. These controls ensure spills are prevented and immediate response actions are facilitated when necessary.

Routine maintenance, as part of the vessel's PMS, ensures the vessels are operating efficiently, in line with manufacturer specifications, and reduces the likelihood of mechanical failures that could result in leaks. The vessels will also comply with appropriate hazardous material regulations, ensuring safe and compliant handling throughout the survey activity.

Additional control measures (Table 7-4) were considered but rejected, as the associated costs and effort were disproportionate to the potential environmental benefits. The combination of the adopted measures, including regular maintenance, spill response preparedness, and storage and handling of chemicals in accordance with SDS, significantly reduces the risk of minor hydrocarbon or chemical leaks to the marine environment, ensuring the residual risk is ALARP.

Table 7-4: Demonstration of 'as low as reasonably practicable' for minor hydrocarbon or chemical leaks

Control Type	Control/ Management	Evaluation	Adoption?
Eliminate	Eliminate use of vessels	Use of vessels cannot be eliminated as a seismic vessel, support and chase vessels must be used to collect the required data. A support vessel is also needed for many reasons and cannot be removed from the survey activity.	No
Substitute	N/A	N/A.	N/A
Engineering	N/A	N/A.	N/A
Isolation	N/A	N/A.	N/A
Administrative	On-board spill response kits on vessels	Environmental benefit outweighs minor costs in implementing and locating spill response kits near hydrocarbon storage/bunkering areas on vessels. The use of these spill kits is also contained within the vessel spill response plan.	Yes (standard CM)
	Refuelling transfer procedures to prevent bunkering spills	Reduces the potential for bunkering spills with minimal cost involved.	Yes (standard CM)
	Spill response plans	Environmental benefit outweighs minor costs in implementing and testing the vessel spill response plan (SOPEP), which contains plans to prevent spills from reaching the marine environment. The SOPEP is a requirement under MARPOL Annex I which requires all vessels over 400 gross tonnages have a SOPEP or Shipboard Marine Pollution Emergency Plans outlining options to control the source of a hydrocarbon spill.	Yes (standard CM)
	Chemical selection process is followed	Improves water quality discharge (reduced toxicity) to the marine environment in the event of an unplanned release.	Yes (standard CM)
	Hydrocarbon or chemical storage containers will be properly stored with lids that are tight and secured to prevent spillage during vessel movement or rough weather	Ensures proper storage and management of chemicals - reducing the risk of mismanagement, accidental spills, or incorrect handling. These measures enhance safety, facilitate appropriate response actions in case of leaks, and support compliance with hazardous material regulations.	Yes (standard CM)

Control Type	Control/ Management	Evaluation	Adoption?
	Storage containers will be managed in a manner that provides for secondary containment in the event of a spill or leak		Yes (standard CM)
	Storage containers will be labelled with the technical product name as per the SDS		Yes (standard CM)
	Hazardous substances will be stored, segregated, handled and used in accordance with the product's SDS		Yes (standard CM)
	Vessels to be maintained in accordance with applicable PMS	Ensures the vessels are running efficiently and as per manufacturer's specifications. Routine maintenance reduces the probability of hydrocarbon and chemical leaks to the environment.	Yes (standard CM)
	Oily water prevention in accordance with MARPOL 73/78 Annex I	MARPOL 73/78 Annex I stipulates the oily water prevention system and treatment requirements for oil in water discharge from vessels. Ensures proper management of oily water discharges. Environmental benefit outweighs the minor administrative cost of implementation.	Yes (standard CM)

7.4.6 Acceptability Demonstration

Demonstration of Acceptability	
Compliance with Legal Requirements, Laws, Standards	Compliance with MARPOL 73/78 Annex I. SOPEP in place in accordance with MARPOL 73/78 Annex I requirements.
Policy Compliance	The management is aligned with Eni policies and standards.
Social Acceptability	The survey area is not within an area of known shipping or high fishing activity.
Area Sensitivity/ Biodiversity	An accidental hydraulic fluid leak/chemical release has the potential to cause a localised temporary reduction in water quality. Given the low predicted release volume, the low toxicity and rapid dilution in the marine environment, toxicity impacts to marine fauna are highly unlikely.
ESD Principles	The impact assessment presented throughout this section demonstrates compliance with the principles of ESD.
ALARP	The residual risk has been demonstrated to be ALARP.

7.5 Introduction of Invasive Marine Species (Risk ID U5)

7.5.1 Summary of Environmental Impact

Hazard	Introduction of Invasive Marine Species		
	Frequency	Severity	Risk
Inherent Risk	B	3	M
Residual Risk	A	3	L

7.5.2 Description of Hazard

Invasive marine species (IMS) are non-native flora or fauna that establish new populations outside their natural habitats. They are often transported as larvae or juveniles on international vessels, either on hulls or in ballast and bilge water. IMS, once introduced, are often unable to be eradicated and can have significant impacts on the marine ecosystem as they are likely to have little or no natural competition or predation, resulting in IMS outcompeting native species for food or space, preying on native species, or changing the nature of the environment.

The survey activity has the potential to translocate or introduce IMS to the survey area due to the international movements of survey vessels.

7.5.3 Potential Environmental Impact

Potential impacts caused by IMS include:

- out-competing and displacing native species
- increasing predation or possibly depleting native flora and fauna
- altering the abundance and diversity of native species, resulting in changes to ecosystem function.

If left unmanaged, IMS can often result in irreversible impacts to the marine environment. Bax et al. (2003) state IMS often significantly change the environment in which they are introduced. This change may include applying predation pressure on native organisms, smothering habitats, or providing new structural habitat (Bax et al., 2003).

Receptors within the survey area most likely to be impacted by the introduction of IMS include benthic habitats and communities and fish species and populations. The establishment of IMS can also impact on marine users, particularly fishers.

The risk of IMS establishing in the survey area as a result of the survey activity is considered low, due to the location of the survey activity in relatively deep waters (40-180m) and general lack of key biological features such as shoals or reefs. IMS are generally unable to successfully establish in deep water environments due to the lack of suitable light and habitat (Geiling, 2014). Additionally, the risk of IMS introduction into the survey area is considered low due to the remoteness of the area, which is located 175km from any coastline; therefore, the likelihood that any marine organisms could become established at the survey area is remote.

7.5.4 Management Control Measures

Standard control measures for this risk comprise:

- All vessels will comply with Timor-Leste entry requirements and IMO International Convention for the Control and Management of Ships Ballast Water and Sediments 2004-MARPOL 73/78 (as appropriate to vessel class), including:
  - Ballast water exchanges conducted more than 50NM from land and in more than 200m water depth.
- International Convention on the Control of Harmful Anti-fouling Systems on Ships, which requires vessels (applicable to vessels only, of appropriate class) have a valid International Anti-fouling Systems Certificate.
- Implementation of IMS risk assessment tool (by Eni Logistics).

Additional control measures (Table 7-5) considered and adopted include:

- Survey equipment to be cleaned and dried before use in the survey area.

7.5.5 As Low As Reasonably Practicable Demonstration

The use of vessels cannot be eliminated, as they are essential for conducting the survey activity. Several controls have been put in place to mitigate the risk of introducing IMS through ballast water or hull fouling.

To assess and manage the risk of IMS introduction, an IMS risk assessment tool has been implemented for all vessels before mobilisation. This tool evaluates the risk level of each vessel and ensures only vessels deemed to have a low IMS risk are deployed. This assessment allows for additional control measures, such as dry-docking, to be considered based on the vessel's risk profile.

The vessels also comply with the International Convention for the Control and Management of Ships' Ballast Water and Sediments 2004. This compliance ensures ballast water exchange procedures are followed, significantly reducing the risk of transporting IMS through ballast water. The vessels' adherence to this international regulation ensures ballast water is managed properly, preventing the introduction of invasive species into the survey area. The vessel will also comply with the International Convention on the Control of Harmful Anti-fouling Systems on Ships to help with the risk of unplanned IMS.

Survey equipment used in the survey activity will be thoroughly cleaned and dried before deployment. This reduces the likelihood of transferring IMS through equipment, further ensuring the survey area remains free of species from other regions. This additional control measure has been adopted to minimise the risk of IMS introduction into the survey area.

Other additional controls were considered (Table 7-5) but rejected as the associated costs and effort were disproportionate to the potential environmental benefits. Vessels with alternative ballast systems that do not require a discharge was considered but rejected, due to the significant costs and delays involved in sourcing such vessels. Similarly, the heat treatment of ballast water was rejected due to the potential environmental harm it could cause, such as the death of native species through temperature differences.

The combination of the adopted measures, including the IMS risk assessment tool, compliance with ballast water management regulations, and cleaning of survey equipment, ensures the risk of IMS introduction is reduced to ALARP.

Table 7-5: Demonstration of 'as low as reasonably practicable' for introduction of invasive marine species

Control Type	Control/ Management	Evaluation	Adoption?
Eliminate	Do not use vessels	The use of vessels is unavoidable; therefore, the risk of exotic species being transported in ballast water or hull fouling cannot be completely eliminated.	No
	Do not exchange ballast	Exchange of ballast water is a safety-critical activity for marine operations and elimination of exchange could put the vessel and its crew at risk.	No
Substitute	Alternative ballast system which does not require a discharge	Using an alternative ballast system to avoid uptake/discharge of water would reduce the requirement for ballast water exchange; however, sourcing such vessels may present significant costs and delay in survey activity schedule and ballast water exchange is standard practice on many vessels.	No
	Ballast the vessel using only finely filtered water or freshwater	Ballast water requirements change frequently and supplying the required large volumes of finely filtered seawater, or freshwater. is either not possible quickly enough or would require large redesign of vessel(s) to create enough storage. Making freshwater, or filtering seawater, requires a large amount of energy, decreasing efficiency and sustainability. Therefore, the costs are disproportionate to benefits. Using 'local' water as ballast provides an effective means of reducing IMS introductions to ALARP.	No
Engineering	Heat treatment of ballast water to eliminate IMS	Would reduce potential for IMS to establish by eliminating individuals present in ballast water; however, discharge of water at much higher temperature than surrounding marine environment would likely result in death of native marine species.	No

Control Type	Control/ Management	Evaluation	Adoption?
	Niche areas and deployed equipment built/redesigned to reduce IMS attachment or stowage	Design of vessels, niche areas and the seismic equipment make them as efficient as possible at their task. Additional redesign adds significant cost and may decrease the efficiency of equipment. Costs are disproportionate to benefits.	No
Isolation	N/A	N/A.	N/A
Administrative	Vessels will comply with Timor-Leste entry requirements and IMO International Convention for the Control and Management of Ships Ballast Water and Sediments 2004-MARPOL 73/78 (as appropriate to vessel class), including: • Ballast water exchanges conducted more than 50nm from land and in more than 200m water depth	Compliance with these requirements reduces the risk of potential IMS from establishing within the survey area from discharge of ballast water. Vessels carrying ballast water and engaged in international voyages shall manage ballast water in accordance with a Ballast Water Management Plan so marine pest species are not introduced.	Yes (standard CM)
	Implementation of an IMS risk assessment tool	Ensures vessels are assessed to low IMS risk before mobilising for the survey activity. Minimal cost involved in demonstrating vessel(s) are of 'low risk' of introducing IMS through completing an IMS risk assessment. Additional controls (such as dry docking) would be considered, based on the outcome of the IMS risk assessment.	Yes (standard CM)

Control Type	Control/ Management	Evaluation	Adoption?
	International Convention on the Control of Harmful Anti-fouling Systems on Ships, which requires vessels (applicable to vessels only, of appropriate class) have a valid International Anti-fouling Systems Certificate	Helps mitigate the risk of unplanned introduction of IMS by ensuring vessels use environmentally safe anti-fouling systems.	Yes (standard CM)
	Survey equipment to be cleaned and dried before use in the survey area	Reduces the potential for IMS to be transferred into the survey area and ensures these risks are managed to ALARP.	Yes

7.5.6 Acceptability Demonstration

Demonstration of Acceptability	
Compliance with Legal Requirements, Laws, Standards	Compliance with: • Timor-Leste entry requirements and IMO International Convention for the Control and Management of Ships Ballast Water and Sediments 2004-MARPOL 73/78 • International Convention on the Control of Harmful Anti-fouling Systems on Ships, which requires vessels (applicable to vessel only, of appropriate class) have a valid International Anti-fouling Systems Certificate.
Policy Compliance	The management is aligned with Eni policies and standards.
Social Acceptability	The survey area is not within an area of known shipping or high fishing activity.
Area Sensitivity/ Biodiversity	Provided the biosecurity controls are implemented during the survey activity, the risk of introduction of IMS is deemed low.
ESD Principles	The impact assessment presented throughout this EMP demonstrates compliance with the principles of ESD.
ALARP	The residual risk has been demonstrated to be ALARP.

7.6 Marine Diesel Oil Spills to Sea (Risk ID U6)

7.6.1 Summary of Environmental Impact

Hazard	Marine Diesel Oil Spills to Sea		
	Frequency	Severity	Risk
Inherent Risk	B	3	M
Residual Risk	A	3	L

7.6.2 Description of Hazard

MDO used by the seismic and support vessels can be lost due to refuelling/bunkering incidents or collisions with other vessels. During operational activities, spills can occur

from damaged hoses, coupling failures, loss of connection, vessel collisions, or loss of vessel position. Overfilling spills are contained within the vessel's drainage system. If a refuelling pipe ruptures, the activity stops, but some fuel may still escape.

The worst-case spill during refuelling for this operation is estimated at 37.5m³. A vessel collision could rupture a fuel tank, potentially releasing up to 1,200m³ of MDO to the sea surface, although measures like pumping between tanks and ballasting can limit the discharge.

MDO properties are summarised in Table 7-6. Figure 7-1 and Figure 7-2 display the MDO weathering results under various environmental conditions from the hydrocarbon spill assessment completed by RPS (2024).

Table 7-6: Properties of marine diesel oil use in modelling

Name	Volatiles (%)	Semi-volatiles (%)	Low Volatiles (%)	Residual (%)
Boiling point (°C)	< 180	180 to 265	261 to 380	>380
	Non-persistent			**Persistent**
MDO	4.0	32.0	54.0	10.0

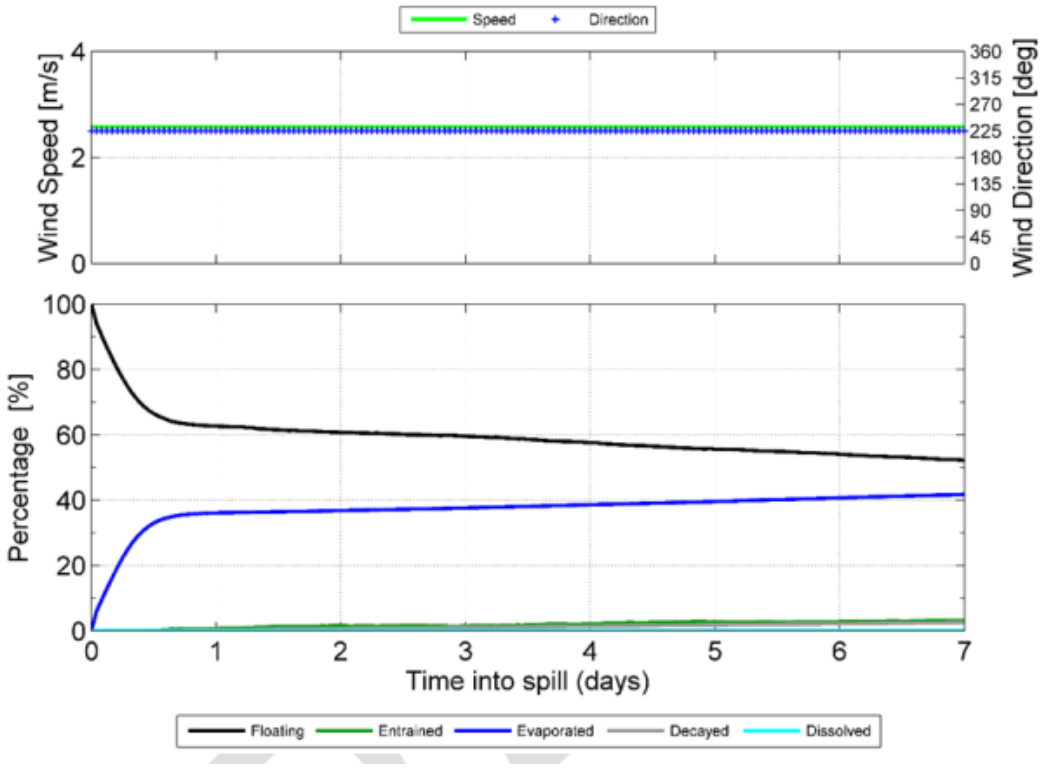


Figure 7-1: Predicted weathering of 50m³ of marine diesel oil tracked over seven days, subjected to constant 5-knot (2.6m/s) wind, currents and 27º water temperature

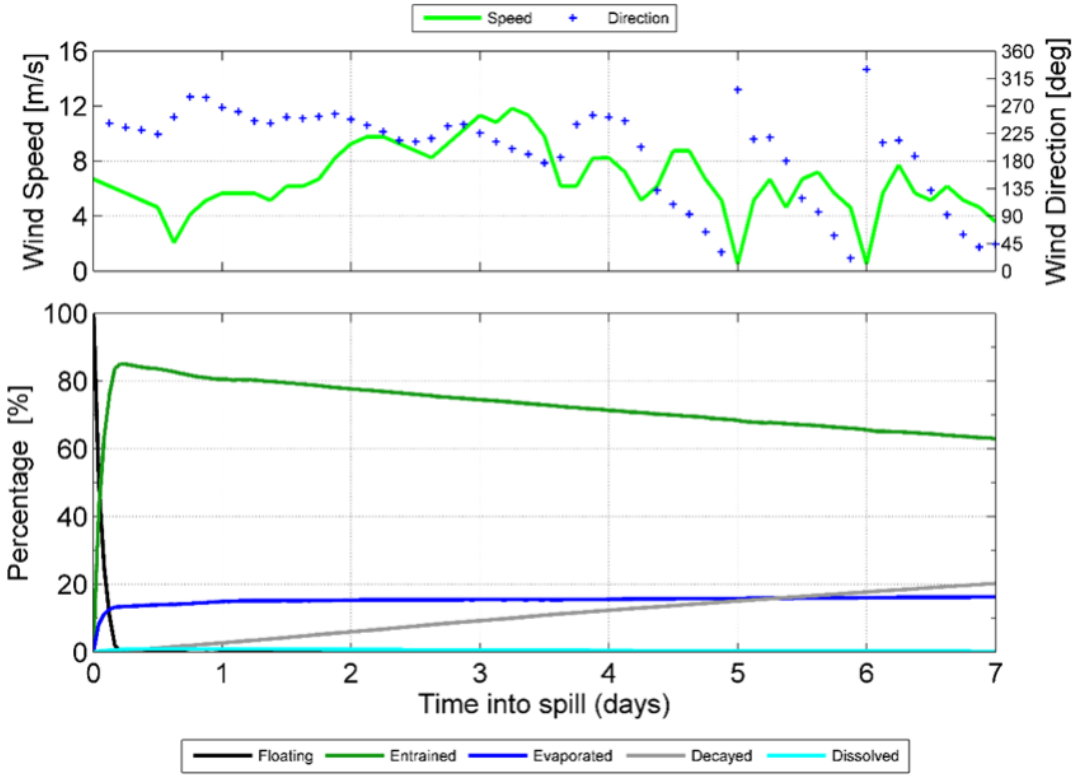


Figure 7-2: Predicted weathering of 50m³ of marine diesel oil tracked over seven days, subjected to variable wind speeds 2 to 23 knots (1 to 12m/s), currents and 27º water temperature

7.6.2.1 Spill Risk Assessment Methodology

Spill modelling was performed by RPS (RPS, 2024) on behalf of Eni to inform the risk assessment. The spill scenario involved a 1,200m³ surface spill of MDO over one hour from the seismic vessel resulting from a vessel collision. This spill scenario was selected as it represents the worst-case hydrocarbon spill event that could result during the survey activity. The modelled hydrocarbon spill scenario release location is shown in Table 7-7.

Table 7-7: Coordinates of the hydrocarbon spill modelling release location

Release Location	Longitude^	Latitude^	Easting*	Northing*
Closest location in the seismic survey area to the Timor-Leste shoreline	127° 53' 24.72" E	9° 55' 25.17" S	378335	8902825

*Datum: WGS 1984 ^GDA94 MGA Zone 52S

Modelling Software

The spill modelling was performed using the Spill Impact Model Application Package (SIMAP), an advanced 3D trajectory and fates model. The model calculates the transport, spreading, entrainment and evaporation of spilled hydrocarbons over time, based on the prevailing wind and current conditions and the physical and chemical properties of the hydrocarbon itself. The modelling does not take into consideration any of the spill prevention, mitigation and response capabilities that would be implemented in response to a hydrocarbon spill.

Modelling was conducted using a stochastic or probabilistic approach to simulate the defined credible scenarios using the same spill information – location, spill volume, duration, and composition of hydrocarbons – but randomly selected start times to ensure a range of seasonal wind and current conditions were assessed.

Once all the simulations were run, the results were combined and statistically analysed to determine the potential areas of hydrocarbon exposure in the surrounding waters, shorelines and sensitive receptors based on the thresholds. The stochastic approach captures a wide range of potential weathering outcomes under different environmental conditions, which is reflected in the aggregated spatial outcomes showing the areas that might be affected by hydrocarbons in a spill event.

The modelling outcomes demonstrate a worst-case hydrocarbon release extent by incorporating the maximum distances the hydrocarbon spill could travel under varying conditions. This worst-case hydrocarbon release extent captures the extent of every modelled hydrocarbon spill scenario; an actual hydrocarbon spill event may comprise a significantly smaller area than that shown by the modelling outcomes.

Thresholds

Hydrocarbons in the marine environment can be categorised into four separate phases, each with varying fates and impact mechanisms, being:

- floating: hydrocarbons on the surface of the water
- shoreline: accumulated hydrocarbon stranded onshore
- entrained: oil droplets that are suspended in the water column and insoluble

- dissolved: dissolved into the water, becoming evenly distributed throughout the water column.

Impact exposure thresholds were applied to the hydrocarbon spill modelling and used to inform the assessment of potential impacts and risks from a hydrocarbon release. Thresholds used in the modelling are shown in Table 7-8.

Table 7-8: Summary of the thresholds applied

Floating Oil Concentration (g/m²)	Shoreline Oil Accumulation (g/m²)	Entrained Hydrocarbons Concentration (ppb)	Instantaneous Dissolved Hydrocarbons (ppb)
1	10	10	10
10	100	100	50
50	1,000	-	400

7.6.3 Potential Environmental Impact

Results from the hydrocarbon spill modelling by RPS (2024) were extrapolated and used to assess the credible spill scenario. This scenario investigated a potential exposure from the surface release of 1,200m³ of MDO over one hour from a vessel spill. The MDO was tracked for 30 days to allow the concentrations to decrease below the lowest threshold (1g/m²).

An MDO spill may temporarily impact water quality for a short period while the release is dispersed and evaporates. When released to the marine environment, the MDO will spread quickly and thin out to low thickness levels, thereby increasing the rate of evaporation. Due to its chemical composition, up to 4% of the MDO mass should evaporate within the first 12 hours (boiling point (BP) < 180°C); a further 32.0% should evaporate within the first 24 hours (180°C < BP < 265°C); and an additional 54.0% should evaporate over several days (265°C < BP < 380°C), depending on prevailing wind conditions (RPS, 2024).

MDO also has low volatility and low aromatics, limiting the toxicity effects of entrained hydrocarbons. However, despite these properties, the potential impacts on the marine environment can still be significant, particularly in the short term. Recovery is expected to be relatively quick once the MDO disperses, but localised effects on marine fauna and water quality may still occur, requiring careful monitoring and mitigation.

Table 7-9: Maximum distances from the release location to floating oil exposure thresholds from a surface vessel spill for each season

Season	Distance and Direction Travelled	Floating Oil Exposure Thresholds		
		1g/m²	10g/m²	50g/m²
Summer	Maximum distance (km) from release location	187	105	67
	Direction	Northwest	Southwest	Southwest
Transitional	Maximum distance (km) from release location	265	216	86
	Direction	Southwest	West	West
Winter	Maximum distance (km) from release location	96	65	44
	Direction	Northwest	West	West

As shown in Table 7-9, floating oil concentrations exceeding 1g/m² could extend up to 265km from the release location. This distance is reduced to 216km and 86km as the threshold increases to 10g/m² and 50g/m², respectively.

The highest probability of exposure to floating oil at concentrations at or above 1g/m² is Oceanic Shoals Australian Marine Park at 4%, occurring during transitional conditions. Bellona Bank recorded the fastest time until exposure to floating oil at or above 1g/m², at 65 hours for a spill commencing during transitional conditions (Table 7-10). No receptors were forecast to be exposed by floating oil during winter conditions.

Additionally, Bellona Bank showed the highest probability of exposure to entrained hydrocarbons (40%) and dissolved hydrocarbons (3%) at or above the 10ppb threshold, with the highest concentration predicted at 1,145ppb and 35ppb, respectively (RPS, 2024). Sunrise Bank (located 25km north of the survey area) had the quickest time to exposure for entrained hydrocarbons, at 29 hours, experiencing a worst-case exposure of 245ppb during transitional conditions.

The highest probability of shoreline accumulation of MDO at or above 10g/m² occurred during summer conditions, reaching 22%, reducing to 2% for the transitional season and no contact for winter (Table 7-11). The maximum accumulated volume along any shoreline with concentrations ≥10g/m² was predicted for Timor-Leste and Lautem (Timor-Leste province) at 3m³ during summer, impacting 5km of shoreline for each location. The maximum volume accumulated on any shoreline during the transitional season was less than 1m³, impacting 1km of shoreline at Timor-Leste and Lautem; however, no shoreline accumulation was predicted for the winter season.

Table 7-10: Receptors predicted to be exposed to hydrocarbons after a vessel collision for each modelled season

Category	Name	Probability (%) of Floating Hydrocarbon			Maximum Time Before Exposure (hours)		
		≥1g/m²	≥10g/m²	≥50g/m²	≥1g/m²	≥10g/m²	≥50g/m²
Summer Conditions							
Reefs/Shoals/Banks	Bellona Bank	1	NC	NC	187	NC	NC
	Echo Shoals	2	NC	NC	187	NC	NC
	Sunset Shoal	1	NC	NC	66	NC	NC
Transitional Conditions							
Australian Marine Park	Oceanic Shoals	4	1	NC	149	168	NC
KEF	Carbonate bank and terrace system of the Sahul Shelf	2	NC	NC	434	NC	NC
	Carbonate bank and terrace system of the Van Diemen Rise	3	1	NC	163	168	NC
	Pinnacles of the Bonaparte Basin	3	NC	NC	254	NC	NC
Reefs/Shoals/Banks	Bellona Bank	3	3	NC	65	67	NC
	Echo Shoals	1	NC	NC	121	NC	NC
	Karmt Shoal	1	NC	NC	261	NC	NC
	Sunset Shoal	1	NC	NC	142	NC	NC
Winter Conditions – no floating oil contact with any receptor							

Table 7-11: Summary of oil accumulation on shorelines after a vessel collision for each modelled season

Shorelines	Probability (%) of Shoreline Oil			Minimum Time to Receptor (hours)			Maximum Local Accumulated Concentration (g/m²)		Maximum Accumulated Volume (m³) ≥10g/m²		Maximum Accumulated Volume (m³) ≥100g/m²		Maximum Accumulated Volume (m³) ≥1,000g/m²	
	≥10 g/m²	≥100 g/m²	≥1,000 g/m²	≥10 g/m²	≥100 g/m²	≥1,000 g/m²	Average	Worst-case	Average	Worst-case	Average	Worst-case	Average	Worst-case
Summer Conditions														
Indonesia	4	1	NC	234	425	NC	1.8	108	<1	2	<1	2	NC	NC
Timor-Leste	6	NC	NC	254	NC	NC	2	62	<1	3	NC	NC	NC	NC
Lautem (Timor-Leste province)	6	NC	NC	254	NC	NC	2	62	<1	3	NC	NC	NC	NC
Viqueque (Timor-Leste province)	1	NC	NC	445	NC	NC	0.2	14	<1	<1	NC	NC	NC	NC
Transitional Conditions														
Timor-Leste	2	NC	NC	382	NC	NC	0.4	19	<1	<1	NC	NC	NC	NC
Lautem (Timor-Leste province)	2	NC	NC	382	NC	NC	0.4	19	<1	<1	NC	NC	NC	NC
Winter Conditions – no shoreline accumulation predicted for any shoreline receptor														

**NC: No contact to receptor predicted for specified threshold.*

Sensitive receptors that have the potential to be impacted as a result of an unplanned spill include:

- marine mammals
- marine reptiles
- seabirds and migratory shorebirds
- plankton
- fish, rays and sharks
- coral reefs
- submerged reefs and shoals
- coastal marine environments.

An MDO spill is considered unlikely. However, sensitive receptors such as marine fauna, particularly mobile species, can generally move away from the affected area to avoid significant impacts. While marine fauna may transit through the release area, contact is unlikely to result in impacts greater than minor short-term behavioural changes, limited to one or a few individual species. No significant impact on overall population viability or ecosystems is anticipated.

Sensitive receptors that have the potential to be impacted as a result of an unplanned spill are discussed further in the next subsections.

7.6.3.1 Marine Mammals

Marine mammals are likely to be exposed primarily through inhalation of volatiles during surfacing and from feeding. Impacts may include changes in behaviour, reduced activity, inflammation of the mucous membranes, lung congestion, pneumonia, liver disorders and neurological damage.

Cetaceans have smooth skin, which means hydrocarbons are unlikely to stick to their bodies. Observational evidence suggests cetaceans may detect and avoid areas affected by spills (International Petroleum Industry Environmental Conservation Association (IPIECA), 1995). Bottlenose dolphins, for example, have been found to actively avoid surface slicks after few brief contacts with no adverse impacts (Smith et al., 1983). It is unclear whether other marine mammals in the survey area have the same ability to detect and avoid hydrocarbon slicks. However, it is possible that even if whales and dolphins can detect hydrocarbon slicks, their attraction to specific breeding, feeding or resting areas may override their tendency to avoid the presence of hydrocarbons. Therefore, any physical contact with surface hydrocarbons would likely cause irritation and sublethal stress, given their physical characteristics and potential ability to avoid slicks.

The potential impact to cetaceans due to ingestion of hydrocarbon is limited, since only low numbers of cetaceans are expected to pass through the affected area in the event of a hydrocarbon spill. Additionally, the characteristics of the MDO suggest any oil on the sea surface would disperse and evaporate over time, leaving behind less toxic residues. These residues would become weathered and may form waxy flakes due to wave and wind actions. Therefore, significant impacts to cetacean populations are not expected to result from the hydrocarbon spill.

7.6.3.2 Marine Reptiles

Marine reptiles, such as turtles, are not known to exhibit avoidance behaviour towards oil spills. Therefore, turtles may be exposed through inhalation, ingestion and physical contact, causing negative impacts to the skin, blood, digestive and immune systems, and salt glands. Inhaling oil vapours can lead to internal damage, including neurological impairment (IPIECA, 1995). Ingesting tarballs can result in blockage and injury to the digestive tract and buoyancy problems due to the build-up of fermentation gases (NOAA, 2010a).

The hydrocarbons that pose the most aquatic toxicity in a spill are usually the more volatile aromatic and soluble components, such as polycyclic aromatic hydrocarbons. However, weathered residues of MDO would not contain high levels of aromatic hydrocarbons that could cause significant aquatic toxicity. Therefore, in the unlikely event of an MDO fuel spill, marine turtles may be exposed to low levels of hydrocarbons.

7.6.3.3 Fish, Rays and Sharks

Fish, rays and sharks may be affected by dissolved and entrained hydrocarbons through ingestion or gill contamination. Smothering through coating of gills can lead to the lethal and sublethal effects of reduced oxygen exchange, and coating of body surfaces may lead to increased incidence of irritation and infection.

However, due to their high mobility, pelagic fish possess the ability to evade surface waters beneath oil spills by swimming into deeper waters or moving away from the affected areas (International Tanker Owners Pollution Federation Limited (ITOPF), 2011). However, indirect exposure may still occur through consumption of contaminated prey; fishes that are exposed to sublethal dissolved aromatics are likely to recover due to their ability to metabolise hydrocarbon toxicants (Johnson et.al., 2002).

Fish populations in open waters and diverse fish groups in shallow waters around islands may be exposed to dissolved aromatics and entrained hydrocarbon phases. However, fish have natural instincts to avoid many aromatic hydrocarbons (Iwama and Nakanishi, 1996) and are therefore not likely to come into contact with high concentrations of dissolved aromatics or entrained hydrocarbons.

7.6.3.4 Plankton

Exposure to hydrocarbons within the water column can result in alterations in species composition, encompassing declines or increases in one or more species or taxonomic assemblages (Batten et al., 1998). This exposure can induce diminished rates of photosynthesis in phytoplankton, leading to suffocation, as well as provoke behavioural or environmental modifications that render them more vulnerable to predation (Tomajka, 1985). Given their high turnover rate, planktonic communities are expected to swiftly recuperate, typically within a timeframe of weeks to months (ITOPF, 2011).

7.6.3.5 Seabirds and Migratory Shorebirds

Seabirds and shorebirds can be exposed to hydrocarbons through direct contact and ingestion. Direct contact can compromise the insulation properties of their plumage, adversely affecting birds' ability to thermoregulate, resulting in hypothermia and pneumonia. Oiled feathers can also lead to a loss of buoyancy, resulting in drowning.

Seabirds typically do not exhibit avoidance behaviour towards oil spills, and may come into contact with oil slicks while foraging or resting on the water surface, which can lead to their feathers becoming matted and causing hypothermia, starvation and drowning.

Soiled birds can also ingest hydrocarbons directly through preening or indirectly by consuming contaminated prey. Ingestion and oiling can cause internal harm to sensitive membranes and organs. Long-term exposure to oil can also result in a decrease in reproductive success due to the loss of breeding adults and the deformity of eggs or chicks (Australian Maritime Safety Authority, 2012).

7.6.3.6 Submerged Shoals and Reefs

The potential impacts of a worst-case scenario spill on submerged reefs, banks and shoals in the survey area are potentially significant. If a large amount of hydrocarbons was to be spilled, these features would be exposed to dissolved aromatic compounds and concentrations of hydrocarbons in the water, which could have detrimental effects. Submerged shoals and reefs that have the potential for hydrocarbon expose include Echo Shoals, Sunrise Bank, Bellona Bank and Oceanic Shoals.

Filter feeders that inhabit these submerged reefs and shoals are particularly vulnerable to the ingestion of hydrocarbons and absorption of aromatic compounds. This can lead to a range of harmful effects, including changes in respiration rates, decreased filter feeding activity, reduced growth rates, biochemical effects, increased predation, reproductive failure, and mechanical damage by waves due to inability to maintain a hold on substrate (Connell and Miller, 1981).

Diverse fish assemblages are also associated with the shallow water around submerged reefs and shoals and may be impacted in case of a worst-case scenario spill during the survey activity.

7.6.3.7 Coral Reefs

Direct contact between hydrocarbon droplets and sensitive coral species, such as branching corals, can result in coral mortality. However, the toxicity effects of direct contact with entrained hydrocarbons are likely to be reduced by weathering processes, which decrease the content of soluble aromatic components before contact occurs. It is the water-soluble fractions that are believed to cause the most harm to coral reefs (Shigenaka, 2001). Impacts on corals and other sessile benthos from exposure to entrained oil at levels higher than 200ppb are expected to primarily be sublethal in nature. However, it is possible for some coral species and sessile benthos to experience mortality in highly affected areas of a reef. Sublethal effects on corals may include polyp retraction, changes in feeding behaviour, bleaching (loss of symbiotic algae), increased mucus production leading to impaired growth rates and reproduction. Lethal effects would result in a reduction in coral coverage and a change in the composition of coral communities. The recovery of impacted reef areas will rely on coral larvae from neighbouring unaffected or partially impacted coral communities.

In the unlikely event of a worst-case scenario spill occurring during coral spawning seasons (March/April and October/November), direct contact with entrained hydrocarbons may decrease successful fertilisation and survival of coral larvae. Consequently, there is the potential for a reduction in recruitment and settlement of new coral populations. Additionally, the early life stages of reef-associated organisms, such as reef fish and invertebrates, may be negatively affected, resulting in sublethal impacts and, in some cases, mortality. The precise impact on resident coral communities will depend on the concentration and inherent toxicity of the hydrocarbons, as well as the duration of exposure and the water depth of the affected communities.

7.6.3.8 Coastal Marine Environments

There are many different types of shorelines, ranging from cliffs, rocky beaches, sandy beaches, mud flats and mangroves, and each of these influences the volume of oil that can remain stranded ashore and its thickness before the shoreline saturation point occurs.

Modelling predicted that in a worst-case scenario, up to 3m² of MDO could accumulate on the shorelines of Timor-Leste and Lautem after at least 254 hours (Table 7-11). This extended period allows for the natural dispersion and evaporation of the MDO due to its low density and viscosity. Once on the shoreline, the MDO undergoes natural weathering and biodegradation processes. Coastal processes, such as high wave energy, help break down the hydrocarbons, reducing their toxicity and environmental impact. Therefore, the predicted level of impact from an MDO spill on coastal environments is considered low.

7.6.4 Management Control Measures

Standard control measures for this risk comprise:

- Navigation equipment and procedures on vessels will be compliant with the COLREGS and Chapter V of SOLAS.
- Fuel type used (marine diesel) – in accordance with MARPOL 73/78 Annex VI.
- Refuelling transfer procedures to prevent bunkering spills.
- Vessel spill response plan in place for vessels.
- Oil spill contingency plan in place for survey activity.
- Support and chase vessels used to deter non-survey activity vessels from the survey area.
- Support and chase vessels will have a communication sheet in Bahasa and Tetum with key survey information to be provided to fishers encountered during the survey activity.
- Support and chase vessels will have FLOs onboard who are Bahasa and Tetum speakers.

Additional control measures (Table 7-12) considered and adopted include:

- AIS transponders fitted to survey vessels and tail buoy.
- Radio communication watch kept at all times.

7.6.5 As Low As Reasonably Practicable Demonstration

The use of vessels during the survey activity cannot be eliminated, as they are essential for supporting the survey activity. Similarly, bunkering activities in the field are necessary due to the remoteness of the survey area. Eliminating bunkering would remove the spill risk associated with fuel transfers, but it would require vessels to return to shore for refuelling, leading to increased fuel consumption, higher atmospheric emissions, and additional operational risks such as greater vessel traffic and prolonged survey activity duration, which outweigh the environmental benefits.

To manage the risk of fuel spills, MDO is used in compliance with MARPOL 73/78 Annex VI, as it is lighter than other fuels such as heavy fuel oil, evaporates faster, and persists less in the marine environment, should there be any unplanned release of MDO.

Additionally, navigation equipment and procedures on vessels comply with COLREGS and SOLAS Chapter V, ensuring the vessels are visible to other marine users, thus reducing the risk of vessel collisions.

To further reduce the risk of fuel-related spills, vessel spill response plans and oil spill contingency plans are in place to efficiently manage any unplanned hydrocarbon releases, ensuring spills do not reach the marine environment. Refuelling transfer procedures, applied by contractors, also minimise the potential for spills during bunkering activities. Support and chase vessels will be deployed to deter non-survey activity vessels from entering the survey area, minimising the potential for interference and safety hazards.

Additional control measures were considered (Table 7-12) and adopted to reduce the risk. Regular radio communication watch will be kept at all times, ensuring continuous communication between seismic and support vessels, reducing the risk of collisions. All crew will undergo environmental induction to raise awareness of the risks associated with marine operations and ensure compliance with environmental standards. Moreover, AIS transponders have been fitted to survey vessels and tail buoys, transmitting vessel information to improve safety and reduce collision risks.

Other additional control measures were considered but rejected due to their high costs and limited environmental benefits. Given the controls that have been adopted, the residual risk is considered ALARP.

Table 7-12: 'As low as reasonably practicable' demonstration for marine diesel oil spills to sea

Control Type	Control/ Management	Evaluation	Adoption?
Eliminate	Eliminate the use of vessels	Vessel use is required to support the survey activity and cannot be eliminated.	No
	Eliminate bunkering activities	Would remove the spill risk from bunkering. However, the remoteness of the survey area requires that bunkering of fuel to occurs in the field, so the survey activity can be completed.	No
Substitute	No fuel bunkering via hose	Removes spill risk from hose operations. Drums could be used; however, presents cost associated with multiple vessel transits and additional HSE risks during transfer of drums.	No
	Use survey vessels with smaller fuel and oil tank sizes	This would mean more frequent trips to port for refuelling, which would increase costs and the duration of the survey activity, as well as result in greater risks. Furthermore, implementing this control measure would likely lead to a delay in the timing of data acquisition due to the time needed to contract an appropriate survey vessel.	No

Control Type	Control/ Management	Evaluation	Adoption?
Engineering	AIS transponders fitted to survey vessels and tail buoy	AIS transponders will transmit key information to all vessels able to receive AIS data and will include details such as vessel position (from global positioning system), identity, type, speed, course and caution notes). The AIS will also receive AIS information from other vessels in the survey area.	Yes
Isolation	N/A	N/A.	N/A
Administrative	Navigation equipment and procedures on vessels compliant with COLREGS and Chapter V of SOLAS	Ensures the survey vessels are seen by other marine users. Reduces risk of environmental impact from vessel collisions due to ensuring safety requirements are fulfilled. Negligible costs of operating navigational equipment. COLREGS and Chapter V of SOLAS require vessels to have navigational equipment to avoid collisions.	Yes (standard CM)
	Fuel type used (MDO) in accordance with MARPOL 73/78 Annex VI	MDO is lighter than other types of fuels (such as heavy fuel oil) and will evaporate faster and persist less in the marine environment. MDO is already used on the vessels in accordance with MARPOL 73/78 Annex VI. Minimal cost as vessels required to comply with MARPOL 73/78.	Yes (standard CM)
	Refuelling transfer procedures to prevent bunkering spills	Reduces the potential for bunkering spills with minimal cost involved.	Yes (standard CM)
	Vessel spill response plan	Environmental benefit outweighs minor costs in implementing and testing the vessel spill response plan, which contains plans to prevent spills from reaching the marine environment.	Yes (standard CM)
	Oil spill contingency plan	Implements response plans to manage an unplanned hydrocarbon release quickly and efficiently to reduce impacts to the marine environment. Environmental benefit outweighs minor costs in implementing.	Yes (standard CM)
	Support and chase vessels to deter non-survey activity vessels from the survey area	Prevents non-survey activity vessels from entering the survey area.	Yes (standard CM)

Control Type	Control/ Management	Evaluation	Adoption?
	Radio communication watch kept at all times	Seismic and support vessels will keep open radio communications between each other as well as scanning local working channels for contact with other vessels that may be operating in the vicinity, and therefore reduce the potential for collision.	Yes
	Support and chase vessels will have communication sheet to be provided to fishers	Reduces the risk of fishing vessels interacting with the survey activity.	Yes (standard CM)
	Support and chase vessels will have FLOs onboard		Yes (standard CM)

7.6.6 Acceptability Demonstration

Demonstration of Acceptability	
Compliance with Legal Requirements, Laws, Standards	Vessels will be compliant with standard maritime safety/navigation procedures, including COLREGS and Chapter V of SOLAS.
Policy Compliance	The management is aligned with Eni policies and standards.
Social Acceptability	The survey area is not within an area of known shipping or high fishing activity.
Area Sensitivity/ Biodiversity	In the unlikely event of a marine diesel spill, impacts to transient marine fauna within the vicinity of the spill include those to air-breathing animals such as cetaceans, turtles and sea snakes due to inhalation of vapours if they surface in the diesel slick. Seabirds have also been identified as at risk if they contact the diesel slick by oiling their feathers, leading to loss of buoyancy and the potential for hypothermia. However, the rapid rates of evaporation will limit exposure to transient animals and limit the extent of potential impacts. Habitat modification/degradation/disruption/loss, deteriorating water quality and marine pollution are identified as potential threats; however, with controls in place, impacts of the risk is considered acceptable.
ESD Principles	The impact assessment presented throughout this EMP demonstrates compliance with the principles of ESD.
ALARP	The residual risk has been demonstrated to be ALARP.

8 ENVIRONMENTAL OBJECTIVES, STANDARDS AND MEASUREMENT CRITERIA

Table 8-1 presents environmental performance objectives, environmental performance standards, and measurement criteria for the survey activity. These:

- define objectives and set standards for measuring Eni's performance in protecting the environment during the survey activity
- include measurement criteria for assessing whether performance objectives and standards have been met.

The terms used for measuring the environmental performance are defined below:

- Performance objective – a statement of the goal that Eni aims to achieve regarding the management of a given hazard.
- Performance standard – a statement of performance required of a system, an item of equipment, a person or a procedure that is used as a basis for managing environmental risk. Generally, multiple standards may relate to a single objective.
- Measurement criteria – defines how the application of the performance standard will be verified. Several measurement criteria may relate to a single performance standard. Measurement criteria are defined in a manner that enables efficient inspection and audit against the performance objectives and allows for an audit trail.

Table 8-1: Environmental performance objectives, standards and criteria for survey activity

Risk ID	Aspect	Potential Impacts	Performance Objectives	Performance Standards	Measurement Criteria	Responsible Person
P1	Interaction with Other Marine Users	The presence of vessels (the seismic vessel and support vessels) and seismic survey equipment (streamers, buoys) have the potential to interact with third-party vessels (fishing and shipping) if they pass through the survey area.	No interference with licenced commercial fishing vessels or operations, or other marine users from survey activity.	Navigation lighting and aids in accordance with the COLREGS and Chapter V of SOLAS.	Pre-mobilisation audit and inspection before the survey activity begins, along with crew inductions. Bridge logs. Eni's marine vessel vetting summary demonstrates vessel is compliant with COLREGS and Chapter V of SOLAS (as appropriate to class).	Eni offshore representative
				Support and chase vessels will have FLOs onboard who are Bahasa and Tetum speakers	Records of FLO activity and reports documenting interactions with third-party vessels. End of Activity Report.	
				Streamers marked with tail buoys.	Pre-mobilisation audit and inspection before vessel leaves port.	
				Stakeholder engagement.	Documentation of consultation records and notifications.	
				Support/chase vessels used to deter non-survey activity vessels from the survey area, as well as identify debris and fish aggregating devices.	Number of near misses and incidents reported using incident reporting procedures. Records of non-survey activity vessels identified.	
				Support/chase vessels will be able to identify, tow and recover fishing equipment and debris	Records of identified fishing equipment and debris.	
P2	Noise Emissions –	Noise emissions generated by	Minimise underwater noise emissions where	Vessels will adhere to JNCC Guidelines for Minimising the	Compliance reports verifying adherence to JNCC guidelines.	

Risk ID	Aspect	Potential Impacts	Performance Objectives	Performance Standards	Measurement Criteria	Responsible Person
	Seismic Source	operating the seismic source during the survey activity has the potential to impact marine fauna.	practicable to mitigate impact to marine megafauna.	Risk of Injury to Marine Mammals from Geophysical Surveys (2017).	MMO daily and weekly logs.	Operations Projects Coordinator
				Vessels will adhere to Eni Minimum HSE Requirements in Geophysical Operations, including requirements for offshore seismic surveys.	HSE audit reports confirming compliance.	
				Use of sufficient MMO and PAMS on vessels.	MMO daily and weekly logs. PAM daily and weekly logs.	
				Marine megafauna interaction requirements included in survey activity inductions.	Induction records. MMO daily and weekly logs.	
				No equipment testing outside of the survey area.	Bridge logs verifying no unplanned testing outside the defined survey area.	
				Airgun firing (including testing) must not exceed the planned maximum production volumes outlined in the environmental licence application.	Compliance verification against the approved environmental licence application.	
				Incorporate pre-shooting survey searches and soft starts into the survey activity.	Bridge logs. MMO daily and weekly logs	
				Cetacean sighting and compliance reports to be submitted to ANP (End of Activity Report).	Compliance and sighting reports.	

Risk ID	Aspect	Potential Impacts	Performance Objectives	Performance Standards	Measurement Criteria	Responsible Person
				Incorporate JNCC mitigations for night-time and poor visibility conditions, including use of PAM operatives in addition to MMO visual mitigation,	MMO daily and weekly logs. PAM daily and weekly logs. Bridge logs verify the implementation of these procedures.	
				If unplanned break in survey activity occurs during night-time or poor visibility conditions, mitigation zone is to be monitored using PAM procedures.	PAM daily and weekly logs Compliance and sighting reports. Bridge logs verify the implementation of these procedures.	
				If PAM operatives are not available, the survey activity will be delayed until conditions are suitable for visual conditions.	Bridge logs verify the implementation of these procedures. MMO daily and weekly logs. PAM daily and weekly logs.	
P3	Noise Emissions – Vessels, Mechanical Equipment and Helicopters	Noise emissions generated by operation of the seismic, support and chase vessels, helicopters and mechanical equipment during the seismic survey have the potential to impact marine fauna.	Minimise underwater noise emissions where practicable to mitigate impact to marine megafauna.	Vessels and support vessels to be maintained in accordance with the applicable PMS.	Vessel daily/weekly records of maintenance. Contractor maintenance management records indicate compliance with applicable PMS.	Operations Projects Coordinator
				Marine megafauna interaction requirements included in survey activity inductions.	Induction records indicate awareness of requirements in relation to interactions with marine fauna. Induction attendance. MMO daily and weekly logs.	
P4	Atmospheric Emissions	Impact to local air quality from fuel combustion on vessels.	Reduces atmospheric emissions to as low as reasonably practicable.	Air pollution prevention certification in accordance with MARPOL 73/78 Annex VI.	Current International Air Pollution Prevention Certificate or equivalent.	Operations Projects Coordinator

Risk ID	Aspect	Potential Impacts	Performance Objectives	Performance Standards	Measurement Criteria	Responsible Person
				Fuel type used (marine diesel) – in accordance with MARPOL 73/78 Annex VI.	Fuel bunkering records.	
				Equipment (engines, thrusters, generators, etc) is maintained in accordance with the applicable PMS.	Records indicate equipment maintenance and inspection in accordance with manufacturer's PMS. Records indicate vessels meet Eni Exploration & Production Marine Manual (Marine assurance standard).	
				Vessel incinerators will be maintained to manufacturer's specification and operated in accordance with MARPOL 73/78 Annex VI.	Maintenance records.	
				Ozone depleting substances shall not be deliberately released – in accordance with MARPOL 73/78 Annex VI.	Daily report log.	
				Fuel consumption will be recorded and monitored for abnormal consumption, with corrective action taken if necessary.	Daily report log.	
P5	Light Emissions	Lights on seismic vessel and support vessels will be required on a 24-hour basis for safety and navigational	Lighting on vessels and support vessels is kept at the minimum necessary for safe deck operations and vessel navigation.	Management of lighting in accordance with the COLREGS and Chapter V of SOLAS.	Induction records indicate awareness of lighting requirements. Records to confirm contracted vessels meet requirements of Eni's	Operations Projects Coordinator

Risk ID	Aspect	Potential Impacts	Performance Objectives	Performance Standards	Measurement Criteria	Responsible Person
		purposes, which could lead to changes in marine fauna behaviour.			vessel vetting evaluation and audits. Eni's marine vessel vetting summary demonstrates vessel is compliant with COLREGS and Chapter V of SOLAS (as appropriate to class).	
P6	Planned Vessel Discharges	Localised decrease in water quality. Behavioural impacts to marine fauna (e.g. avoidance/attraction) of marine fauna.	No accidental discharges to the marine environment.	Sewage treatment system in accordance with MARPOL 73/78 Annex IV. Waste management procedure in accordance with MARPOL 73/78 Annex V. Vessels will have and be compliant with a Garbage Management Plan in accordance with MARPOL 73/78 Annex V, as appropriate to vessel class. Oily water treatment system in accordance with MARPOL 73/78 Annex I. Oily water prevention in accordance with MARPOL 73/78 Annex I. Valid International Oil Pollution Prevention Certificate, which confirms that required measures to reduce impacts of planned oil discharges are in place on vessels.	Number of non-conformance incidents with MARPOL requirements. Records indicate discharges are managed in accordance with the identified procedures, such as: • discharge logs • operational logs showing that treatment systems were operating as intended during discharges. Maintenance and inspection records. International Sewage Pollution Prevention certificates are present and valid for each vessel. The certificate verifies the sewage systems on board comply with MARPOL requirements. Valid International Oil Pollution Prevention Certificate or equivalent.	Operations Projects Coordinator

Risk ID	Aspect	Potential Impacts	Performance Objectives	Performance Standards	Measurement Criteria	Responsible Person
				Equipment/machinery involved in the treatment of wastes will be routinely maintained.	Records demonstrate the latest maintenance has occurred.	
				Chemical selection process in Eni is followed and all chemicals to be used must be submitted for approval to ANP before use.	All chemicals discharged are recorded and reported in an Environmental Performance Report to ANP. Records of chemical assessment.	
				All crew will participate in the vessel and environmental induction before mobilising for the survey activity.	Induction records.	
U1	Vessel Collision or Entanglement with Marine Fauna	Injury/mortality to marine fauna.	No incidents of physical harm from vessel collisions with marine fauna.	Vessels will adhere to the JNCC Guidelines for Minimising the Risk of Injury to Marine Mammals from Geophysical Surveys (2017).	Compliance reports verifying adherence to JNCC guidelines. MMO daily and weekly logs.	Eni offshore representative
				Vessel will adhere to Eni Minimum HSE Requirements in Geophysical Operations, including requirements for offshore seismic surveys.	HSE audit reports confirming compliance.	
				Use of sufficient MMOs and PAM operatives on vessels.	MMO daily and weekly logs. PAM daily and weekly logs.	
				Marine megafauna interaction requirements included in survey activity inductions.	Induction records indicate awareness of requirements in relation to interactions with marine fauna. Induction attendance.	

Risk ID	Aspect	Potential Impacts	Performance Objectives	Performance Standards	Measurement Criteria	Responsible Person
					Vessel master is aware of cetacean interaction requirements and reporting strikes to ANP. MMO daily and weekly logs.	
				Turtle guards on seismic tail-buoys	Records show turtle guards on seismic tail-buoys.	
				Any vessel strike incident to marine mammals shall be reported to ANP as soon as possible.	Incident reports confirming timely reporting to ANP.	
U2	Loss of Equipment and Dropped Objects	Loss of seismic survey equipment or accidental dropped objects, such as streamers, due to human error or equipment failure, may cause localised seabed disturbance, impact benthic fauna, and pose a risk of ingestion or entanglement for marine fauna.	No loss of equipment to the marine environment.	Hazardous and non-hazardous waste management process in place in accordance with MARPOL 73/78 Annex V: • All wastes will be collected and segregated into clearly marked containers before onshore disposal by a licenced waste management contractor. • All bins on deck will be covered to prevent rubbish blowing overboard. • Records will be maintained of solid and hazardous waste volumes generated and transferred for onshore recycling or disposal. • Waste management procedure will be	Waste Management Plan in place. Waste record book in place. Waste management procedures included in induction.	Operations Projects Coordinator

Risk ID	Aspect	Potential Impacts	Performance Objectives	Performance Standards	Measurement Criteria	Responsible Person
				implemented, including safe handling, treatment, transportation and appropriate segregation and storage of all waste generated.		
				Lost waste will be recovered when safe and practicable to do so.	Records of dropped objects overboard and retrieved items are reported via the Eni Incident Reporting and Investigation Procedure and to ANP through the annual environmental performance report.	
				Approved procedures for streamer deployment.	Records showing checks have been completed and operating checklist are filled and signed as per the approved procedure.	
				Routine maintenance and inspection of streamer equipment.	Inspection records confirm equipment is fit-for-purpose and records any maintenance work that is required/carried out.	
				Streamers will be fitted with: • streamer recovery devices (self-inflating) • surface marker buoys • secondary retaining devices • tail buoys.	Vessel incident report/record. Inspection records (visual and/or design) show streamers fitted with: • streamer recovery devices (self-inflating) • surface marker buoys • secondary retaining devices • tail buoys.	

Risk ID	Aspect	Potential Impacts	Performance Objectives	Performance Standards	Measurement Criteria	Responsible Person
				Support vessels will search for and recover lost in-water equipment where possible and safe to do so.	Records of dropped objects overboard and retrieved items are reported via the Eni Incident Reporting and Investigation Procedure and to ANP through the annual environmental performance report.	
				Relevant persons will be notified via radio in the event of a loss of in-water equipment.	Vessel incident report/record.	
U3	Non-hazardous and Hazardous Waste Loss to Marine Environment	Change in water quality. Marine fauna ingestion/ entanglement.	No unplanned overboard release of hazardous or non-hazardous waste to the marine environment.	Hazardous and non-hazardous waste management process in place on vessels in accordance with MARPOL 73/78 Annex V: • All wastes will be collected and segregated into clearly marked containers before onshore disposal by a licenced waste management contractor. • All bins on deck will be covered to prevent rubbish blowing overboard. • Records will be maintained of solid and hazardous waste volumes generated and transferred for onshore recycling or disposal.	Waste Management Plan in place. Waste record book in place. Waste management procedures included in induction materials. Inspection Report shows all hazardous wastes and chemicals are stored in a bunded area capable of containing leakage or spillage.	Operations Projects Coordinator

Risk ID	Aspect	Potential Impacts	Performance Objectives	Performance Standards	Measurement Criteria	Responsible Person
				• Waste management procedure will be implemented, including safe handling, treatment, transportation and appropriate segregation and storage of all waste generated.		
				Lost waste will be recovered when safe and practicable to do so.	Records of dropped objects overboard and retrieved items are reported via the Eni Incident Reporting and Investigation Procedure and to ANP through the annual environmental performance report.	
				All crew will participate in the vessel and environmental induction before the survey activity begins.	Induction records showing content of induction meeting and participation of the crew. Induction list.	
U4	Minor Hydrocarbon or Chemical Leaks	Change in water quality. Local behavioural impact to marine fauna (avoidance).	Zero releases of hydrocarbons or chemicals to the marine environment due to activities such handling, storage, or refuelling.	Spill response plan in place for vessels.	Audit and inspection records demonstrate vessels have spill response plans. Training records show vessel personnel have undergone spill response plans training.	Operations Projects Coordinator
				Spill response kits located in proximity to hydrocarbon storage/bunkering areas and appropriately stocked and replenished as required.	Pre-mobilisation inspection confirms kits are stocked and are the correct type/size and are located in proximity to the hazardous substance location.	
				Chemical selection process in Eni is followed and all	All chemicals discharged are recorded and reported in an	

Risk ID	Aspect	Potential Impacts	Performance Objectives	Performance Standards	Measurement Criteria	Responsible Person
				chemicals to be used must be submitted for approval to ANP before use.	Environmental Performance Report to ANP. Records of chemical assessment.	
				Hydrocarbon or chemical storage containers will be properly stored with lids that are tight and secured to prevent spillage during vessel movement or rough weather.	Pre-mobilisation inspection confirms suitable storage areas for generated wastes which are labelled and have appropriate means of preventing wastes from escaping. Inspection Report shows all hazardous wastes and chemicals are stored in a bunded area capable of containing leakage or spillage. Inspection records show correct and in-date SDS onboard for all hazardous substances.	
				Storage containers will be managed in a manner that provides for secondary containment in the event of a spill or leak.		
				Storage containers will be labelled with the technical product name as per the SDS.		
				Hazardous substances will be stored, segregated, handled and used in accordance with the product's SDS.		
				Vessels to be maintained in accordance with the applicable PMS.	Records demonstrate maintenance in accordance with the PMS.	
				Refuelling transfer procedures to prevent bunkering spills.	Refuelling procedures in place.	
U5	Introduction of Invasive	Change in ecosystem dynamics.	Prevent introduction and establishment of IMS.	Vessels will comply with Timor-Leste entry requirements and IMO	Ballast water transfer records are kept on-board and show ballast water transfer complies with	Eni offshore representative

Risk ID	Aspect	Potential Impacts	Performance Objectives	Performance Standards	Measurement Criteria	Responsible Person
	Marine Species	Change in the functions, interests or activities of other users.		International Convention for the Control and Management of Ships' Ballast Water and Sediments 2004 – MARPOL 73/78 (applicable to vessels only, and as appropriate to vessel class), including: • ballast water exchanges conducted >50nm from land and in >200m water depth.	relevant legislation and requirements.	
				International Convention on the Control of Harmful Anti-fouling Systems on Ships, which requires vessels (applicable to vessels only, of appropriate class) have a valid International Anti-fouling Systems Certificate.	All vessels being used have records indicating that the anti-fouling coating complies with the requirements of Annex I of the International Convention on the Control of Harmful Anti-fouling Systems on Ships.	
				Implementation of IMS risk assessment tool (by Eni Logistics).	Records to confirm contracted vessels meet requirements of the Eni vessel vetting evaluation. Records to confirm implementation of IMS risk assessment tool.	
				Survey equipment to be cleaned and dried before use in the survey area.	Inspection records. Operational logs.	
U6	Marine Diesel Oil Spills to Sea	Change in water quality.	No incidents of unplanned releases of	Navigation equipment and procedures on vessels	Records to confirm vessels meet requirements of the Eni vessel vetting assurance.	Operations Projects Coordinator

Risk ID	Aspect	Potential Impacts	Performance Objectives	Performance Standards	Measurement Criteria	Responsible Person
		Behavioural impact and injury to marine fauna.	hydrocarbons to the marine environment.	compliant with COLREGS and Chapter V of SOLAS.		
				Fuel type used (marine diesel) – in accordance with MARPOL 73/78 Annex VI.	Checks of sulphur content confirm 0.5% sulphur in low sulphur diesel.	
				Refuelling transfer procedures to prevent bunkering spills.	Refuelling procedures in place.	
				Vessel spill response plan in place for vessels.	Vessel spill response plans approved and implemented. Arrangements in place to implement spill response plans. Oil spill contingency plan test record verifies the contingency plan respond capability.	
				Oil spill contingency plan in place for survey activity.		
				Support and chase vessels used to deter non-survey activity vessels from survey area.	Daily vessel report from each watch includes communication checks and records of any communication/ interaction with other vessels. Records show support and chase vessels used to deter non-survey activity vessels from survey area if required.	
				Radio communication watch kept at all times.		
				Support and chase vessels will have FLOs onboard who are Bahasa and Tetum speakers.	Crew records. Operational reports.	
				Support and chase vessels will have a communication sheet in Bahasa and Tetum with key survey information to be provided to fishers		

Risk ID	Aspect	Potential Impacts	Performance Objectives	Performance Standards	Measurement Criteria	Responsible Person
				encountered during the survey activity.		
				AIS transponders fitted to survey vessels and tail buoy.	Pre-mobilisation audit and inspection before starting the survey activity confirms correct operation of all AIS transponders for both transmitting and receiving.	
				All crew will participate in vessel and environmental induction before the survey activity begins.	Induction records. Induction list.	
NA	Incident investigation	N/A	Investigate non-compliances to determine root cause and put in place management measures to prevent reoccurrence.	Hazards and incidents shall be investigated, actions tracked, and corrective actions put in place.	All incidents investigated in accordance with ENI-HSE-PR-025 - Incident Investigation Procedure. Incidents investigated, actions tracked, and corrective actions put in place.	Operations Projects Coordinator
NA	Reporting	N/A	Document environmental performance submitted to ANP.	Eni will submit Environment Performance report at the completion of activities	Environmental reports submitted to ANP.	Operations Projects Coordinator
NA	Record storage	N/A	Store records for five years.	Eni shall store all environmental records for at least five years	Environmental records stored	Operations Projects Coordinator

9 IMPLEMENTATION STRATEGY

9.1 Systems, Practices and Procedures

9.1.1 Health, Safety and Environment Management System Overview

Eni's management of HSE matters is arranged hierarchically in three distinct levels:

- Corporate-level Management System
- Regional (Eni Australia)-level HSE Integrated Management System (HSE IMS)
- Facilities Management Systems.

HSE management in Eni Australia is implemented at the regional and asset level through its HSE IMS, which is responsible for controlling all HSE hazards and risks. The HSE IMS encompasses all of Eni Australia's management systems in terms of:

- the concepts, policies, strategies, HSE goals, processes, procedures and work instructions that comprise the formal content of the HSE IMS
- the organisational structures, communication systems, safety-related data, roles and responsibilities, competencies and training needed by the personnel
- the physical elements that are critical to safety (equipment, structures and engineered systems), including the codes and standards used to design and construct them.

9.1.2 Eni Corporate Management System

Eni Australia adopts the guidelines provided by its corporate parent, Eni Upstream. Eni Upstream issued a Divisional Directive called Management System Guideline-HSE (MSG-HSE-ENI-SPA-ENG). The Eni Australia HSE IMS incorporates the five main Management System elements and 18 sub-elements, as shown in Figure 9-1 and incorporated into the Eni Australia HSE IMS.

Elements are largely based on the structure of the ISO 14001 and ISO 45001 series of standards, and therefore provide a consistent and recognisable platform for managing HSE, while also ensuring the intent of the principle of continuous improvement is followed.

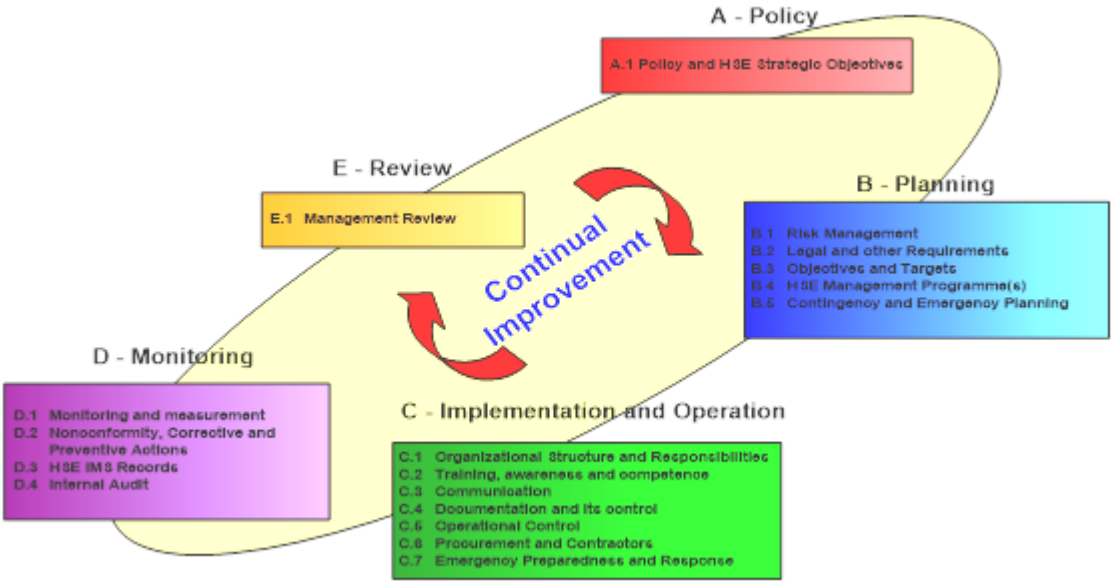


Figure 9-1: Eni Management System elements

9.1.3 Regional Eni Australia Health, Safety and Environment Integrated Management System

The Eni Australia HSE IMS has been certified against the standards of:

- ISO 14001: Environmental Management System
- ISO 45001: Occupational Health and Safety Management.

Audits are performed to verify conformance with these standards and the Eni upstream Corporate Directive.

The HSE Integrated Management System Framework Document (ENI-HSE-IN-002) is a key reference for Eni Australia's HSE IMS and serves as an information source for Eni employees and contractors. This section outlines the strategies used to manage HSE aspects of Eni Australia's operations and ensures continual improvement in line with established objectives. It also describes the core elements of the HSE IMS and their interaction with other relevant documents.

The HSE Integrated Management System Framework Document (ENI-HSE-IN-002) establishes various functional requirements for HSE management. Eni Australia has developed supporting documents, such as standards, processes, guidelines and criteria, to meet these requirements. These documents are classified as information, standards, procedures or specifications. The HSE standards cover a wide range of high-risk activities and reflect Eni Australia's minimum requirements and expectations, based on International Association of Oil & Gas Producers (IOGP) and company best practices.

The HSE standards apply to all personnel working on Eni sites, including employees, contractors and visitors. They are applicable to activities where Eni has direct operational control and activities where Eni has significant influence over its contractors' and suppliers' performance. At the top of the HSE IMS is Eni's HSE statement (attached as Appendix A), which is approved by the Managing Director and serves as a public declaration of Eni's commitment to the environment and improving environmental performance.

9.1.4 Contractor Management System

Activities within the survey area will be implemented under the umbrella of Eni's HSE IMS, which contractors must abide by. Contractors will also be required to have in place formal written systems, practices and procedures for managing HSE. These will be reviewed and accepted by Eni before the survey activity begins.

9.2 Competency

9.2.1 Contractor Selection and Management

In accordance with Eni's Contractor HSE Management Procedure (ENI-HSE-PR-008) and Contractor HSE Specification and Requirements (ENI-HSE-SP-002), all contractors working for Eni must meet the general HSE prerequisites during the contractor selection process. Before starting work related to the planned activity, Eni will evaluate and approve the competencies of the contractor's technicians. Similarly, any subcontractors and specialist service providers engaged under the planned activity will also be approved by Eni.

Eni follows a specific contracting process for selecting and managing contractor vessels and operators for the planned activity. This process involves developing a project-specific scope of work for the vessels, in line with the Logistic Technical Requirements for Supporting Project Activities and Vessel Technical Specifications Requirements detailed in Eni's Marine Transportation Manual (LOGIS-DG-4166-0-2019). These requirements also inform the vessel on-hire inspection process.

To ensure compliance with local, international standards, regulations, and Eni's Marine Transportation Manual (LOGIS-DG-4166-0-2019), each vessel must undergo an audit. The operator will be required to provide a complete set of vessel documents, which will be reviewed by Eni's Marine Advisor to ensure compliance. These reviews may include specific requirements for the vessel's scope of work:

- Vessels must have a current (within 12 months of issue) Eni marine inspection. If the vessel has not been inspected by the Eni Marine Advisor within the past 12 months, an inspection request will be generated.
- All information and advice will then be on-forwarded to Eni Headquarters (LOGIS) for final technical approval. Vessels require technical approval from Headquarters if the vessel is going to carry passengers who are Eni employees or direct contractors.
- Existing vessels, which Eni has listed as recently engaged, are required to hold a current Eni audit from within the last 12 months and be periodically renewed on an annual basis.

9.2.2 Verification of Competence

Personnel qualification and training records will be sampled before and during an activity. Such checks will be performed during the procedure process, inductions, crew change, and inspections and audits.

9.3 Training

9.3.1 General Arrangements

All employees and contractors working on the planned activity must undertake an induction. The induction programs include:

- Company Induction:
  - Eni Golden Rules
  - Eni HSE IMS
  - substance abuse.
- Inductions:
  - Eni EMP Awareness/Legislation:
    - environmental regulatory requirements
    - marine mammal interaction-requirement to record and report sightings of whales and dolphins
    - requirements for waste segregation, labelling, handling and storage
    - housekeeping and spill prevention
    - spill preparedness and response
    - environmental incident reporting
    - requirements for recording waste movements and transfers.
  - HSE Standards Job Hazard Analysis.

Eni ensures its employees and contractors receive adequate training to equip them with the necessary skills, knowledge and competencies to effectively carry out their responsibilities. The company's training and development process is overseen by the Training and Development Procedure (ENI-HRO-PR-020), which outlines how training and competency are handled and how operational employees are trained

HSE training, based on roles and responsibilities, includes:

- dangerous goods awareness
- management of change
- safety case awareness and legislation
- hazard identification and risk management
- manual handling
- HSE management system and auditing
- root cause analysis investigation
- HSE for supervisors.

9.4 Monitoring

9.4.1 Routine Environmental Monitoring

For the planned activity, information is collected for monitoring compliance to this EMP.

9.4.2 Waste Monitoring

Waste management records shall include:

- waste manifests for all wastes transferred to shore

- waste type and volumes disposed of to landfill
- waste type and volumes recycled
- estimate of macerated food and sewage waste discharged offshore.

All waste transported from offshore will be properly manifested. Waste manifests will include information about:

- manifest identification number
- quantity (m^3/kg)
- waste description
- waste container(s) number and description
- date of shipment
- final destination description (such as incineration, landfill)
- generator data
- transporter(s) data and waste acceptance declaration
- receiver data and waste acceptance declaration
- dangerous goods class and United Nations number (for environmentally hazardous waste)
- special handling instructions
- any other information required by the waste contractor.

9.5 Audit and Review

Compliance verification and auditing processes for managing HSE is performed on multiple levels.

At the Eni Australia HSE IMS level, there is a management system element dedicated to the audit and review process and an HSE Auditing Procedure (ENI-HSE-PR-005). This requires that the management system is formally reviewed to ensure ongoing effectiveness and continual HSE improvement. It also ensures critical HSE processes are in place – for example, the HSE auditing of contractors and subcontractors – and annual audit of the Permit to Work system.

At a contractor management level, the HSE performance of the contractors is assessed as part of the contractual performance review process. Eni also reserves the right to undertake HSE audits on contractors and their subcontractors.

At an activity level, HSE is monitored as part of the execution of discrete work scopes; for example, pipeline inspection, maintenance and repair. For these activities, a project-specific plan is prepared that will identify HSE audits, such as before mobilisation and during activity execution.

Environmental audits and inspections aim to:

- identify potential new, or changes to existing, environmental impacts and risk, and methods for reducing those to ALARP
- confirm mitigation measures detailed in this EMP are effectively reducing environmental impacts and risk, that mitigation measures proposed are practicable and provide appropriate information to verify compliance

- confirm compliance with the control measures detailed in this EMP.

Details regarding specific audits are as outlined in Section 9.5.1 and Section 9.5.2.

9.5.1 Vessel Audits

A technical evaluation will be conducted before chartering or subcontracting new vessels, to ensure they meet all applicable international rules, regulations, conventions, State and Commonwealth requirements, as well as Eni standards and best practices. If the vessels have not been used by Eni Australia before, a thorough audit of all vessel documents will be conducted, and an inspection from the Offshore Vehicle Inspection Database or the International Marine Contractors Association will be requested. Vessels that are regularly used will undergo a vessel audit every 12 months.

There is also an internal auditing process for vessels to gather evidence and ensure compliance with EMP commitments. Documentation and evidence of compliance is collected on an ongoing basis.

In addition, the proposed seismic vessel will be inspected to confirm its suitability and compliance with Eni requirements.

9.5.2 Environmental Inspections

The environmental inspection will be conducted by the Offshore HSE Representative or Environmental Advisor and may involve verifying:

- controls detailed within this EMP
- environment containment, including chemical storage, spill response equipment and housekeeping
- general vessel environment risks, including waste management
- other relevant performance standards and controls applicable during the survey activity.

9.6 Non-conformance

Non-conformances may be identified from audits (Section 9.4.2). These conformances are recorded and monitored in an action tracking database, following Eni Australia's Corrective Action Tracking and Non-conformance Reporting Procedure (ENI-HSE-PR-015). Incidents are analysed to identify root causes and determine appropriate corrective actions, in accordance with Eni Australia's Incident Investigation Procedure (ENI-HSE-PR-025).

All identified hazards and incidents prompt the initiation of corrective and preventative actions, as outlined in Eni Australia’s Hazard and Incident Reporting Procedure (ENI-HSE-PR-003). These actions are registered and managed within the Eni SharePoint system.

The Eni HSE Manager ensures all corrective and preventative actions are tracked and that appropriate reminders are communicated to relevant Department Managers.

Eni's vendors who violate this EMP can be managed by issuing a formal Non-conformance Report, following the Vendor Management Procedure (ENI-PRC-PR-001). This process also connects with the contractual legal management. The procedure includes vendor qualification, evaluation, due diligence, feedback, and measures for serious non-performance. This applies to any significant or recurring breaches of Eni's procedures that may lead to environmental harm.

9.7 Reporting

9.7.1 Beginning of Activity

ANP will be notified prior to the start if the survey activity.

9.7.2 End of Activity Report

An end of activity report shall be submitted to the ANP. This will include all the information necessary to enable ANP to determine whether environmental performance objectives and standards for the survey activity have been met, including monitoring data (Section 9.4).

9.7.3 Internal Incident Reporting

All environmental incidents, deviations from this EMP, or events that do not meet the environmental performance objectives of the EMP will be recorded and reported using the Eni Procedure Hazard and Incident Reporting and Investigation (ENI-HSE-PR-003). This includes entering the incident into the incident tracking database, accessible by contractor supervisors and Eni personnel.

Some examples of environmental incidents that need to be reported to Eni include:

- the uncontrollable escape or ignition of petroleum or any other flammable or combustible material causing a potentially hazardous situation
- small spills of hydrocarbons, hydraulic fluids, or any other chemicals, of any volume
- unplanned releases of gas
- overboard disposal of solid waste (accidental or intentional)
- loss of equipment to the ocean (dropped objects)
- incorrect disposal of wastes onshore by waste contractors.

9.7.4 External Incident Reporting

Environmental incidents will be reported to ANP in accordance with Eni's Procedure: Hazard and Incident Reporting and Investigation (ENI-HSE-PR-003). This includes entering the incident into the incident tracking database, accessible by contractor supervisors and Eni personnel.

Some examples of environmental incidents that need to be reported to ANP include:

- escape of discharge into the sea of a mixture of petroleum and water in which the petroleum concentration was greater than 25ppm
- escape or discharge into the sea of more than 80L of petroleum, not being the above
- uncontrollable escape or ignition of petroleum or any other flammable or combustible material causing a potentially hazardous situation.

The written report will specify:

- the date, time and place of the occurrence
- the quantity or approximate quantity of liquid that escaped or burned
- particulars of damage caused by the escape or ignition

- the events so far as they are known or suspected that caused or contributed to the escape or ignition
- particulars of methods used to control the escape or ignition
- particulars of methods used or proposed to be used to repair property damaged by the escape or ignition
- measures taken, or to be taken, to prevent a possible recurrence of the escape or ignition.

Subsequent actions taken to contain and clean up any environmental pollution must also be reported to the relevant government agencies in time intervals of no longer than 10 days.

9.8 Knowledge Sharing and Health, Safety and Environment Communication

HSE communications include both internal communication to employees and external communication to stakeholders, and is managed in accordance with procedure: HSE Communications, Consultation and Participation (ENI-HSE-PR-016). Emergency communications are described in the Incident and Crisis Management Communications Manual (ENI-HSE-PL-038).

HSE commitments and obligations are established, recorded, maintained, communicated and managed within Eni in accordance with Procedure: Maintaining Knowledge of HSE Commitments and Obligations (ENI-HSE-PR-006).

9.8.1 Internal Eni Communications

Typical examples of key internal Eni communications relevant to the survey activity are:

- periodic management meetings
- morning call
- back-to-back roster handovers
- HSE meetings
- pre-start meetings
- safety initiatives and communications
- management safety visits.

9.8.2 Non-verbal Communication

In addition to the meetings described above, there are non-verbal means of communicating HSE issues within Eni, including:

- Eni intranet websites
- emails
- HSE noticeboards.

The Eni Intranet site has an HSE page that contains links to:

- HSE IMS
- reporting forms

- incident and crisis management documentation
- Safety Case documentation
- Environmental Management Plan
- emergency response documentation
- health risk assessment.

Emails are regularly used to communicate HSE issues within Eni. Typically, these would be:

- HSE Alerts – HSE Alerts are specific alert notices that arise from Hazard and Incident Reports and are typically only considered for high-potential incidents. The HSE Manager will decide whether to issue an HSE Alert to inform the wider workforce.
- HSE Bulletins – Notices on HSE topics that need to be raised in the workforce can be done so using HSE Bulletins. They can focus on an HSE theme or just raise a specific item of interest. The HSE Manager coordinates the development of new HSE Bulletins.

HSE noticeboards are present in all Eni offices and plants. They function to inform the workforce about HSE issues. Regular items which are placed on the HSE noticeboards include:

- HSE Commitment Statement
- Incident statistics
- Incident descriptions
- Audit reports
- Hazard cards (for reporting hazards).

9.9 Management of Change

Change is managed in accordance with the Eni Australia Procedure: Management of Change (ENI-HSE-PR-002).

The procedure covers changes in operational assets, systems, processes, operations, products, organisation and staffing that could impact hazard or risk levels, environmental outcomes, compliance with laws or standards, or stakeholders involved in these areas. This procedure does not apply to standard modifications or routine changes within existing work processes, such as the Permit to Work system.

The identified risk may change due to internal and external factors, in which case the EMP has to be reviewed. Changes that may lead to an EMP review include:

- those concerning the scope of the activity descriptions (Section 3)
- advancement in technology
- new scientific information
- changes in understanding of the environment such as advices regarding protected species (Section 4.4.6).
- potential new advice from stakeholders.

Factors that may lead to an EMP review are identified through multiple means, including:

- internal knowledge sharing and HSE communication (Section 9.8.1)
- internal communications (Section 9.8.1)
- HSE management review (Section 9.1.1)
- non-verbal communications (Section 9.8.2)
- external communications

A review of the EMP may be initiated by the management review or further understanding of the environmental risks through knowledge-sharing (Section 9.8). Internal reviews will cover various aspects, including overall design and effectiveness of the EMP, progress in the management control measures, changes in environmental risks, changes in business conditions. and any emerging environmental issues of changes in understanding of the environment. These reviews may also lead to the adoption or reconsideration of previously rejected management measures within the EMP.

The EMP will be revised if:

- an environmental inspection and audit detect significant breaches of the EMP requirements
- there is a significant new environmental risk or effect, or a significant increase in an existing environmental risk or effect that is not covered by the existing EMP.

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APPENDICES

APPENDIX A

ENI HEALTH, SAFETY AND ENVIRONMENT STATEMENT

health safety & environment statement

Eni Australia Ltd, in its natural resources and energy evolution activities is committed to providing a safe work place, safe systems of work, a competent workforce and a culture conducive to exercising prudent Health, Safety, Environment (HSE) and Energy Management practices and behaviours.

This commitment statement applies to all operational activities undertaken by Eni Australia Ltd, including activities carried out by our contractors and sub contractors.

Eni Australia Ltd will:

- Provide a safe and healthy workplace for the prevention of worker related injury and ill health.
- Set objectives and targets to ensure continual improvement in the HSE Management System and overall HSE performance.
- Comply with relevant legislation and other obligations, or apply company standards where laws and regulations do not exist.
- Commit to eliminating HSE risks across the business life cycle to As Low as Reasonably Practicable
- Adopt high management and technical standards to prevent and mitigate major accidents associated with process safety events.
- Include HSE performance in appraisal of staff and contractors.
- Respect the environment and prevent pollution by actively monitoring and managing emissions, effluents, discharges and other impacts on the environment.
- Endeavour to reduce greenhouse gas emission intensity, fugitive emissions and process flaring as part of our climate strategy.
- Adopt energy efficient systems in our planning activities.
- Provide systems, resources and skills to maintain emergency response capabilities.
- Consult with stakeholders, local communities, public interest groups, workers and their representatives.
- Remain committed to sustainable development and the welfare of our host communities, and
- Promote HSE best practice in all our activities.

All staff, contractors and sub contractors at Eni Australia Ltd have a personal responsibility to support this HSE Statement and are encouraged to openly report any HSE issue or concern. In addition, everyone is obliged to intervene in unsafe acts or conditions to prevent injury, environmental impact or damage to assets.

Managing Director

Denis Palermo

Date 01 November 2023

eni australia