Regia MSS: Preliminary Environmental Impact and Risk Assessment

March 2023

Klarite

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Introduction

This preliminary environmental impact and risk assessment (PEIRA) has been prepared by Klarite to support CGG Services (Australia) Pty Ltd (CGG) in its environmental management of the Regia Marine Seismic Survey (Regia MSS).

Klarite is an independent professional services firm specialising in environmental management of offshore energy developments. Established in 2017, Klarite has performed environmental impact and risk assessment throughout the offshore marine area in Australia and has years of experience in the offshore regulatory framework.

The PEIRA follows a standardised methodology for identifying environmental impacts and risks from offshore petroleum activities and determining their relative significance.

Purpose

The purpose of this PEIRA is to:

- Identify key environmental values and sensitivities (which include social, economic, and cultural features).
- Perform an initial evaluation of the environmental impacts and risks associated with the Regia MSS to support consultation efforts.

The findings of this assessment will be used to inform project design and decision making, and to identify any necessary mitigation measures and management strategies. The PEIRA will also provide a basis for further study, including the potential for baseline characterisation studies, and investigation as required. This document serves as a starting point for a full environmental assessment, which will be required before the activity can progress through the approvals process.

Environmental Planning Area Description

To commence the PEIRA an Environmental Planning Area was established to frame the initial studies and community consultation effort. Within that area an Activity Planning Area was established to frame the maximum geographical limits of the activity. The Environmental Planning Area and Activity Planning Area are shown in Figure B4-1.

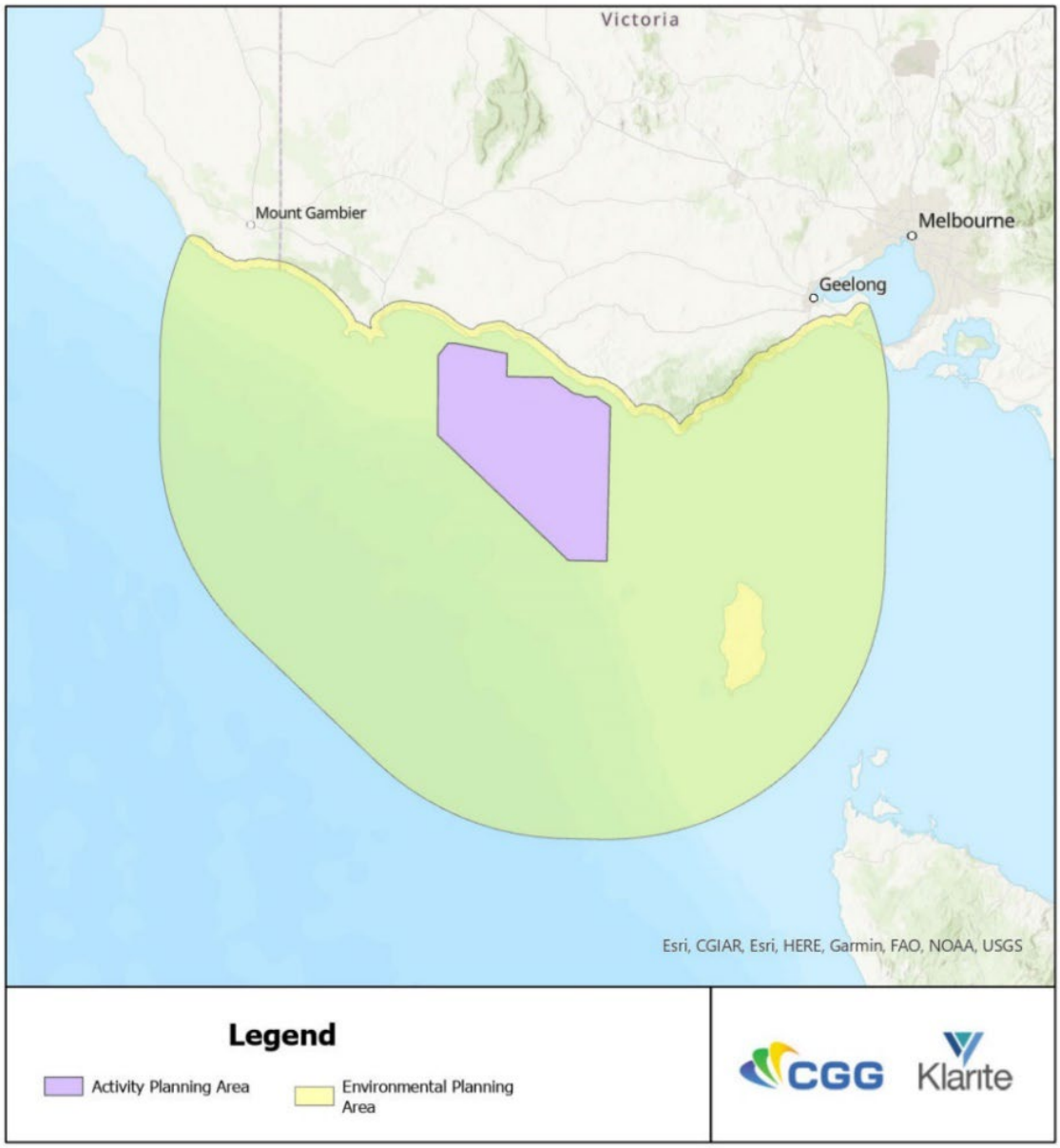


Figure B4-1 - Regia MSS Environmental Planning Area and Activity Planning Area.

The Environmental Planning Area has been set at 155 km around the Activity Planning Area. This distance has been selected using professional judgement and a review of previous impact and risk assessments for similar activities in the region. Further justifying the distance, the NERA Reference Case: Consequences analysis of an accidental release of diesel (NERA 2018) found that diesel spills under 700m^3 were reliably predicted to disperse within this distance. The Environmental Planning Area will be validated or modified based on recommended within this PEIRA.

Scope of Assessment

This scope of this PEIRA covers the Environmental Planning Area, which includes the Activity Planning Area and the surrounding area that may be affected by the activity. The PEIRA aims to identify and evaluate the impacts and risks of the activity on the:

- physical and biological environment, including air quality, water quality, sediment quality, climate, marine life, and marine habitats; and
- human environment, including marine industries, cultural and indigenous values, recreational activities, tourism, coastal developments, and marine protected areas.

Environmental Regulations and Guidelines

The primary legislation governing the Regia MSS is the *Offshore Petroleum and Greenhouse Gas Storage Act 2006* (the Act) and the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023 (the Regulations).

There are numerous additional laws, regulations, and guidelines that apply requirements to the Regia MSS activity. These are the subject of a separate study being completed by CGG and are only discussed here if they are relevant to the management of environmental impacts and risks.

The following terms are used in this PEIRA and are defined in the Regulations:

A petroleum activity or activity means operation or works in an offshore area undertaken for the purpose of: (a) exercising a right conferred on a petroleum titleholder under the Act by a petroleum title; or (b) discharging an obligation imposed on a petroleum titleholder under the Act or a legislative instrument under the Act.

An environmental impact is a change, whether adverse or beneficial, that wholly or partially results from an activity.

The following terms are used in this PEIRA and are defined in various relevant environmental management standards and guidelines:

An environmental aspect is an element of an activity that can interact with the environment.

An environmental risk is the probability and consequence of an unwanted accident.

Methodology

The environmental assessment methodology used in the PEIRA has been developed based on widely adopted best practice and industry standards, primarily AS/NZS ISO 31000:2018: Risk Management – Principles and Guidelines. There are two parts of the methodology, one for environmental impacts and one for environmental risks. Both parts of the assessment are underpinned by a clear description of the activity, data collected in preparation of this document, and the identification of environmental aspects arising from the Regia MSS.

Project Description

Klarite was provided a description of the activity which is available on the Regia MSS Consultation Hub (www.regiamss.com.au).

Data Collection

A review of relevant literature and data sources was undertaken to gather information on the Environmental Planning Area and the baseline environmental conditions. No field surveys were undertaken to collect data given that the marine environment in the Otway region is relatively well understood and the preliminary nature of this PEIRA.

Community consultation for the project has commenced and will provide a valuable source of information on environmental values and sensitivities, as well as the concerns and perspectives of interested parties, including local communities and regulatory agencies. This

PEIRA will be published to help inform the community of the environmental aspects of the activity so that their views can be properly reflected in the full environmental assessment.

Information sources accessed to inform this PEIRA are detailed in Table B4-1.

Table B4-1: Information Sources Accessed to Inform PEIRA

Information Source	Managed by	Date Accessed
Protected Matters Search Tool https://www.dcceew.gov.au/environment/epbc/protected-matters-search-tool	Department of Climate Change, Energy, the Environment and Water	11 Feb 2023
Species Profile and Threats Database	Department of Climate Change, Energy, the Environment and Water	Feb/Mar 2023
Submarine Cable Map https://www.submarinecablemap.com/	TeleGeography	11 Feb 2023
Victorian Desalination Project https://www.dtf.vic.gov.au/partnerships-victoria-ppp-projects/victorian-desalination-project	Victorian State Government	11 Feb 2023

Impact Assessment Techniques

The impact assessment for the PEIRA consists of a desktop study conducted to evaluate the environmental impacts of the activity on the Environmental Planning Area, based on the data collected during the data collection phase. Professional judgement and good practice have been relied on to complete the PEIRA and recommendations for further studies including modelling, have been made where necessary to support the full environment assessment.

Risk Assessment Techniques

The risk assessment for the PEIRA consists of a desktop study conducted to identify the hazards associated with the activity and analyse the probability and consequence of each hazard to determine the risks associated with the activity. The results of the probability and consequence analysis will be used to characterise the overall risk associated with the activity, and to prioritise mitigation measures and management strategies. Professional judgement and good practice have been relied on to complete the PEIRA and recommendations for further studies, including modelling, have been made where necessary to support the full environmental assessment.

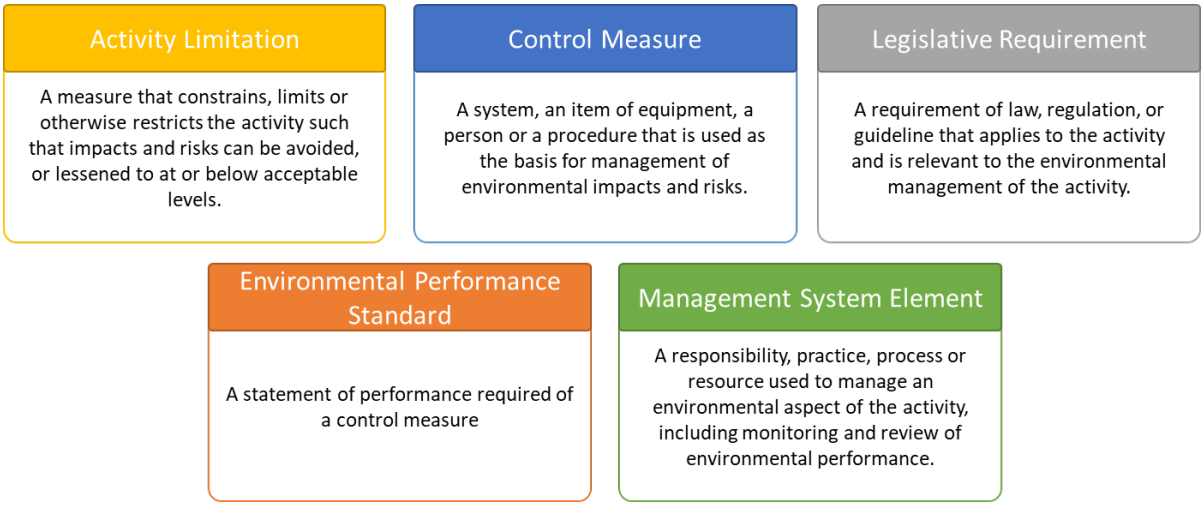
Assessment of Potential Significance

Assessment of potential significance is a key outcome of the PEIRA. It provides context for any additional baseline studies and guides the full environmental impact and risk assessment. Under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act), an action (*activity*) will require approval from the Environment Minister if the action has, will have, or is likely to have, a significant impact on a matter of national environmental significance. A 'significant impact' is an impact which is important, notable, or of consequence, having regard to its context or intensity. Whether or not an action is likely

to have a significant impact depends upon the sensitivity, value, and quality of the environment, which is impacted, and upon the intensity, duration, magnitude, and geographic extent of the impacts (DAWE 2013).

Treatment of Environmental Impacts and Risks

Throughout the PEIRA (and the subsequent full assessment) there will be mitigation and management measures that will be implemented preparing for, and during, the activity. There are five types of mitigation and management measures as shown below. Where a mitigation or management measure is identified for the Regia MSS from this PEIRA they will be shown within the text to emphasise their importance for environmental management.



Environmental Aspects

Cause Effect Pathways

A cause-effect pathway refers to the chain of events that connects a specific cause to an effect. In the context of environmental impacts and risk assessments, cause-effect pathways describe the relationships between environmental aspects and the impacts or consequences they could have on the environment.

A cause-effect pathway typically starts with the identification of a potential hazard, such as the physical presence of a seismic survey vessel, and then examines the potential pathways by which that hazard could result in an impact, such as the release of pollutants into the water affecting water quality or the generation of underwater sound at levels that can cause harm to marine life.

The identification of cause-effect pathways is an important step in the assessment process, as it allows for a systematic evaluation of the environmental impacts and risks of a proposed activity. It also provides a basis for developing mitigation and management strategies.

Identification

To understand the magnitude, extent and duration of an environmental impact or risk the pathway of each environmental aspect needs to be identified. The following list describes the environmental aspects identified from the Regia MSS activities to date that can lead to environmental impacts.

- Artificial light – the presence of vessels undertaking night-time operations will result in artificial light discharge into the marine environment.
- Physical presence – the presence of components of the activity, such as the physical presence of vessels operating in marine waters may interfere with other marine users.
- Underwater sound – components of the activity will generate impulsive sound and other components will generate continuous sound. Both could affect ecological, economic, or social receptors.
- Atmospheric emissions – vessels used on the activity will generate atmospheric emissions, which could affect ambient physical conditions and ecological receptors.
- Planned discharges – the activity will likely result in planned liquid discharge pathways, such as those typically generated by vessels.

The following list describes the environmental aspects identified in the Regia MSS to date that may lead to environmental risks.

- Accidental release of fuel – whilst undertaking the activity, unplanned events may occur which result in a discharge of marine diesel.
- Accidental release of materials or waste overboard – whilst undertaking the activity, unplanned release of waste, or equipment may occur.
- Introduction of marine pest species – vessels that transit between ports may temporarily harbour invasive marine species that have could be introduced or even establish in foreign places.
- Collisions with marine fauna – vessels have limited manoeuvrability at stages during the activity and may be unable to avoid collisions with marine fauna.

Typical environmental aspects from offshore petroleum activities that were considered and determined to not be relevant to this assessment are listed below.

- Benthic disturbance – there is no pathway for the activity to result in changes to physical receptors, for example disturbance to the seabed, as there will be no anchoring as part of the activity.

Activity Limitation
No anchoring permitted within the activity planning area.

Extent and Duration

Each environmental aspect has a related spatial extent within the Environmental Planning Area. The Regulations require that the Environment Plan must describe the existing environment that may be affected by the activity. Therefore, this PEIRA seeks to identify the appropriate extent and duration of each environmental aspect so that the search for environmental values and sensitivities can be specific to the environmental aspect. Table B4-2 identifies and justifies the extent and duration of each environmental aspect for the Regia MSS.

Table B4-2 - Extent and Duration of Regia MSS Environmental Aspects

Environmental Aspect	Extent	Duration	Justification
Artificial light	Activity Planning Area +20 km	90 days	The National Light Pollution Guidelines (CoA 2020) detail that where there is important habitat for listed species that are known to be affected by artificial light within 20 km of a project, species specific

Environmental Aspect	Extent	Duration	Justification
			impacts should be considered through an Environmental Impact Assessment process. The measurable change in light from ambient conditions is likely to occur at <20 km from the source; but due to difficulties with calculating light intensity in biologically relevant measurements, the distance in CoA (2020) has been used. Once the vessels leave the Activity Planning Area this aspect ceases.
Physical presence	Activity Planning Area	90 days	There will be no activities beyond the Activity Planning Area which will be narrowed to the Operational Area later in the assessment process. The larger area has been used for this PEIRA.
Underwater sound	Underwater sound area	90 days	This is an additional area that varies depending on how sound is received by the receptor. This area will be predicted through qualitative underwater sound modelling.
Atmospheric emissions	Activity Planning Area	90 days	There will be no activities beyond the Activity Planning Area which will be narrowed to the Operational Area later in the assessment process. The larger area has been used for this PEIRA.
Planned discharges	Activity Planning Area	90 days survey duration +1 day	When the survey ends the planned discharges associated with the activity end. Planned discharges are such that after a 24-hour period any impacts would be indistinguishable from other marine activities in the area.
Accidental release of fuel	Environment Planning Area	90 days survey duration +7 days	When the survey ends this aspect ends. If there were an accidental release of fuel the consequences of the release would not be detectable a further 7 days post-incident due to the rapid evaporation and dispersion of the fuel.
Accidental release of materials or waste overboard	Environment Planning Area	90 days	Any buoyant waste released overboard is likely to wash up on shorelines hence why the larger Environment Planning Area has been used. Once the activity ends this aspect is no longer relevant.
Introduction of marine pest species	Activity Planning Area	90 days	The vessel will not be conducting petroleum activities beyond the Activity Planning Area, which will be

Environmental Aspect	Extent	Duration	Justification
			narrowed to the Operational Area later. Once the activity ends this aspect is no longer relevant.
Collision with marine fauna	Activity Planning Area	90 days survey duration	The vessel will not be conducting petroleum activities beyond the Activity Planning Area, which will be narrowed to the Operational Area later. Once the activity ends this aspect is no longer relevant.

Screening

Not all environmental aspects interact with the identified component parts of the environment. For example, water quality will not be affected by artificial light. Table B4-3 shows the interactions between each environmental aspects and identified components of the environment. Additional component parts of the environmental may be identified through the consultation process. These will be considered in the full assessment.

Table B4-3 - Screening of Environmental Aspects against the Components of the Environment.

		Environmental Aspects								
		Artificial Light	Physical Presence	Underwater Sound	Atmospheric Emissions	Planned Discharges	Accidental Release of Fuel	Accidental Release of Materials or Waste Overboard	Introduction of marine pest species	Collisions with marine fauna
Environment Component										
Physical Environment	Air Quality				✓					
	Ambient Light	✓								
	Ambient Sound			✓						
	Climate				✓					
	Sediment Quality						✓			
	Water Quality					✓	✓	✓		
Ecological Environment	Benthic Assemblages			✓			✓	✓	✓	
	Coastal Habitats and Communities				✓		✓			
	Plankton	✓		✓	✓	✓	✓			
	Invertebrates	✓		✓	✓	✓	✓		✓	
	Fish	✓	✓	✓	✓	✓	✓	✓		✓
	Birds	✓	✓	✓	✓	✓	✓	✓		
	Marine Reptiles	✓	✓	✓	✓	✓	✓	✓		✓
	Marine Mammals	✓	✓	✓	✓	✓	✓	✓		✓
Human Environment	Coastal Development	✓					✓			
	Commercial Fishing and Aquaculture		✓				✓	✓	✓	
	Diving		✓	✓			✓		✓	
	Indigenous Culture		✓				✓	✓		
	Marine Industries		✓				✓			
	Marine Protected Areas		✓				✓	✓		
	Marine Tourism		✓				✓			
	Recreational Fishing		✓				✓		✓	

Baseline Environmental Conditions

The baseline environmental conditions identified below are used as a reference point to evaluate the impacts and risks of the Regia MSS. The baseline conditions are also used to determine the significance of the impacts and risks identified in the PEIRA and to identify any necessary mitigation measures and management strategies.

Summary

The marine environment of the offshore Otway Basin, Victoria, Australia, is a diverse and dynamic ecosystem that supports a range of important physical, ecological, and human activities. The Environmental Planning Area encompasses a wide range of habitats, including open ocean, coastal waters, rocky shores, sandy beaches, seagrass beds, and kelp forests. These habitats support a variety of marine species, including fish, crustaceans, molluscs, birds, marine reptiles, marine mammals, and seaweeds. The marine environment also supports a range of human activities, including but not limited to fishing, diving, shipping, and recreation.

Water quality in the Environmental Planning Area is generally good, with relatively low levels of pollutants and relatively high levels of dissolved oxygen. The area is also relatively protected from human impacts, with few major industries or coastal developments in the immediate vicinity. However, the Environmental Planning Area is subject to some environmental stressors, including nutrient runoff, sedimentation, and marine debris.

Physical Environment

The physical environment refers to the non-living natural elements of an ecosystem, including air, water, soil, minerals, and energy from the sun. These elements interact with each other and with living organisms to form a complex system that supports and sustains life.

The physical environment plays a crucial role in shaping the biotic components of an ecosystem, influencing the distribution and diversity of plants, animals, and microorganisms. For example, the availability of water, light, and nutrients determines the types of vegetation that can grow in a particular area, while topography and geology shape the physical structure of the landscape, providing habitats and resources for various species.

Understanding the physical environment is essential for comprehending the functioning of an ecosystem and for developing sustainable management practices that preserve and enhance the ecological, economic, and social values of the environment. The following components of the physical environment are considered in this PEIRA and will be carried through to the full assessments.

- Air Quality
- Ambient Light
- Ambient Sound
- Climate
- Sediment Quality
- Water Quality

Ecological Environment

The ecological environment refers to the living components of an ecosystem, including plants, animals, and microorganisms, as well as their interactions with each other and with the non-living elements of the environment. These interactions form the food webs and nutrient cycles that sustain life and maintain the stability and resilience of the ecosystem.

The ecological environment is shaped by the physical environment, as well as by historical events, such as natural disasters, evolution, and human activities. Biodiversity, or the variety of species and their interactions, is a key feature of the ecological environment, providing the essential functions and services that support human well-being, such as food, medicine, and recreation.

Understanding the ecological environment is important for conserving and restoring biodiversity, preserving the integrity and functioning of ecosystems, and supporting the livelihoods and well-being of people and communities. It involves monitoring and assessing changes in species composition, populations, and interactions, as well as evaluating the impacts of human activities, such as habitat destruction, pollution, and introduction of non-native species, on the ecological environment. The following components of the ecological environment are considered in this PEIRA and will be carried through to the full assessments.

- Benthic Assemblages
- Coast Habitats and Communities
- Plankton
- Invertebrates
- Fish
- Birds
- Marine Reptiles
- Marine Mammals

These components of the ecological environment may include the following matters that must be considered in the full assessments:

- the presence of a listed threatened species or listed threatened ecological community.
- the presence of a listed migratory species.
- any values and sensitivities that exist in, or in relation to, part or all of:
    - a Commonwealth marine area; or
    - Commonwealth land.

Human Environment

The human environment refers to the relationships between people and the environment, including the physical, psychological, social, economic and cultural elements that shape human well-being. It encompasses the communities, economies, and cultures that depend on the environment for their livelihoods, health, and well-being.

In the context of marine areas, the human environment includes coastal developments, fishing and aquaculture industries, tourism and traditional owners who have a close connection to the sea and its resources. The relationship between traditional owners and the sea often involves a deep cultural, spiritual, and economic connection, and they have a unique knowledge and understanding of the marine environment that has been passed down through generations.

Understanding the human environment is critical for developing effective and equitable environmental management strategies that balance the needs of people with the conservation of the environment. It involves considering the social, economic, and cultural values and impacts of environmental change, and engaging with the various stakeholders, including traditional owners, to ensure that their perspectives and needs are incorporated into decision-making processes. The following components of the human environment are considered in this PEIRA and will be carried through to the full assessments.

- Coastal Development
- Commercial Fishing and Aquaculture
- Diving
- Indigenous Culture
- Marine Industries
- Marine Protected Areas
- Marine Tourism
- Recreational Activities

In this list Marine Protected Areas may include the following matters that must be considered in the full assessments:

- the National Heritage values of a National Heritage place.
- the ecological character of a declared Ramsar wetland.

Noting that there is no proposed activity, or part of the activity, being undertaken in any part of a declared World Heritage property.

Environmental Impacts

Environmental impacts are identified and evaluated based on the cause effect pathways that arise from the activity. This PEIRA provides a first pass at evaluating the significance of the environmental impacts to:

- Support community consultation.
- Direct further assessment towards areas of higher impact.
- Inform decision making during the activity design.
- Justify if no further assessment is required for negligible effects.

The evaluation step at this preliminary stage involves using professional judgement to compare the estimated environmental impacts to internal assessment criteria, determining the overall significance of the impacts, and deciding on actions for further assessment.

This impact assessment is designed to facilitate consultation with the community, including government agencies, community groups, and other relevant organisations about the nature and scale of environmental impacts from the activity. This PEIRA will be published, with a summary, on the Regia MSS Consultation Hub (www.regiamss.com.au) and used in consultation with the community.

Environmental Impact Evaluation

At the preliminary stage, environmental impacts are a combination of a subjectively estimated level of effect combined with a subjectively estimated level of uncertainty. The impact assessment methodology is explained in the Environmental Assessment Framework document available on the Regia MSS Consultation Hub. The outcomes of the evaluation are presented in Table B4-4.

Impacts Not Further Assessed

The PEIRA identified four environmental aspects where the environmental impact to some environment components were ranked as having a negligible level of effect. Each identified environmental aspect will be carried through to the full assessment, however, the environment component where the impact was ranked as negligible will not be carried through to the full impact assessment for that environmental aspect. Justification for this decision is provided in the sections below.

Artificial Light

Marine Mammals: Change in fauna behaviour

Artificial light has not been reported to cause a significant behavioural disturbance to marine mammals, despite their often-higher activity levels at night. Results from a previous independent review and assessment of the sensitivity of marine mammals to mining and exploration activities in the Great Australian Bight Marine Park indicate that the consequence of light pollution impacts to marine mammals were insignificant (defined as occasional short-term attraction and/or disruption to marine mammals) (Pidcock, Burton and Lunney, 2003). Therefore, impacts to marine mammals from light emissions are not predicted and have not been evaluated further.

Coastal Development: Change to functions, interests, and activities

The coastline is sparsely populated with no cities (i.e. >100,000 people congregated around an urban centre) located on the coastline. The largest town that may be able to see the mandatory minimum navigational light is Warrnambool at the northwest of the Activity Planning Area. There is a shipping channel through the Activity Planning Area and artificial

light produced by the survey at night-time will be no different to artificial light from other marine users navigating at night. Therefore, impacts to coastal developments from light emissions are not predicted and have not been evaluated further.

Atmospheric Emissions

Ecological environment: Change to local air quality, change in climate, change in ecosystem dynamics

Atmospheric emissions have the potential to result in a change in air quality. As a result of a change in ambient air quality, a change in physical condition may occur to benthic assemblages, plankton, invertebrates, fish, marine reptiles, marine mammals and coastal habitats and communities.

Control Measure
Implement the CGG marine assurance system to ensure compliance of contract vessels with MARPOL, COLREGS, and Marine Orders 21, 30, 31, 59 70,71,72, 91, 95, 96, 97, 98.

The use of fuel to power vessel engines, generators and mobile and fixed plant will result in emissions of greenhouse gases (GHG) such as carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O), along with non-GHG such as sulphur oxides (SO_X) and nitrous oxides (NO_X).

A change in air quality has the potential to result in a change in physical condition. The activity is of a short duration and will only involve up to three vessels. It is a once-off activity. Based on a 2018 seismic survey in Bass Strait, approximately 50 tonnes of fuel were used per day by the vessel spread. This results in the daily emissions of approximately:

- 1.2 tonnes of nitrogen dioxide (NO_X)
- 0.04 tonnes of sulphur dioxide (SO_X)
- 110 tonnes of carbon dioxide (CO_2)

Based on a 90-day survey, it could be expected that 4,500 tonnes of fuel would be used, resulting in similar daily emissions of NO_X, SO_X and CO_2.

Potential receptors above the sea surface within the Environmental Planning Area that may be exposed to reduced air quality include seabirds and marine megafauna that surface for air (e.g., marine mammals and marine turtles). Emissions will be small in quantity and will dissipate quickly into the surrounding atmosphere, therefore any localised reduction in air quality is not expected to result in any measurable effect.

While these emissions add to the GHG load in the atmosphere, which adds to global warming potential, they are relatively small on a state, national and global scale, representing an insignificant contribution to overall GHG emissions. Emissions will be small in quantity and short-term. The emissions from up to three vessels for 90 days will not significantly contribute to climate change.

Therefore, impacts to ecological components of the environment from atmospheric emissions are not predicted and have not been evaluated further.

Table B4-4: Preliminary Environmental Impact Evaluation

Environment Component	Environmental Aspect	Environmental Impact	Effect	Uncertainty	Preliminary Outcome
Air Quality	Atmospheric Emissions	Change to local air quality	Negligible	Low	No further assessment
Ambient Light	Artificial Light	Change in ambient light	Minor	Low	Qualitative assessment
Ambient Sound	Underwater Sound	Change in ambient sound	Minor	Low	Qualitative assessment
Climate	Atmospheric Emissions	Change in climate	Negligible	Low	No further assessment
Water Quality	Planned Discharges	Change to water quality	Negligible	Low	No further assessment
Benthic Assemblages	Underwater Sound	Change in physical condition	Negligible	Low	No further assessment
Coastal habitats and communities	Atmospheric Emissions	Change in ecosystem dynamics	Negligible	Low	No further assessment
Plankton	Artificial Light	Change in fauna behaviour	Minor	Low	Qualitative assessment
	Underwater Sound	Change in fauna behaviour	Minor	Low	Qualitative assessment
		Change in physical condition	Minor	Low	Qualitative assessment
	Atmospheric Emissions	Change in ecosystem dynamics	Negligible	Low	No further assessment
	Planned Discharges	Change in fauna behaviour	Negligible	Low	No further assessment
		Change in physical condition	Negligible	Low	No further assessment
Invertebrates	Artificial Light	Change in fauna behaviour	Minor	Low	Qualitative assessment
	Underwater Sound	Change in fauna behaviour	Minor	Low	Qualitative assessment
		Change in hearing capacity	Negligible	Moderate	Qualitative assessment
		Change in physical condition	Moderate	Low	Qualitative assessment
	Atmospheric Emissions	Change in ecosystem dynamics	Negligible	Low	No further assessment
	Planned Discharges	Change in fauna behaviour	Negligible	Low	No further assessment
		Change in physical condition	Negligible	Low	No further assessment
Fish	Artificial Light	Change to fauna behaviour	Minor	Low	Qualitative assessment
	Underwater Sound	Change in fauna behaviour	Minor	Low	Qualitative assessment
		Change in hearing capacity	Minor	Low	Qualitative assessment
		Change in physical condition	Minor	Low	Qualitative assessment
	Atmospheric Emissions	Change in ecosystem dynamics	Negligible	Low	No further assessment
	Planned Discharges	Change in fauna behaviour	Negligible	Low	No further assessment
		Change in physical condition	Negligible	Low	No further assessment
Birds	Artificial Light	Change in fauna behaviour	Minor	Low	Qualitative assessment
	Underwater Sound	Change in fauna behaviour	Negligible	Low	No further assessment

Environment Component	Environmental Aspect	Environmental Impact	Effect	Uncertainty	Preliminary Outcome
		Change in hearing capacity	Negligible	Low	No further assessment
		Change in physical condition	Negligible	Low	No further assessment
	Atmospheric Emissions	Change in ecosystem dynamics	Negligible	Low	No further assessment
	Planned Discharges	Change in fauna behaviour	Negligible	Low	No further assessment
		Change in physical condition	Negligible	Low	No further assessment
Marine Reptiles	Artificial Light	Change in fauna behaviour	Minor	Low	Qualitative assessment
	Underwater Sound	Change in fauna behaviour	Minor	Moderate	Qualitative assessment
		Change in hearing capacity	Minor	Moderate	Qualitative assessment
		Change in physical condition	Minor	Low	Qualitative assessment
	Atmospheric Emissions	Change in ecosystem dynamics	Negligible	Low	No further assessment
	Planned Discharges	Change in fauna behaviour	Negligible	Low	No further assessment
		Change in physical condition	Negligible	Low	No further assessment
Marine Mammals	Artificial Light	Change in fauna behaviour	Negligible	Low	No further assessment
	Underwater Sound	Change in fauna behaviour	Minor	Moderate	Qualitative assessment
		Change in hearing capacity	Moderate	Moderate	Quantitative assessment
		Change in physical condition	Negligible	Low	No further assessment
	Atmospheric Emissions	Change in ecosystem dynamics	Negligible	Low	No further assessment
	Planned Discharges	Change in fauna behaviour	Negligible	Low	No further assessment
		Change in physical condition	Negligible	Low	No further assessment
Coastal Development	Artificial Light	Change in functions, interests, or activities	Negligible	Low	No further assessment
Commercial Fishing and Aquaculture	Physical Presence	Change in functions, interests, or activities	Moderate	Moderate	Quantitative assessment
Diving	Physical Presence	Change in functions, interests, or activities	Minor	Low	Qualitative assessment
	Underwater Sound	Change in physical condition	Moderate	Moderate	Quantitative assessment
Indigenous Culture	Physical Presence	Change in functions, interests, or activities	Minor	Moderate	Qualitative assessment
Marine industries	Physical Presence	Change in functions, interests, or activities	Minor	Low	Qualitative assessment
Marine Protected Areas	Physical Presence	Change in functions, interests, or activities	Minor	Low	Qualitative assessment
Marine Tourism	Physical Presence	Change in functions, interests, or activities	Minor	Moderate	Qualitative assessment
Recreational Fishing	Physical Presence	Change in functions, interests, or activities	Minor	Low	Qualitative assessment

Planned Discharges

Ecological Environment: Change to water quality, change in fauna behaviour and change in physical condition

Vessel discharges have the potential to result in a change in water quality. As a result of a change in ambient water quality, further impacts may occur to marine fauna, including:

- a change in fauna behaviour
- injury/mortality to fauna

Discharges of organic matter, such as those present in sewage, greywater or food waste can lead to an increase in scavenging behaviour in fauna. Discharges will be localised and temporary as they will be quickly broken down by microbial action and dispersed by wave action and local ocean currents. Sewage solids will be broken down during treatment before being discharged, which will aid the decomposition process. Likewise, under MARPOL, food scraps are required to be macerated to a size small enough to pass through a 25 mm mesh before being discharged.

Control Measure
Implement the CGG marine assurance system to ensure compliance of contract vessels with MARPOL, COLREGS, and Marine Orders 21, 30, 31, 59 70,71,72, 91, 95, 96, 97, 98.

Plankton have a patchy distribution linked to localised and seasonal productivity that produces sporadic bursts in populations (DEWHA 2007). A change in water quality associated with discharges of sewage, greywater or food waste is unlikely to lead to a significant change in plankton distribution at a measurable level and will not result in a change in the viability of the population or ecosystem.

Marine fauna likely to be present within the upper water column are expected to be highly mobile and therefore able to avoid any localised change in ambient water quality. Species with limited mobility (i.e., plankton, fish embryo and larvae) are extremely unlikely to be impacted by any effects of temporary and localised increases in turbidity and low toxicity due to rapid dilution. No significant impacts are expected to plankton species, or on higher trophic levels reliant on plankton abundance.

Levels of contaminants within deck washdown, rainwater and deck drainage are likely to be insignificant. OSPAR (2014) indicates that the predicted no effect concentration (PNEC) for marine organisms exposed to dispersed oil is 70.5 ppb. Due to wave action and ocean currents any low-level contaminants will be quickly diluted and dispersed with no or negligible environmental impact. Shell (2009) conducted modelling that showed discharges of hydrocarbon and other chemical concentrations will be rapidly diluted and expected to be below PNEC within a relatively short time and will meet UNEP (1999) standards within 70m of their discharge.

Bilge water will be treated prior to discharge via an oily water separator with a maximum concentration of 15 ppm oil-in-water being achieved prior to discharge and therefore will have negligible impacts on water quality and hence plankton and marine fauna.

A change in water quality because of routine vessel discharges is unlikely to cause a change in behaviour or a change in physical condition of plankton and marine fauna at a measurable level and will not result in a change in the viability of the population or ecosystem. Therefore, impacts from planned vessel discharges on marine fauna are not predicted and have not been evaluated further.

Underwater Sound

Invertebrates: Change in hearing capacity

Invertebrates detect sound by sensing either the 'particle motion' (Przeslawski et al. 2016a;b; Carroll et al. 2017), through external and/or internal physiological structures such as hairs, statocysts and muscles; or the 'pressure' component (or both) of a sound field in the marine

environment. Invertebrate statocysts are the mechanosensory organ equivalent to the inner ear of humans and are responsible for the detection of gravity, position and movement (Day et al. 2020). Because they lack gas-filled bladders, marine invertebrates are unable to detect the pressure changes associated with sound waves (Carroll et al. 2017; Parry & Gason 2006). As no functional cause-effect relationship has been established for a change in hearing, permanent and/or temporary threshold shifts in invertebrates are not predicted and have not been evaluated further. Impacts to statocysts, a balance sensory receptor present in some aquatic invertebrates, are evaluated under 'Fauna injury/mortality'.

Birds: Change in fauna behaviour, hearing capacity and physical condition

Impulsive and continuous underwater sound emissions have the potential to result in a change in ambient sound. As a result of a change in ambient sound, further impacts may occur to birds, including a change in fauna behaviour, hearing capacity and physical condition.

There are no thresholds for underwater sound impacts to seabirds. As such, no modelling can be conducted. The threshold for physiological damage on the auditory system for seabirds is unknown, however most seabirds are generally shallow divers and utilise surface waters where the acoustic signals 'destructively interfere' with the sea surface, resulting in much lower sound exposure compared with deeper waters (Marine Technology Directorate, 1996: cited in SCAR, 2002) and the time of exposure underwater is short.

If individual birds or flocks are present in the Environmental Planning Area during acquisition, vessel movement is expected to temporarily deter them from foraging in the immediate vicinity of the vessel. The uncertainty of underwater sound impacting individuals or a population of any given species during plunge/dive feeding is extremely low. While resting/rafting on the water surface, there is limited potential for seabirds to be affected by the seismic sound due to the limited transmission of sound between the air-water interface. If there is an effect, it is likely to be a startle response, resulting in the bird flying away. Seabirds feed on multiple prey species and have widespread foraging areas. While displacement of some prey species may result in the displacement of these birds, this impact is localised, temporary and recoverable in any one location. Given their widespread foraging areas (ACAP 2018) and the small area possibly affected by prey displacement, seabirds are not expected to be impacted by reduced net foraging opportunities.

Impacts to shorebird species are not predicted from the activity, given their prey is concentrated within the intertidal zone along the coastline. The little penguin is capable of diving to 72 m but typically dives to 10-20 m. The species is known to generally forage within 20 km of their nesting site during the non-breeding season and 15 km of their nest during the breeding season (October to December) (Australian Wildlife, 2014). The little penguin has a foraging BIA (10 km buffer) around Christmas Island (off the northeast coast of King Island), which is a breeding colony. The Regia Activity Planning Area is more than 25 km from the little penguin BIA. On this basis, encounter rates with little penguin in the Activity Planning Area is considered unlikely. It is inferred that penguins have relatively poor hearing thresholds in the lower frequencies, which is where marine seismic surveys have the most energy (McCauley, 1994). However, Pichegru et al (2017) identified that African penguins switched foraging direction and distance in response to seismic activity but that the response was short-term. As seabirds spend very little time underwater, and shorebirds including the little penguin are located outside of the Activity Planning Area, impacts to birds from underwater sound emissions are not predicted and will not be evaluated further.

Marine Reptiles: Change in hearing capacity; change in physical condition

Underwater sound emissions have the potential to result in a change in ambient sound. As a result of a change in ambient sound, further impacts may occur to marine reptiles,

including change in physical condition. The Sound Exposure Guidelines for Fishes and Sea Turtles Guidelines (Popper et al. 2014) details that there is no direct evidence of mortality or potential mortal injury to marine turtles from shipping and continuous sounds. As no functional cause-effect relationship has been established, no change in physical condition is predicted from continuous underwater sound. Studies to date on marine turtles have not identified a change in physical condition as an impact from seismic sound (Nelms 2016, McCauley et al. 2000, Popper et al. 2014). As no functional cause-effect relationship has been established, changes to the physical condition of turtles from seismic sound will not be evaluated further.

Risk Assessment

Environmental risks are identified and evaluated based on the cause effect pathways that arise from the activity. This PEIRA provides a first pass at evaluating the significance of the environmental risk to:

- Support community consultation.
- Direct further assessment towards areas of higher risk.
- Inform decision making during the activity design.
- Justify if no further assessment is required for negligible effects.

The evaluation step at this preliminary stage involves using professional judgement to compare the estimated environmental risks to our corporate criteria, determining the overall significance of the risks, and deciding on actions for further assessment.

This risk assessment is designed to facilitate consultation with the community, including government agencies, community groups, and other relevant organizations about the nature and scale of environmental risks from the activity. This PEIRA will be published, with a summary, on the Regia MSS Consultation Hub (www.regiamss.com.au) and used in consultation with relevant persons.

Environmental Risk Evaluation

At the preliminary stage, environmental risks are assessed on the basis of a combination of an estimated likelihood combined with a subjectively estimated level of consequence. The risk assessment methodology is explained in the Environmental Assessment Framework document available on the activity website. The outcomes of the evaluation are presented in Table B4-5.

Risks Not Further Assessed

The PEIRA has one environmental aspect where the environmental risks to some environment components are ranked as having a negligible level of effect. Each environmental aspect will be carried through to the full assessment, however, the environment component where the risk is ranked as negligible will not be carried through to the full impact assessment for that environmental aspect. Justification for this decision is provided in the sections below.

Accidental Release of Materials or Waste Overboard

Water Quality: Change in water quality

Legislative Requirement
Marine Order 95: that vessels must have a garbage management plan, placards and maintain a garbage record book. Waste with potential to be windblown shall be stored in covered containers

Loss of materials or waste overboard has the potential to change water quality relied on by marine fauna through ingestion or entanglement. Marine turtles and seabirds are particularly at risk from entanglement. Marine turtles may mistake plastics for food; once ingested, plastics can damage internal tissues and inhibit physiological processes, which can both potentially result in fauna fatality. Floating, non-biodegradable marine debris has been highlighted as a threat to marine turtles, whales, whale sharks, albatrosses and giant petrels in relevant recovery plans and approved conservation advice for those species. Marine debris causing entanglement and ingestion was recognised in 2003 as a key threatening process for marine vertebrates under the EPBC Act leading to the development of the Threat Abatement Plan for the Impacts of Marine Debris on the Vertebrate Wildlife of Australia Coasts and Oceans (DoEE 2018). The recovery plans and approved conservation advice, as well as the threat abatement plan, have specified several recovery actions to help combat this threat. Of relevance to this activity

there is a legislative requirement that prevents this type of marine pollution. Marine Order 95 stipulates that vessels must have a garbage management plan, placards and maintain a garbage record book. Waste with potential to be windblown shall be stored in covered containers to minimise the risk of loss to the marine environment. Marine Order 95 gives effect under Australian law to MARPOL Annex VI.

Benthic assemblages: Change in habitat

Control Measure
Streamers will have recovery units fitted to prevent benthic disturbance in the event of loss.

Loss of equipment or waste has the potential to cause localised seabed disturbance with potential damage to benthic habitats. Given the size of equipment used for a survey, only a relatively small area of the seabed would be disturbed, a maximum of 0.001km^2 based on loss of a streamer that settled on the seabed, though this is unlikely as the streamers will have recovery units. There are no risks to biodiversity or ecosystem function and integrity from any waste that could be lost overboard. Lasting impacts are not predicted as the small area would quickly recover. The consequence to benthic assemblages is ranked as negligible and has not been evaluated further.

Table B4-5 - Preliminary environmental risk evaluation.

Environment Component	Environmental Aspect	Environmental Risk	Probability	Consequence	Preliminary Outcome
Water Quality	Accidental Release of Fuel	Change in water quality	Rare	Moderate	Low
	Accidental Release of Materials or Waste Overboard	Change in water quality	Rare	Negligible	Low (Negligible)
Sediment Quality	Accidental Release of Fuel	Change in sediment quality	Rare	Moderate	Low
Benthic Assemblages	Accidental Release of Fuel	Change in ecosystem dynamics	Rare	Moderate	Low
	Accidental Release of Materials or Waste Overboard	Change in habitat	Rare	Negligible	Low (Negligible)
	Introduction Of Marine Pest Species	Change in ecosystem dynamics	Rare	Severe	Moderate
Plankton	Accidental Release of Fuel	Change in physical condition	Rare	Moderate	Low
Invertebrates	Accidental Release of Fuel	Change in fauna behaviour	Rare	Moderate	Low
		Change in physical condition	Rare	Moderate	Low
	Introduction Of Marine Pest Species	Change in ecosystem dynamics	Rare	Severe	Moderate
Fish	Accidental Release of Fuel	Change in fauna behaviour	Rare	Moderate	Low
		Change in physical condition	Rare	Moderate	Low
	Accidental Release of Materials or Waste Overboard	Change in physical condition	Rare	Minor	Low
	Collisions With Marine Fauna	Change in physical condition	Rare	Moderate	Low
Birds	Accidental Release of Fuel	Change in fauna behaviour	Rare	Moderate	Low
		Change in physical condition	Rare	Moderate	Low
	Accidental Release of Materials or Waste Overboard	Change in physical condition	Rare	Minor	Low
Marine Reptiles	Accidental Release of Fuel	Change in physical condition	Rare	Moderate	Low
	Accidental Release of Materials or Waste Overboard	Change in physical condition	Rare	Minor	Low
	Collisions With Marine Fauna	Change in physical condition	Rare	Moderate	Low
Marine Reptiles	Accidental Release of Fuel	Change in fauna behaviour	Rare	Moderate	Low
	Collisions With Marine Fauna	Change in physical condition	Rare	Moderate	Low
Marine Mammals	Accidental Release of Fuel	Change in fauna behaviour	Rare	Moderate	Low
		Change in physical condition	Rare	Moderate	Low

Environment Component	Environmental Aspect	Environmental Risk	Probability	Consequence	Preliminary Outcome
	Accidental Release of Materials or Waste Overboard	Change in physical condition	Rare	Minor	Low
	Collisions With Marine Fauna	Change in physical condition	Rare	Major	Moderate
Coastal Habitats and Communities	Accidental Release of Fuel	Change in ecosystem dynamics	Rare	Moderate	Low
Commercial Fishing	Accidental Release of Fuel	Change to functions, interests, or activities	Rare	Moderate	Low
	Accidental Release of Materials or Waste Overboard	Change to functions, interests, or activities	Rare	Minor	Low
	Introduction Of Marine Pest Species	Change to functions, interests, or activities	Rare	Severe	Moderate
Shipping Activity	Accidental Release of Fuel	Change to functions, interests, or activities	Rare	Moderate	Low
Traditional Owners	Accidental Release of Fuel	Change to functions, interests, or activities	Rare	Moderate	Low
		Change in aesthetic value	Rare	Moderate	Low
	Accidental Release of Materials or Waste Overboard	Change to functions, interests, or activities	Rare	Minor	Low
Coastal Development	Accidental Release of Fuel	Change to functions, interests, or activities	Rare	Moderate	Low
	Accidental Release of Materials or Waste Overboard	Change to functions, interests, or activities	Rare	Moderate	Low
Marine Protected Areas	Accidental Release of Fuel	Change in aesthetic value	Rare	Moderate	Low
	Accidental Release of Materials Or Waste Overboard	Change in aesthetic value	Rare	Minor	Low

Mitigation and Management

This PEIRA considers the residual environmental impacts and risks that occur with the application of legislative requirements as a minimum. Further, industry standards will be applied during the design of the activity, many of which aim to avoid or minimise environmental impacts and risks. Mitigation measures are adopted within the design and implementation of the activity to further reduce environmental impacts and risks. They are typically specific to the environmental setting of the activity may be informed through consultation and may not be defined until the final details of the activity are known.

Mitigation Measures

In determining the mitigation measures included at any stage of the activity, a hierarchy of controls system will be implemented. This is a widely accepted system to classify mitigation measures and promote adoption of the most effective mitigation measures first. The hierarchy, in order of decreasing effectiveness is:

- Elimination/avoidance
- Substitution
- Engineering
- Administrative/ procedural
- Offsetting

In an environmental context, procedural mitigation measures can include further studies which improve the accuracy of predicted impacts and risks, validate assumptions, establish baselines, monitor impacts, or reduce scientific uncertainty.

Management Plans

In the context of this PEIRA, management plans refer to the strategies, procedures, and measures that are put in place to minimise the environmental impacts and risks associated with the activity. They outline how the impacts or risks will be monitored, managed, and mitigated over the course of the activity. Management plans may include measures such as mitigation measures, monitoring programs, emergency response plans, and contingency plans. They aim to ensure that the proposed activity is carried out in an environmentally responsible and sustainable manner. The following management plans are either mandatory or should be considered by CGG based on this PEIRA:

- Oil Pollution Emergency Plan (mandatory)
- Operational & Scientific Monitoring Program (mandatory)
- Marine Mammal Adaptive Management Plan
- On-water Interactions Management Plan

Conclusion and Recommendations

The following identified environmental impacts and risks will be carried through to the full assessment stage and will be refined based on further assessment and consultation.

Environmental Aspect	Environmental Impact	Preliminary Outcome
Artificial Light	Change in ambient light	Qualitative assessment
	Change in fauna behaviour	Qualitative assessment
Underwater Sound	Change in ambient sound	Qualitative assessment
	Change in fauna behaviour	Qualitative assessment
	Change in hearing capacity	Quantitative assessment
	Change in physical condition	Quantitative assessment
Physical Presence	Change in functions, interests, or activities	Quantitative assessment

Environmental Aspect	Environmental Risk	Preliminary Outcome
Accidental Release of Fuel	Change in water quality	Low
	Change in sediment quality	Low
	Change in ecosystem dynamics	Low
	Change in physical condition	Low
	Change in fauna behaviour	Low
	Change to functions, interests, or activities	Low
	Change in aesthetic value	Low
Introduction Of Marine Pest Species	Change in ecosystem dynamics	Moderate
	Change to functions, interests, or activities	Moderate
Accidental Release of Materials or Waste Overboard	Change in physical condition	Low
	Change to functions, interests, or activities	Low
	Change in aesthetic value	Low
Collisions With Marine Fauna	Change in physical condition	Moderate

The following recommendations are made for CGG to consider:

1. Commission independent underwater sound modelling to understand the effect thresholds and distances for specific receptors within the Environment Planning Area.
2. Split the full assessment of underwater sound into two components for impulsive and continuous sound sources.
3. Review the NERA Reference Case 2018:1003 Consequence analysis of an accidental release of diesel and regionally relevant spill models from similar worst-case events to determine the applicability of the NERA Reference Case and, subsequently, the need for activity specific spill modelling.

This PIERA has not identified any management plans required to be implemented at this stage of the assessment, noting that many environmental impacts and risks have been carried through for full assessment, which is more likely to result in management plan requirements.

References

ACAP. 2018. Agreement on the Conservation of Albatrosses and Petrels. Amended by the Sixth Session of the Meeting of the Parties. Skukuza, South Africa, 7- 11 May 2018.
Carroll AG, Przeslawski R, Duncan A, Gunning M and Bruce B. 2017. A critical review of the potential impacts of marine seismic surveys on fish & invertebrates. Marine Pollution Bulletin 114: pp9-24.

AS/NZS ISO 31000:2018: Risk Management – Principles and Guidelines.

Australian Wildlife. 2014. Little Penguins. https://australianwildlife.com.au/little-penguins/

CoA. 2020. National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds. Commonwealth of Australia.

DAWE. 2013. EPBC Act Policy Statement 1.1 – Significant Impact Guidelines – Matters of National Environmental Significance. Department of the Environment, Water, Heritage and the Art.

Day R, Fitzgibbon Q, McCauley R, Hartmann K and Semmens J. 2020. Lobsters with pre-existing damage to their mechanosensory statocyst organs do not incur further damage from exposure to seismic air gun signals. Environmental Pollution. 267. DOI: 10.1016/j.envpol.2020.115478.

DEWHA. 2007. South-west Marine Bioregional Plan Bioregional Profile – A Description of the Ecosystems, Conservation Values and Uses of the South-west Marine Region. Department of the Environment, Water, Heritage and the Arts.

DoEE. 2018. Threat Abatement Plan for the Impacts of Marine Debris on the Vertebrate Wildlife of Australia Coasts and Oceans. Department of Environment and Energy. Commonwealth of Australia.

McCauley RD. 1994. 'Seismic Survey.' In: Environmental Implications of Offshore Oil and Gas Developments in Australia – the Findings of an Independent Scientific Review. Eds., Swan JM, Neff JM, Young PC. Australian Petroleum Exploration Association. Sydney.

McCauley RD, Fewtrell J, Duncan AJ, Jenner C, Jenner MN, Penrose JD, Prince RIT, Adhitya A, Murdoch J, McCabe K. 2000. Marine seismic surveys: Analysis and propagation of airgun signals; and effects of air-gun exposure on humpback whales, sea turtles, fishes and squid. Report Number R99-15. Prepared for Australian Petroleum Production Exploration Association by Centre for Maine Science and Technology, Western Australia. 198 p.

Nelms SE, Piniak WE, Weir CR, Godley BJ. 2016. Seismic surveys and marine turtles: An underestimated global threat? Biological Conservation 193: pp49–65.

NERA. 2018. Reference Case 2018:1003 Consequence analysis of an accidental release of diesel. National Energy Resources Australia.

OSPAR. 2014. Establishment of a list of Predicted No Effect Concentrations (PNECs) for naturally occurring substances in produced water. OSPAR Commission. OSPAR Agreement: 2014-05.

Parry GD, Heislers S, Werner GF and Asplin Gason A. 2002. Assessment of Environmental Effects of Seismic Testing on Scallop Fisheries in Bass Strait. Marine and Freshwater Resources Institute Report No. 50. Marine and Freshwater Institute, Queenscliff, Victoria.

Pichegru L, Nyengera R, McInnes AM et al. 2017. Avoidance of seismic survey activities by penguins. Sci Rep 7, 16305 (2017). https://doi.org/10.1038/s41598-017-16569-x.

Pidcock S, Burton C and Lunney M. 2003. The Potential Sensitivity of Marine Mammals to Mining and Exploration in the Great Australian Bight Marine Park Marine Mammal Protection Zone. An independent review and risk assessment report to Environment Australia. Report to Environment Australia.

Popper AN, Hawkins AD, Fay RR, Mann DA., Bartol S, Carlson TJ, Coombs S, Ellison WT, Gentry RL. 2014. Sound Exposure Guidelines for Fishes and Sea Turtles: A Technical Report prepared by ANSI- Accredited Standards Committee S3/SC1 and registered with ANSI. SpringerBriefs in Oceanography, Volume ASA S3/SC1.4 TR-2014. ASA Press.

Przeslawski R, Bruce B, Carroll A, Anderson J, Bradford R, Brock M, Durrant A, Edmunds M, Foster S, Huang Z., Hurt L, Lansdell M, Lee K, Lees C, Nichols P and Williams S. 2016a. Marine Seismic Survey Impacts on Fish and Invertebrates: Final Report for the Gippsland Marine Environmental Monitoring Project. Geoscience Australia, Canberra.

Przeslawski R, Hurt L, Forrest A and Carroll A. 2016b. Potential short-term impacts of marine seismic surveys on scallops in the Gippsland Basin. FRDC Project No 2014/041. Geoscience Australia. Canberra.

SCAR. 2002. SCAR Report 21 - 2002 January - SCAR Working Group on Geodesy and Geographic Information. Report of the Third SCAR Antarctic Geodesy Symposium, St Petersburg, Russia, 18-20 July 2001.

Shell. 2009. Prelude Floating LNG Project Draft Environmental Impact Statement. EPBC 2008/4146.

UNEP. 1999. Environmental Quality Standards Regulations, 1999. United Nations Environment Program.