SGH | Energy

LONGTOM ENVIRONMENT PLAN

AUGUST 2019 5 YEAR REVISION

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ACRONYMS

AFMA	Australian Fisheries Management Authority (Cmlth)
AHTS	Anchor Handling, Tug, and Supply (vessel)
AMOSC	Australian Maritime Oil Spill Centre
AMSA	Australian Maritime Safety Authority
APASA	Asia-Pacific Applied Science Associates
API	American Petroleum Institute
APPEA	Australian Petroleum Production & Exploration Association
AQIS	Australian Quarantine Inspection Service
AS/NZS	Australian Standards/New Zealand Standards
ASX	Australian Stock Exchange
BOD	Biological Oxygen Demand
BVI	Blade-Vortex Interaction
CAMBA	China/Australia Migratory Birds Agreement 1986
CAR	Corrective Action Request
CHARM	Chemical Hazard Assessment and Risk Management
CITES	Convention on International Trade in Endangered Species of Wildlife and Flora
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DAFF	Department of Agriculture, Fisheries and Forestry (now Department of Agriculture)
DNV	Det Norske Veritas
DSDBI (now DJPR)	Department of State Development, Business and Innovation. *Note:* Previously the Department of Primary Industries (DPI)
DJPR (formerly DEDJTR, DSDBI)	Department of Jobs, Precincts and Regions (formerly Department of Economic Development, Jobs, Transport and Resources (and previously the Department of State Development, Business and Innovation (DSDBI)
DELWP	Department of Environment, Land, Water and Planning (note; previously the Department of Environment and Primary Industries
DEPI	Department of Environment and Primary Industries. *Note:* Previously the Department of Sustainability and Environment (DSE)
DoEE	Department of the Environment and Energy (formerly the Department of the Environment and SeWPAC)
DOI	Department of Industry
DRET	Department of Resources, Energy and Tourism (dissolved Sept. 2013 with the majority of its functions assumed by the Department of Industry (except for tourism which was assumed by the Department of Foreign Affairs and Trade
EMBA	Environment that may be affected

EP	Environment Plan
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cmlth)
ERA	Environmental Risk Assessment
ERP	Emergency Response Plan
ESD	Environmentally Sustainable Development
FFG Act	Flora and Fauna Guarantee Act, 1988, Vic.
GDA	Geocentric Datum of Australia
GHG	Greenhouse Gas
HIS	High-Speed Impulsive
HQ	Hazard Quotient
IMO	International Maritime Organisation
IMS	Incident Management System
ISO	International Standards Organisation
JAMBA	Japan/Australia Migratory Birds Agreement 1974
LC	Lethal Concentration
MCMPR	Ministerial Council on Minerals and Petroleum Resources
MDO	Marine diesel oil
MGA	Map Grid of Australia
MSDS	Material Safety Data Sheet
MODU	Mobile Offshore Drilling Unit
NCEP	National Centres for Environmental Predictions
NCR	Non-Compliance Report
NEBA	Net Environmental Benefit Analysis (SGH)
NEPM	National Environment Pollution Measure
NES	National Environmental Significance
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority (Cmlth)
NOPTA	National Offshore Petroleum Titles Administrator
OCNS	Offshore Chemical Notification Scheme
OIW	Oil-in-Water
OPEP	Oil Pollution Emergency Plan
OPGGS	Offshore Petroleum and Greenhouse Gas Storage (Act and Regulations)
OSCP	Oil Spill Contingency Plan (see OPEP)
OSPAR	Oslo-Paris Convention
PMS	Planned Maintenance System
PLONOR	Pose Little or No Risk
RCC	Rescue Coordination Centre
ROV	Remote Operated Vehicle
SEWPaC	Department of Sustainability, Environment, Water, Population and Communities (Cmlth) – now the Department of Environment and Energy

SFT	Surface Flow Tree
SOPEP	Shipboard Oil Pollution Emergency Plan
SSSV	Sub-Surface Safety Valve
SST	Sub-Sea Tree
STP	Sewage Treatment Plant
TD	Total Depth
TVDRT	True Vertical DepthBelow Rotary Table
VSC	Vessel Safety Case
VSP	Vertical Seismic Profile
WBM	Water-based mud
WOMP	Well Operations Management Plan
ZPI	Zone of potential impact (see EMBA)

UNITS OF MEASUREMENT

‘	Foot (30 cm)
“	Inch (2.54 cm)
bbl	Barrel (159 litres)
Bcf	Billion cubic feet
°C	Degrees centigrade
°F	Degrees Fahrenheit
cP	Centipoise
dB	Decibels
dB(A)	Decibels A-weighting
hp	Horse power
Hz	Hertz
kl	Kilolitre (1,000 litres)
km	Kilometre (1,000 metres)
km2	Square kilometres
kW	Kilowatt
L	Litre (1,000 ml)
m	Metre (100 cm)
ML	Megalitre (1 million litres)
m^2	Square metre
m^3	Cubic metre
mcf	Million cubic feet
mg/L	Milligrams per litre
ml	Millilitre
mm	Millimetre

MM	Million
MMboe	Million barrels of oil equivalent
nm	Nautical mile (1.856 km)
PJ	Petajoule
ppg	Pounds per gallon
ppm	Parts per million
t	Tonne (1,000 kg)
μm	Micrometre (micron)
V	Volt

1 Introduction

1.1 Background

SGH Energy VICP54 Pty Ltd (SGH Energy or SGHE and previously Nexus) has been producing gas and condensate from the Longtom gas field, in production licence VIC/L29, since October 2009. The Longtom gas field is located approximately 31 km off Victoria's eastern coast in Bass Strait.

This Operations Environment Plan (EP) was prepared in accordance with the requirements of the *Offshore Petroleum and Greenhouse Gas Storage Act 2006* (OPGGS Act) and associated OPGGS (E) Regulations, and with reference to the *Environment Plan Content Requirements Guidance Note* produced by NOPSEMA.

This Operations EP is a description of environmental management for operation of the offshore facilities and the intervention and maintenance activities associated with the Longtom Gas facilities, including. the tie-in of a third subsea well, Longtom-5, into the Longtom pipeline.

It was last accepted by NOPSEMA on the 11th August 2014 and this revision has been prepared for its 5 year revision.

1.2 Longtom Outline

The Longtom gas field was discovered in June 1995 and lies approximately 30km offshore of Orbost in East Gippsland, Victoria (Figure 1.1).

The Longtom subsea facilities commenced production in October 2009 and are shown schematically in Figure 1.2. The subsea facilities consist of the following:

- Two existing subsea wells and production trees in water depths of approximately 51 to 57 m and plans for the tie in of one future well.

  Production can take place from subsea wells, Longtom-3 and Longtom-4. A third subsea well, Longtom-5, is proposed to be drilled within 150 m of the Longtom-3 well (subject to a separate Drilling EP) and will tie-in to the existing offshore facilities. The tie-in, operation, intervention and maintenance of this third well will be undertaken as per the requirements set out in this EP.
- A 17 km 300mm nominal diameter pipeline originating at the Longtom-3 well and connecting into the offshore end of the Patricia Baleen (PB) pipeline, in pipeline licence VIC/PL38.
- A subsea umbilical extension connected to the existing Patricia Baleen umbilical line that provides electrical, hydraulic and chemical services to the Longtom facilities.

Longtom production flows to shore via the Patricia Baleen offshore gas pipeline, and then to the Orbost gas plant. The PB pipeline is owned and operated by Cooper Energy. The Orbost gas plant is owned and operated by APA.

The Patricia Baleen gas field, pipeline and gas plant are the responsibility of Cooper and APA, as described above and are outside the scope of this EP.

In May 2015 production was suspended from the Longtom field due to an electrical fault which led to the loss of communications. The Patricia Baleen offshore gas pipeline was later shut down and operations at the Patricia Baleen gas plant suspended. It is currently unknown when the electrical fault can be rectified to allow production to be reinstated from the Longtom-3 and Longtom-4 wells. Intervention and maintenance campaigns will continue to be carried out and this EP will remain in force to cover these activities and the Longtom production operations on recommencement.

1.3 Longtom Operator

SGHE-VICP54 Pty Ltd is the licence holder of production license (VIC/L29) and pipeline licence (VIC/PL38). SGHE is the nominated environmental operator of the Longtom pipeline facility and this includes the associated wells and piping.

SGHE is part of Seven Group Holdings (SGH), an Australian diversified operating and investment group with investments in media, oil and gas and industrial services. SGHE acquired Nexus Energy in December 2014 which incorporated the following oil and gas assets:

- Production:
  - VIC/L29 (100% interest) – Longtom gas production.
- Development:
  - AC/L9 (15% interest) – Crux field development.
- Exploration and appraisal:
  - WA-377-P (100% interest) – Echuca Shoals field.

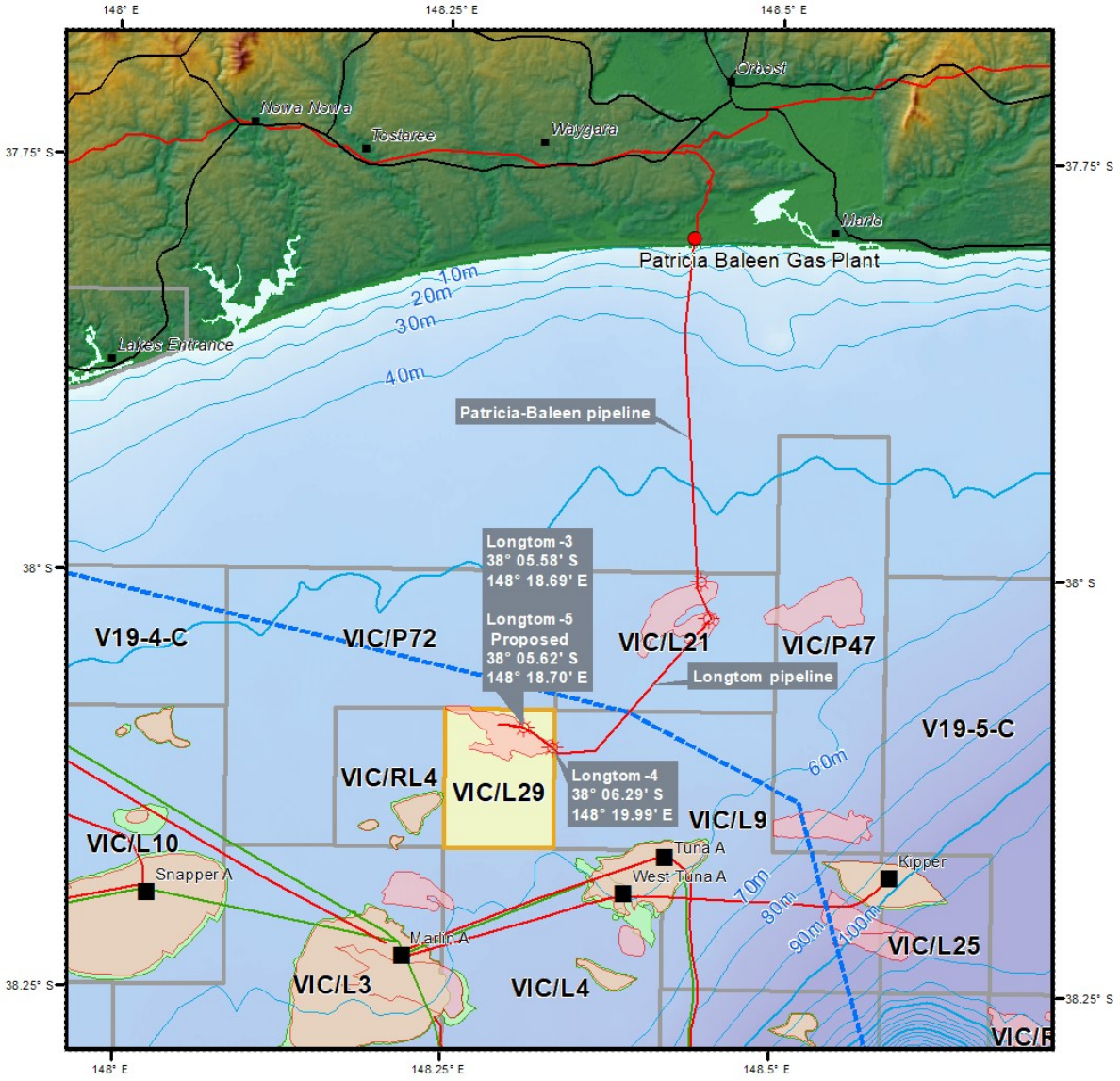

Figure 1-1 Project location

The SGHE office is located in Melbourne at:

160 Harbour Esplanade
Docklands
VIC 3008 Australia

The environmental contact for the project is:

Rob Tyler
HSEC Adviser
Tel: (03) 8628 7277
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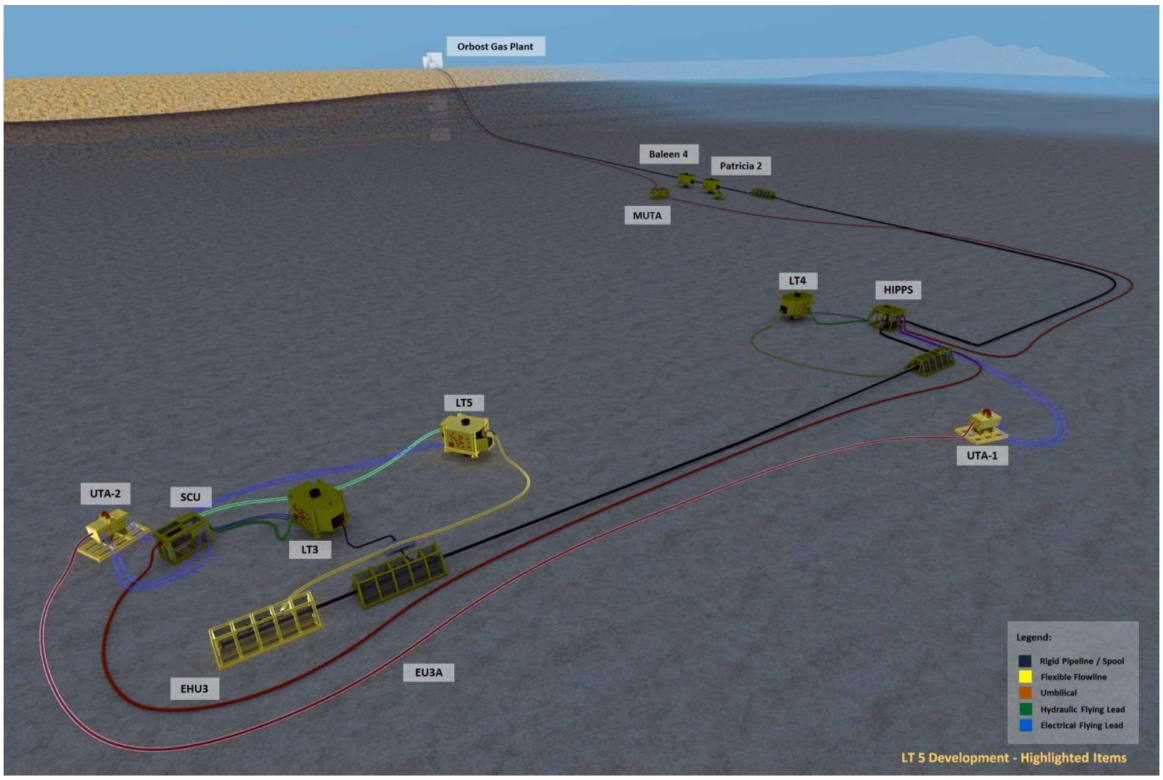


Figure 1-2 Longtom Gas Project – schematic

1.4 Purpose of the Environment Plan

This EP has been prepared by SGHE in accordance with the OPGGS (E) Regulations (under the OPGGS Act), and more specifically with regard to Regulation 9 for submission to, and acceptance from, NOPSEMA.

This EP covers:

- Description of the activity.
- Stakeholder consultation.
- Description of the environment.
- Description of environmental impacts and risks.
- Environmental performance objectives, standards and measurement criteria.
- Implementation strategy.
- Reporting arrangements.

The environmental assessment contained within the EP aims to systematically identify and assess the potential environmental impacts associated with the project and presents measures to avoid, mitigate and manage known and potential adverse impacts to the environment, in particular the marine environment.

1.4.1 Scope of the Environment Plan

In accordance with Regulation 4(1) of the OPGGS (E) Regulations, an EP is required for all 'petroleum activities'. This EP covers the following 'petroleum activities' related to the Longtom Gas Project:

1. Operation and production of hydrocarbons from subsea wells (Longtom-3, Longtom-4 and future Longtom-5) in VIC/L29.
2. Intervention and maintenance activities related to these wells and the Longtom pipeline (in pipeline licence VIC/PL38).
3. Tie-in of the Longtom-5 well into the Longtom pipeline.

Operational activities include choke changes to manage production rates and the testing of subsea valves. Operational activities will occur throughout the life of this EP.

Intervention and maintenance activities may include, but are not limited to, ROV and/or diving campaigns to:

- Inspect the subsea facilities.
- Conduct testing of the subsea equipment.
- Replace communication, hydraulic or electrical cables and other subsea equipment.
- Stabilise the subsea facilities with sand bags/concrete mattresses.
- Install a temporary pig launcher.

Intervention and maintenance activities are expected to take place approximately once every 1-3 years and will generally only last about a week. The exact requirements are dependent on equipment availability and the duration may be extended due to adverse weather conditions and other operational requirements.

Tie-in of Longtom-5 activities include; the tie-in of the flying leads (communication, hydraulic and electrical), installation of production spools and the testing of the new Longtom 5 facilities. The timing of the tie-in is unknown but the duration of tie-in activities are expected to only be in the order of several weeks.

This EP does not cover decommissioning activities and does not include the Patricia Baleen assets.

1.5 Legislative Requirements

This section describes the regulatory requirements that apply to the project and are relevant to the project's environmental management. As the project is located in Commonwealth waters, only applicable Commonwealth legislation is discussed. Table 1-1 presents a summary of Commonwealth legislation (including any international conventions enacted) potentially relevant to the project.

1.5.1 Offshore Petroleum and Greenhouse Gas Storage Act 2006

The OPGGS Act provides the regulatory framework for all offshore oil and gas exploration and production in Commonwealth waters (those areas more than three nautical miles from the Territorial sea baseline and extending seaward to the outer limits of the continental shelf).

The OPGGS (E) Regulations have been made under the OPGGS Act. The objective of these Regulations is to ensure that any petroleum activity carried out in an offshore area is consistent with the principals of ecologically sustainable development and has appropriate environmental performance objectives, standards, measurement criteria and an implementation strategy, such that the environmental impacts and risks of the activity are reduced to as low as reasonably practicable..

As of 1 January 2012, NOPSEMA took over the responsibility for administration of offshore environmental regulation from all the State and Territory-based designated authorities.

1.5.2 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) protects nationally and internationally important flora, fauna, ecological communities and heritage places, defined in the EPBC Act as matters of National Environmental Significance (Protected Matters) (NES). Under the EPBC Act, all activities that are likely to have a significant impact on a matter of NES require Commonwealth assessment and approval.

The relevant matters of NES are:

1. Listed threatened species and communities.
2. Listed migratory species.
3. Ramsar wetlands of international importance.
4. Commonwealth marine environment.

5. World heritage properties.
6. National heritage places.
7. Marine environment (and the Great Barrier Reef Marine Park).
8. Nuclear actions.

Given the relatively small temporal and spatial scale of the project, and that no impacts on matters of NES were predicted, the project was referred to the then Commonwealth Department of Environment and Heritage (DEH) under the EPBC Act, on 26 September 2006, and was deemed a non-controlled action on 23 October 2006 (EPBC Ref: 2006/3072) (Attachment 2).

Nexus also submitted an EPBC Referral for the Longtom-5 drilling campaign (including details of the proposed flowline tie-in to the existing Longtom pipeline) to the then Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) on 6 August 2012 (EPBC Ref 2012/6498). The referral was deemed 'Not a controlled action if undertaken in a particular manner' on 6 September 2012 (Attachment 2).

1.5.3 Australian Ballast Water Management Requirements (DAWR, 2017)

The Australian Ballast Water Management Requirements set out the obligations on vessel operators with regards to the management of ballast water and ballast tank sediment when operating within Australian seas.

Its application to the Longtom activity is that it provides requirements on how vessel operators should manage ballast water when operating within Australian seas to comply with the Biosecurity Act and helps address IMS risk – see section 6.3.12.

1.5.4 Environment Guidelines and Codes of Practice

1.5.4.1 Government Guidelines

This EP was initially developed in accordance with NOPSEMA's Guidance Note on 'Environment plan content requirements' (N4700-GN1074, NOPSEMA, January 2013). This guidance note interprets the EP requirements that need to be met and demonstrated under the OPGGS (E) Regulations. Other, more recently issued NOPSEMA Guidelines, Guidance Notes and Information Papers, were reviewed as relevant for the 2019, 5 yearly update of this EP (e.g. GN1344, Environment plan content requirements, Rev 4, April 2019).

1.5.4.2 Industry Code of Practice

In Australia, the petroleum exploration and production industry operates within an industry code of practice developed by the Australian Petroleum Production and Exploration Association (APPEA); the APPEA Code of Environmental Practice (2008). This code provides guidelines for activities that are not formally regulated and have evolved from the

collective knowledge and experience of the oil and gas industry, both nationally and internationally.

The APPEA Code of Practice covers general environmental objectives for the industry, including planning and design, assessment of environmental risks, emergency response planning, training and inductions, auditing and consultation and communication. For the offshore sector specifically, it covers issues relating to geophysical surveys, drilling and development and production.

SGHE adheres to the APPEA Code of Environmental Practice when undertaking petroleum exploration and production activities.

1.5.5 Associated Regulatory Approvals

In association with this EP, the following documents have been, or will be, submitted to regulatory agencies for approval:

- Oil Pollution Emergency Plan (OPEP): Issued to NOPSEMA for acceptance in conjunction with this EP, and to AMSA, AMOSC and the Victorian Department of Transport (DoT) for information.
- Longtom Pipeline Safety Case accepted by NOPSEMA.
- Well Operations Management Plan (WOMP): accepted by NOPSEMA.

1.6 Environmental Policy Statement

SGHE publicly recognises its obligation to the community to take all practicable steps to ensure that its operations and activities are conducted in an efficient and environmentally responsible manner. In achieving this, the project will be managed to comply with SGHE' Health, Safety, Environment and Community Policy.

Table 1-1 Key Commonwealth legislation relevant to the project

Legislation	Coverage	International Convention Enacted	Administering Authority
Offshore Petroleum and Greenhouse Gas Storage Act 2006 and Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009	The OPGGS Act addresses all licensing, health, safety, environmental and royalty issues for offshore petroleum exploration and development operations extending beyond the 3 nautical mile limit. Ensures that petroleum activities are undertaken in an ecologically sustainable manner and in accordance with an EP. Note this EP was originally submitted in December 2013 under the then applicable Environment Regulations and updated in 2019 for relevant amendments.	• Not applicable.	NOPSEMA
Environment Protection and Biodiversity Conservation Act 1999	Protects matters of NES, provides for Commonwealth environmental assessment and approval processes and provides an integrated system for biodiversity conservation and management of protected areas.	• Convention on Biological Diversity and Agenda 21, 1992. • Convention on International Trade in Endangered Species of Wildlife and Flora, 1973 (CITES). • Japan/Australia Migratory Birds Agreement, 1974 (JAMBA). • China/Australia Migratory Birds Agreement 1986 (CAMBA). • Republic of Korea/Australia Migratory Birds Agreement, 2006 (ROKAMBA). • Convention on Wetlands of International Importance especially Waterfowl Habitat, 1971 (Ramsar Convention). • International Convention for the Regulation of Whaling, 1946. • Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention), 1979.	DoEE

Table 1-1 Key Commonwealth legislation relevant to the project (cont'd.)

Legislation	Coverage	International Convention Enacted	Administering Authority
Environment Protection (Sea Dumping) Act 1981	Aims to prevent the deliberate disposal of wastes (loading, dumping, and incineration) at sea from vessels, aircraft, and platforms.	• Convention on the Prevention of Marine Pollution by Dumping of Waste and Other Matter, 1972 (London Convention).	DoEE
Australian Maritime Safety Authority Act 1990	Sets out the functions of the Australian Maritime Safety Authority (AMSA), with responsibilities for maritime safety, search and rescue, and ship sourced pollution prevention functions.	• International Convention on Oil Pollution (Preparedness, Response and Cooperation), 1990 (OPRC).	AMSA
Historic Shipwrecks Act 1976	Protects the heritage values of shipwrecks and relics (older than 75 years) below the low water mark.	• Convention on Conservation of Nature in the South Pacific (APIA Convention), 1976. • Australia and Netherlands Agreement Concerning Old Dutch Shipwrecks, 1972. • Convention on the Protection of Underwater Cultural Heritage, 2001.	DoEE
Hazardous Waste (Regulation of Exports and Imports) Act 1989	Regulates the import and export of hazardous waste material.	• Basel Convention on the Control of Transboundary Movements of Hazardous Waste and their Disposal, 1992.	DoEE
Ozone Protection and Synthetic Greenhouse Gas Management Act 1989	Regulates the manufacture, import and export of ozone depleting substances.	• Montreal Protocol on Substances that Deplete the Ozone Layer, 1987. • UN Framework Convention on Climate Change, 1992.	DoEE
Navigation Act 2012	Regulates ship-related activities (safety of life at sea, safe navigation) and invokes certain requirements of the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78) relating to equipment and construction of ships and prevention of pollution to the marine environment.	• Certain sections of the MARPOL Convention (MARPOL 73/78).	AMSA
Protection of the Sea (Prevention of Pollution from Ships) Act 1983	Regulates ship-related operational activities and invokes certain requirements of the MARPOL convention relating to discharge of noxious liquid substances, sewage, garbage, air pollution etc.	• Certain sections of the MARPOL Convention (MARPOL 73/78).	AMSA

Table 1-1 Key Commonwealth legislation relevant to the project (cont'd.)

Legislation	Coverage	International Convention Enacted	Administering Authority
Australian Ballast Water Management Requirements (DAWR, 2017)	The Australian Ballast Water Management Requirements set out the obligations on vessel operators with regards to the management of ballast water and ballast tank sediment when operating within Australian seas.	• International Convention for the Control and Management of Ships' Ballast Water and Sediments (adopted in principle in 2004 and in force on 8 September 2017)	DAWR
Biosecurity Act 2015	Manages diseases and pests that may cause harm to human, animal or plant health or the environment. Requires Captains of ships to notify the Department of Agriculture and Water Resources, (Agriculture Biosecurity) of any ill travellers (listed human diseases) before the ship docks. Manages biosecurity risks in relation to goods (including those posed by diseases or pests) that are brought into Australian territory and from vessels entering it including ship sanitation. Implements the Ballast Water Convention and regulates the ballast water and sediment of certain vessels, requiring reporting of intended or actual discharges of ballast water in Australian territorial seas.	• International Health Regulations (2005), Geneva • SPS Agreement (Agreement on the Application of Sanitary and Phytosanitary Measures set out in Annex 1A to World Trade Organization Agreement) • Ballast Water Convention (International Convention for the Control and Management of Ships' Ballast Water and Sediments), (2004), London • United Nations Convention on the Law of the Sea (1982), Montenegro Bay • Biodiversity Convention (Convention on Biological Diversity) (1992), Rio de Janeiro	DAWR

1.7 Risk and Impact Summary

SGHE has identified the hazards associated with operation of the Longtom facilities and has assessed their potential impacts and risks – see Section 6 for more detail. The following table summarises the identified hazards and presents their assessed impact or risk. Controls and actions have been identified to reduce these risks to As Low As Reasonably Practical and all the hazards are considered acceptable. Objectives, standards and measurement criteria have been developed to ensure the ongoing effectiveness of these controls and to maintain the level of risk.

Table 1-2 Summary of impacts and risks

#	Hazard	Potential Impact	Potential Risk
Routine Impacts			
1	Discharge of hydraulic fluid	Moderate	
2	Physical presence of offshore facilities – impact on marine fauna and seabed	Low	
3	Physical presence of offshore facilities – impact on other users	Low	
Non Routine Risks			
4	Loss of containment of hydrocarbons – subsea equipment damage		Low
5	Loss of containment of hydraulic fluid, MEG and methanol – subsea equipment damage		Low
Impacts from Vessels/ROV Operations/Longtom-5 tie-in			
6	Vessel collisions with marine fauna	No credible impact	
7	Noise emissions	No credible impact	
8	Light emissions	No credible impact	
9	Atmospheric emissions	No credible impact	
10	Discharge of sewage and grey water	Low	
11	Discharge of putrescible waste	Low	
12	Discharge of contaminated deck/bilge water	Low	
13	Discharge of non-hazardous waste	Low	
14	Discharge of hazardous waste	Low	
15	Discharge of cooling water	No credible impact	
16	Discharge of desalination brine water	No credible impact	
Impacts from Vessels/ROV Operations/Longtom-5 tie-in			
17	Introduction of invasive marine species		Low
18	Vessel diesel spill		Low
19	ROV discharges		Low
20	Discharges during Longtom-5 tie-in		Low

Those hazards identified as “Not Applicable” have been assessed to pose such a low impact or consequence that there is no credible real risk, they have only been included for completeness.

2 Description of the Activity

This chapter describes the project's operational activities and the intervention and maintenance activities proposed in accordance with Regulation 13 (1) of the OPGGS (E) Regulations. The chapter also provides a description of the tie-in activities proposed for Longtom 5.

The chapter describes the following:

- Project location
- History and timing.
- Field characteristics.
- Operational activities.
- Proposed intervention and maintenance activities.
- Activities associated with the tie-in of Longtom 5.
- Design standards.

2.1 Location

The Longtom gas field is located in eastern Bass Strait within production licence VIC/L29, approximately 30 km (16.2 nm) offshore south-southwest of Orbost in Commonwealth waters at approximately 55 m depth (see Figure 1-1). The project area comprises a pipeline corridor 17 km long between the Longtom 3 well and the tie into the Patricia Baleen pipeline. The coordinates of the project area are listed in Table 2-1

Table 2-1 Coordinates for the project area

	Latitude	Longitude
Longtom-3 well	38° 05' 34" S	148° 19' 06" E
Longtom-4 well	38° 06' 18" S	148° 20' 00" E
Proposed Longtom-5 well	38° 05' 37"S	148° 18' 43" E
Patricia Baleen tie-in	38^0 01' 34" S	$148^0$27' 03" E

Projection: GDA 94 Zone 55S

The proposed Longtom-5 well is planned to be drilled within approximately 150 m of Longtom-3.

2.2 Field History and Timing of Activities

The Longtom gas field is located among a prolific oil and gas production province that has supplied oil and gas to Victoria since 1969.

Operational activities commenced with the project's first gas on 23 October 2009 and will continue throughout the life of this EP. Project intervention and maintenance activities are expected to occur for approximately one week every 1-3 years.

The facilities were shutdown for 4 months in 2012-2013 due to an electrical fault. In February 2014 an electrical fault resulted in the shutdown of Longtom-3, and in May 2015 a further electrical fault resulted in shutdown of Longtom-4 and cessation of production.

Plans for recommencement of production are currently being developed.

It is anticipated that the Longtom-5 well will be tied into the Longtom pipeline at some time in the future. Tie-in activities are relatively simple and are likely to only last for a few weeks. The vessel required for tie-in is likely to be similar to a standard offshore vessel required for other intervention and maintenance activities.

2.3 Field Characteristics

A number of wells have been drilled within, and in close proximity to, the Longtom Gas Project, including Longtom-1, Longtom-2, Longtom-3, Longtom-4, Grayling-1A, Sunfish-1 and Sunfish-2. Of these wells, Longtom-3 and Longtom-4 are the only active wells capable of producing gas and small amounts of condensate.

Geologically, the project area is well understood. This includes the reservoir pressures, temperature and composition of the hydrocarbons (Table 2-2). The Longtom wells are sweet gas wells (no H_2S) with small amounts of associated condensate (10 barrels per MMSCF). Condensate is a vapour at reservoir conditions and a liquid at atmospheric conditions, it has the following properties:

- A density of 777.4 kg/m^3 at 25 ºC.
- An API gravity of 51.2.
- A dynamic viscosity of 1.081 cP at 20ºC.
- A pour point of -9 ºC (when fresh).

If released into the environment, this condensate will evaporate quickly and not persist on the water surface. Reviews by APASA indicate that within 24 hours the condensate will have largely evaporated leaving behind waxy flakes posing little environmental impact.

The volumes of persistent and non-persistent components of the condensate are given in

Table 2-3. The Longtom condensate contains 61.5% volatiles, 35.5% semi- to low-volatiles and only 3% of persistent residues.

Table 2-2 Longtom field gas compositions

Component	Mol %				
	Longtom-1	**Longtom-2**	**Longtom-3 ST1**	**Longtom-3H**	**Longtom-4H**
Hydrogen Sulphide	0.00	0.00	0.00	0.00	0.00
Carbon Dioxide	0.73	1.13	0.93	1.30	2.00
Nitrogen	0.97	1.10	0.77	1.28	0.83
Methane	92.48	91.16	92.83	88.62	89.20
Ethane	3.46	3.86	3.49	4.60	4.67
Propane	1.16	1.37	1.10	1.74	1.70
Iso-Butane	0.18	0.25	0.19	0.40	0.32
n-Butane	0.23	0.32	0.22	0.48	0.38
iso-Pentane	0.07	0.10	0.06	0.17	0.13
n-Pentane	0.07	0.09	0.05	0.15	0.10
Hexanes	0.15	0.11	0.08	0.25	0.14
Heptanes	0.24	0.15	0.14	0.34	0.21
Octanes	0.11	0.15	0.05	0.14	0.08
Nonanes	0.09	0.06	0.04	0.11	0.06
Decanes	0.05	0.04	0.01	0.11	0.04
Undecanes	0.01	0.03	0.01	0.10	0.02
Dodecanes plus	0.00	0.08	0.03	0.21	0.12
Totals	100.00	100.00	100.00	100.00	100.00
Gravity	0.622	0.635	0.614	0.676	0.657

Table 2-3 Physical characteristics and boiling ranges of the Longtom condensate

Characteristic	**Volatiles (%)**	**Semi-volatiles (%)**	**Low Volatility (%)**	**Residual (%)**	**Density at 25°C (kg/m³)**	**Viscosity (cP)**
Boiling point (°C)	**<180**	**180 – 265**	**265 – 380**	**>380**		
Longtom condensate	61.5	14.3	21.2	3	777.4	1.081@20°C

Not persistent Persistent

2.4 Operational Activities

The Longtom gas field consists of subsea wells, that can be produced via a pipeline that connects to the existing Patricia Baleen offshore pipeline and the Patricia Baleen or Orbost Gas Plant. The development comprises:

- Three subsea wells and production trees in water depths of approximately 51 to 57 m.

Hydrocarbons can be produced from Longtom-3 and Longtom-4 with facilities available for the future tie-in of Longtom-5 (see Section 2.6). The operational activities described in this section are applicable to all subsea wells.

- A 17 km 300mm nominal diameter pipeline originating at the Longtom-3 well and connecting into the offshore end of the Patricia Baleen pipeline in pipeline licence VIC/PL38.
- A subsea umbilical extension connected to the existing Patricia Baleen umbilical line that provides electrical, hydraulic and chemical services to the Longtom wells and Longtom and pipeline.

Production from the Longtom gas field commenced in 2009. In 2012-2013, the field produced 11.3 PJ of gas and 88,243 bbl of condensate. The facilities were shutdown for 4 months in 2012-2013. In February 2014 an electrical fault resulted in the shutdown of Longtom-3, the closed status of the Longtom 3 wellhead valves was confirmed by ROV in March 2014. In May 2015 production from Longtom-4 was also suspended due to another electrical fault. The pipeline has been depressured to about 700 kPa and an ROV campaign in 2017 has confirmed that the wellhead and pipeline valves are all closed.

2.4.1 Description of the Longtom Pipeline

2.4.1.1 Pipeline Overview

The Longtom pipeline extends 17 km from the Longtom-3 well and connects with the offshore end of the Patricia Baleen pipeline via the pipeline end manifold.

Gas from the Longtom wells flows firstly through the Longtom pipeline and then through the Patricia Baleen pipeline before arriving at the Patricia Baleen Gas Plant (see Figure 2-1).

The operation, monitoring and control of the Longtom wells is conducted from the Gas Plant by the use of an umbilical line which runs from the Gas Plant to the Longtom wells. This umbilical provides:

- Hydraulic and electrical power to open and close valves on the Longtom wells.
- Instrumentation to monitor and record flows, pressures, temperatures and valve status.
- Ability to inject hydrate prevention and corrosion inhibition chemicals into the Longtom pipeline.

To protect the Patricia Baleen pipeline, which has a lower design pressure than the shut-in pressure of the Longtom wells, a subsea High-Integrity Pressure Protection System (HIPPS) has been installed. The use of a HIPPS allows the Patricia Baleen pipeline and associated downstream components to be rated to a lower pressure than the Longtom wells' shut-in pressure. The Longtom HIPPS package is located just downstream of the Longtom-4 tie-in assembly. The HIPPS has been the subject of Safety Integrity Level (SIL) determinations and

SIL verification to ensure that it provides a sufficient level of protection. The SIL level was determined to be Level 2. The HIPPS has been designed to API 17D/6A.

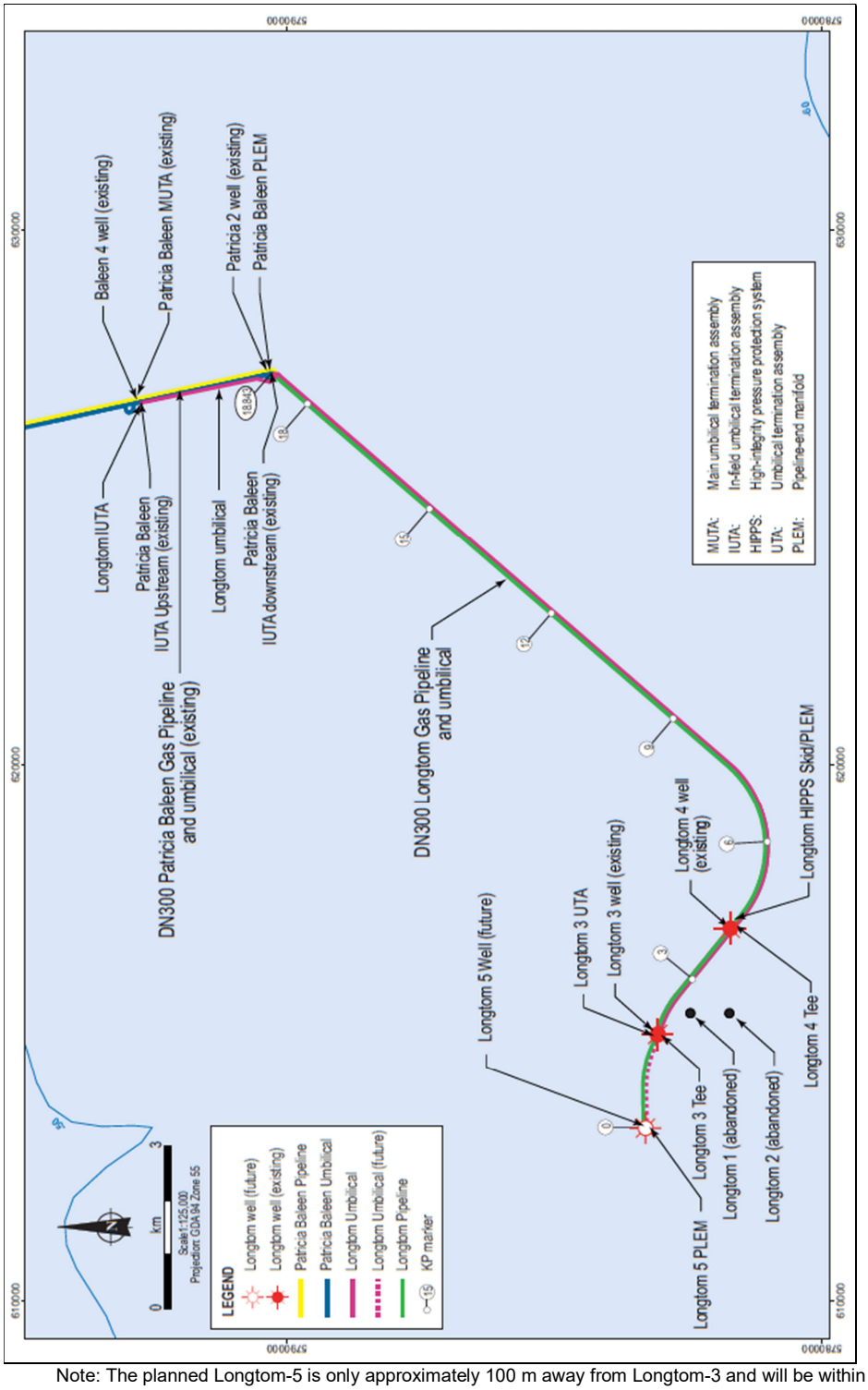
During start-up and operations, methanol and monoethylene glycol (MEG) is pumped from the onshore Chemical Injection System via the umbilical into the subsea wells to prevent the formation of hydrates. Methanol is only required for start-up while MEG is continuously injected during operations.

The operating limits for the pipelines are provided in Table 2-4.

Table 2-4 Longtom / Patricia Baleen Pipelines - anticipated operating range

System	Pressure (MPa(g))
Longtom Pipeline (upstream of the HIPPS)	up to 27.6
Longtom Pipeline (downstream of the HIPPS)	up to 10.0
Patricia Baleen Pipeline	up to 10.0

Operating pressures and temperatures for the pipelines are included in the information provided to Gas Plant operations personnel.



Note: The planned Longtom-5 is only approximately 100 m away from Longtom-3 and will be within the same petroleum safety zone.

Figure 2-1 Location of subsea infrastructure

2.4.1.2 Design Life

The design life for the Longtom pipeline is 25 years. Corrosion inspection of the pipeline in May 2013 and January 2017 indicated that corrosion values are within the design range and that the design life is still applicable.

2.4.1.3 Key Design Parameters

The following metocean parameters were used for the design of the Longtom pipeline (refer also to Table 2-5):

- Mean Sea Temperature: 16.7˚C.
- Still Water level: 61.1m.
- Highest Tide: 0.75m.
- Maximum Single Wave Height: 9.5m.
- Current Strength: 0.4 m/s (@ -54.7m).

Table 2-5 Longtom Pipeline – Key Design Parameters

Parameter	Value
Nominal outside diameter	323.9 mm
Nominal length	17,000 m
Internal corrosion allowance	3 mm
External corrosion allowance	None
External pipeline protection	Coating and sacrificial anodes
Principal design code	AS/NZS 2885.4 (DNV OS F101)
Pressure	27.6 MPag upstream of the HIPPS 10.0 MPag downstream of the HIPPS
Raw gas flow-rate	88.8 MMscfd
Temperature (maximum)	90°C
Temperature (minimum)	-20°C spools -10°C pipeline

2.4.1.4 General Design Considerations

The following design loading conditions for pipeline design, construction and operation were considered during the detailed design of the pipeline, consistent with the Offshore Standard DNV-OS-F101 (Submarine Pipeline Systems) (2000 edition).

- Pipeline size.
- Mechanical design, including pressure containment, collapse, buckling and stability.

- Spanning.
- Fatigue.
- Fracture control.

2.4.1.5 Pipeline Size

A 300 mm nominal diameter (323.9 mm outside diameter) was selected for the Longtom pipeline, which is the same size as the Patricia Baleen pipeline. Spool pieces that connect the wells to the pipeline were sized at 150 mm nominal diameter (168.3 mm outside diameter).

2.4.1.6 Wall Thickness

The wall thicknesses for the pipeline and tie-in spools are provided in Table 2-6.

Table 2-6 Longtom pipeline and spools – wall thicknesses

	Pipeline	LT 3 Rigid Spool	LT 4 Flexible Jumper
Outside Diameter (mm)	323.9	168.3	225.2
Steel Grade	DNV HFW 450 I SUD	DNV OS F101 22Cr IS	Duplex 2205 (Carcass)
Wall Thickness	KP 0.0 – 2.9 14.8mm KP 2.9 – 17.1 13.2mm	10.97mm	Multilayer flexible piping.

2.4.1.7 Stability

The Longtom pipeline is designed to be stable during extreme weather conditions. Stability is achieved using wall thickness and concrete weight coat for the entire pipeline route. Concrete coating has been applied to the offshore pipeline to provide stabilisation without additional requirements for secondary stabilisation including trenching or mattresses. The concrete coating details are shown in Table 2-7.

Table 2-7 Offshore Pipeline Concrete Coating

KP Start	KP Finish	Concrete thickness (mm)	Concrete density (kg/m3)
0.0	2.9	50	2800
2.9	16.4	40	2800
16.4	17.1	50	2800

2.4.1.8 Spanning

Allowable free span lengths have been calculated for three conditions – installation, hydrotest and operations for the entire route of the offshore pipeline.

During the post-lay survey, survey in 2011 and partial survey in early 2014, no pipeline span lengths which exceeded the allowable value were detected. In January 2017 a pipeline survey identified a number of minor spans and these were rectified by the installation of sand / grout bags. The pipeline and any freespans are monitored and if any spans exceeding the allowable are detected during ROV surveys they will be rectified, as and when required by installation of sandbags or similar.

The majority of the pipeline runs parallel to the main currents and the sea floor is relatively flat, hence spanning issues are not considered a significant concern.

2.4.1.9 Tie-in Spools

Longtom-3 is connected to the pipeline through a 150 mm nominal diameter UNS S32205 rigid tie-in spool which is connected to the wellhead and the pipeline using API 1 7D 5000# flanges. The spool is approximately 40 m long.

Longtom-4 is connected to the pipeline through a 150 mm nominal diameter NKT flexible flowline which is connected to the wellhead and the pipeline using ANSI Class 2500 weld neck flanges. The flowline is approximately 56 m long.

Longtom-5 is likely to be connected to the pipeline through a 150mm nominal diameter flowline which is connected to the wellhead and the pipeline. The flowline will be approximately 150m long. Further details on the tie-in of Longtom-5 have been provided in Section 2.6.

2.4.1.10 Accidental Loading

The pipeline protection philosophy is based on a qualitative/quantitative assessment of the frequency of events that could possibly threaten the pipeline, and a quantitative assessment of the consequence of loads from fishing gear and dropped objects.

Protective structures are provided for the HIPPS, tie-in assemblies, PLEMs and all other valves. The protective structures provide protection from the following accidental loads:

- Cable snagging.
- Anchor dragging.
- Trawl-board impact.
- Dropped object.

2.4.1.11 Fatigue

Pipeline fatigue can occur through environmental loads or pressure fluctuations. For the Longtom pipeline, environmental loads can arise from severe storms causing seabed sediments to move resulting in pipeline spans, or damage to the pipeline itself through excessive movement. As noted in Section 2.4.1.7, the pipeline has been designed to be

stable during extreme weather conditions. The need for a survey of the pipeline after severe storms to assess excessive spans will be determined at the time.

Pressure fluctuations experienced by the Longtom pipeline are sufficiently limited that they need not be considered from a fatigue perspective.

2.4.1.12 Fracture Control

Materials meet the fracture toughness requirements of the Offshore Standard DNV-OS-F101 (Submarine Pipeline Systems).

2.4.1.13 Internal Corrosion Management

The Longtom pipeline carries gas containing carbon dioxide in the presence of free water. Although the concentration of carbon dioxide and the gas pressure are both low by comparison with other operating wet gas pipelines, it is necessary to inject corrosion inhibitor into the well stream to maintain the wall thickness required for pressure containment. The corrosion inhibitor is delivered to the Longtom wellheads via the umbilical pre-mixed with the MEG and low dose hydrate inhibitor. The overall operation of the corrosion prevention system is checked by corrosion coupons and corrosion probes located at the onshore section of the Patricia Baleen pipeline in the Gas Plant and by iron counts from samples of pipeline fluids collected at the Gas Plant.

The Longtom pipeline has an internal corrosion allowance of 3 mm. The pipeline inspection in May 2013 indicates that internal corrosion is well within the design parameters.

Pipeline end manifolds (PLEMs) are installed at the offshore ends of both the Longtom and Patricia-Baleen pipelines in order to provide future access for pigging, if required. Each manifold includes a full-bore main valve, bleed valves, other valves and additional equipment, all contained in a protective structure.

More detailed information on internal corrosion management is provided in the Corrosion Management Plan (PB-STO-7000-001).

2.4.1.14 External Corrosion Management

Anti-corrosion Coating

External corrosion protection of the pipeline is provided by a 2.2 mm three-layer polyethylene coating. Protection of the field joints is provided by Canusa MIS 100 heat shrink sleeves.

Tie-in spools, PLEMs and tee assemblies are coated with three layer coating system approved for subsea applications.

Cathodic Protection

The Longtom pipeline system cathodic protection has been designed so that the Longtom pipeline is electrically continuous with the Patricia-Baleen pipeline and the sacrificial galvalum anodes have been designed (quantity, sizing and spacing) with due regard to the current

condition of the Patricia Baleen pipeline anodes and the Patricia Baleen pipeline future current demand. Cathodic protection has been designed in accordance with the Recommended Practice DNV RP B401 (Cathodic Protection Design).

2.4.1.15 Flow Assurance

The Longtom pipeline is operated under a Hydrate Management Plan (Document Number: LT-ENG-RP-005). Hydrate management shall normally be by the continuous injection of MEG from the Gas Plant via the umbilical and into the pipeline at the Longtom wellheads and HIPPS. The MEG will be recovered from the liquid arriving at the Gas Plant for re-use.

Methanol can be injected via a dedicated methanol line in the umbilical to further suppress the formation of hydrates (e.g., during start-up) or to disperse a hydrate should one form.

2.4.1.16 Control Umbilical

An umbilical installed from the end of the existing Patricia Baleen umbilical to the Longtom wells and the HIPPS provides chemicals (corrosion inhibitor, MEG and methanol), hydraulic power, electrical power and control services to the Longtom facilities. The electrical section of the umbilical between Longtom 4 and Longtom 3 was bypassed via the installation of a new electrical / communications cable installed in 2017.

A schematic showing the gas export and umbilical lines is given in Figure 2-2.

A Subsea Control Module (SCM) is installed on the HIPPS skid for the control of the HIPPS and the nearby Longtom-4 wellhead and a Subsea Control Unit (SCU) is installed adjacent to Longtom-3 for the control of the Longtom-3 wellhead. An additional SCM will be installed as part of the Longtom-5 tie-in activities to control Longtom-5.

Operational control of the Longtom facilities is from the Patricia Baleen Gas Plant. Gas plant operations personnel are able to open and close the wellhead valves, operate the Longtom well chokes, the HIPPS valves and inject MEG and potentially methanol into the facilities at various locations to control and manage hydrates.

2.4.2 Commissioning Overview

The pipeline was pressure and function tested in order to ensure its integrity prior to operation. Pressure testing was achieved by filling the facilities with water, pressurising the water and monitoring for any change in pressure over time. This process is referred to as 'hydrotesting'. Similar commissioning activities will be required for Longtom-5 to confirm the integrity of the spools and tie-ins prior to the introduction of hydrocarbons. MEG is expected to be used for this and this will then be produced along with the Longtom-5 gas and processed within the onshore gas plant as such offshore discharges are likely to be minimised.

If water is used it is generally dosed at a controlled rate with four types of chemicals:

- Biocide.
- Oxygen Scavenger.
- Dye.
- Corrosion inhibitor.

These chemicals will be reviewed for environmental acceptability and will be subject to the SGHE chemical selection process. Examples of these are chemicals are provided in section 6.3.15.

Biocide and oxygen scavenger in the linefill and hydrotest water are required to protect the inner wall of the pipeline from oxidation and biological activity during pre-commissioning. The dye is used in the hydrotesting process so that any leaks could be visually detected. Corrosion inhibitor added to the hydrotest water inhibits corrosion.

Commissioning of the umbilical and subsea equipment, including Longtom-5 will be carried out from both the onshore Control Room and from the installation vessel.

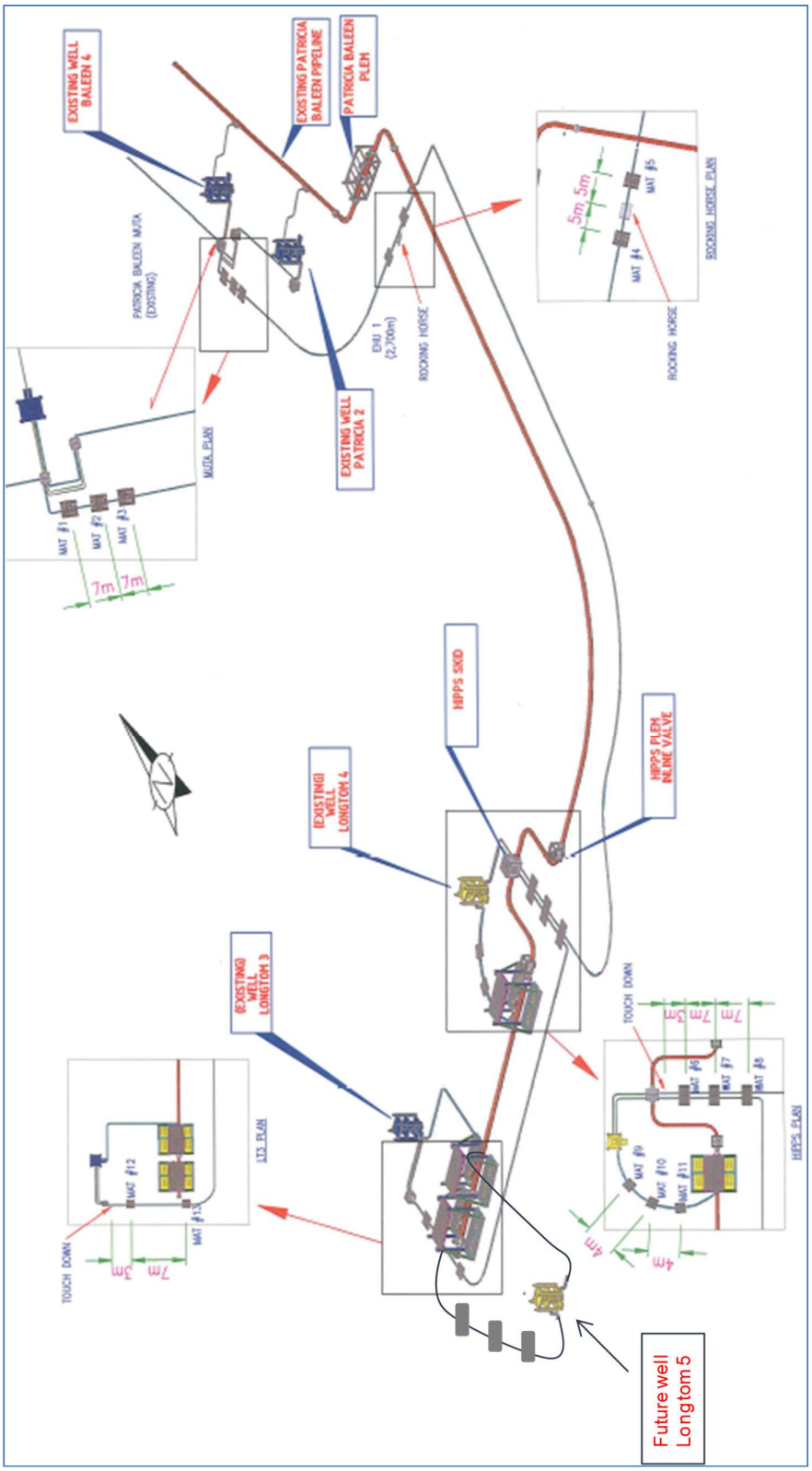


Figure 2-2 Gas export and umbilical lines (schematic)

2.4.3 Operations Overview

Note that the Longtom facilities are currently shut down and an electrical fault in the umbilical prevents operation. The following section describes how the facilities were operated and how they could be operated once the electrical fault is resolved.

Operation of the Longtom facilities has been integrated with the existing Patricia Baleen facilities. The onshore Patricia Baleen facilities (Orbost gas plant) are manned 24 hours a day by rotating operational shifts. The Orbost Gas Plant controls operation of the wells and the pipeline.

All Longtom functions are monitored and controlled from the Orbost Control Room through the existing Master Control System (MCS) using a Subsea Control Module located at each wellhead or on the UTA adjacent to the wellhead.

The subsea control system is an electro-hydraulic system and a Hydraulic Power Unit (HPU) provides the hydraulic power to the subsea controls while the Electrical Power Unit (EPU) supplies power to the umbilical.

Well monitoring functions include wellhead pressure and temperature, flowline pressure and temperature, production choke position and other tree valve positions.

The main operational activity is adjusting the wellhead chokes for the required daily production rate. Other operational activities conducted from the gas plant include the testing of the shutdown systems. The control system has been designed to provide full redundancy so that there is no loss of control or production following the failure of any single component within the control system, including the HPU. The control system has been configured so that in the event of loss of electrical power or signal to the wells, the subsea tree is left in its current state. However, a loss of power to the HIPPS will result in closure of the HIPPS valves and shut-in of production. Production will also be shut-in in the event of loss of hydraulic power as all shutdown systems are designed to be fail closed on loss of hydraulic pressure.

2.5 Potential Maintenance and Intervention Activities

The Longtom offshore facilities are unmanned, and any inspection, intervention and maintenance activities will be conducted on an as needs basis from an offshore vessel.

The facilities were designed to require minimal maintenance and intervention. While normal operations do not require intervention and maintenance activities, a severe storm, fishing impact, failure of subsea equipment or a requirement to pig the pipeline may require the occasional intervention and maintenance activity.

It is anticipated that intervention and maintenance work may be carried out to inspect and make repairs to subsea infrastructure from time to time.

The maintenance and intervention activities that may be required for Longtom facilities include:

- Inspection – e.g. ROV survey and external inspection of equipment status and condition. Internal inspections of the pipeline may also be carried out in the form of intelligent pigging inspections.
- ROV intervention – e.g. physically operating valves, repair / replacement of equipment and span rectification.
- Diver intervention – e.g. repair works.

All intervention and maintenance activities will be risk assessed to ensure that the proposed activity does not pose a greater environmental risk than those assessed and presented within this EP. If it is determined that the activity is of greater environmental risk, then a revised EP will be submitted to NOPSEMA for approval before the activity can commence.

2.5.1 Offshore Vessels

Any offshore maintenance or intervention campaign will require an appropriate offshore support or installation vessel. The size of the vessel will depend on the activity being conducted and may vary from a small vessel out of Lakes Entrance with 10 personnel to conduct a simple visual ROV inspection, to a larger offshore installation vessel potentially with 100+ personnel if a major intervention or diving campaign is required.

Helicopters are not anticipated to be required for operations and maintenance activities. However, a helicopter may be required for medical emergencies and for transfers where vessel-based options are not suitable. Helicopters and fixed wing aircraft may also be utilised in the event of an incident to provide aerial monitoring.

The vessels are considered part of the ‘petroleum activity’, as defined by Regulation 4(1) of the OPGGS (E) Regulations, while they are within the VIC/L29 production licence (the ‘petroleum instrument’) and actively engaged (i.e. with an ROV or diver in the water). The vessels come under the regulatory jurisdiction of AMSA under the *Navigation Act 2012* (Cmlth) at all times.

2.5.2 Use of Remote Operated Vessels

ROVs will be used to conduct visual observations and, where possible and appropriate, to conduct maintenance and intervention activities.

2.5.3 Diving

The inspection, repair or maintenance of the pipeline, wellheads and/or trees may require diving where the work is too complex to undertake via ROV. Diving could include air diving, saturation diving or hard suit diving.

2.5.4 Span Rectification

In addition to maintenance and repair of the Longtom facilities, pipeline span anomalies could potentially occur requiring remediation. Spans can be rectified by the use of sand bags and grout bags, (a bladder/bag that is positioned under the pipeline and pumped full of grout until the bag supports the pipeline) and/or the installation of concrete mattresses.

Rock dumping can also be used to rectify spans and protect against further erosion. Rock dumping is the process of placing imported material around the pipeline to provide support or protection.

2.6 Tie-in of Longtom-5

The Longtom-5 subsea well will be tied into the Longtom facilities by undertaking the following:

- Tie-in of hydraulic and electric flying leads.
- Tie-in of a flexible or rigid production spool.
- Pressure/leak testing.

The Longtom-5 wellhead and subsea tree system will be approximately 3 x 3 x 2.5 m in size and similar to the existing Longtom 3 and 4 trees.

Longtom-5 will be connected to the production pipeline through a 150mm nominal diameter flowline approximately 150m long.

It is likely that some of the tie-in activities will require divers and hence a vessel will be required to undertake the work. As the drilling campaign is yet to be confirmed the timing of the tie-in campaign is also currently unknown.

The flowline will be pre-commissioned and pressure tested prior to mobilisation, so that minimum offshore hydrostatic pressure testing is required (although a leak test will be required on completion of installation). Testing is normally performed by filling the flowlines with MEG or water and applying a pressure and then monitoring the pressure for indications of a leak. As mentioned in section 2.4.2 chemicals are normally added to water if used to maintain the integrity of the equipment and to facilitate the identification of leaks.

Commissioning will commence once the well has been completed and after the hook-up. Commissioning confirms the integrity of the facilities and the state of readiness to operate safely. Commissioning will be subject to detailed commissioning procedures and these will need to be signed off and accepted prior to the introduction of hydrocarbons.

2.7 Design Standards

Table 2-8 lists the key standards and testing requirements of the subsea wellheads and trees.

Further information on the design and standards can be found in the Longtom Pipeline Safety Case. The safety case will be revised prior to the tie-in of Longtom-5 and the design will be subject to independent third-party validation as part of the safety case revision process. The validation will confirm the appropriateness of the design codes and standards to ensure their implementation will result in a design that achieves ALARP.

Table 2-8 Wellhead and Tree standards

Code/Standard	Description
ISO9001 (2000)	Quality Management System requirements.
API Q1	Specification for quality programs for the petroleum, petrochemical and natural gas industry (seventh edition).
API Specification 6A	Wellhead equipment.
ASME Section IX	Weld procedures.
API 17D	Specifications for subsea wellhead and xmas tree equipment.
DNV RP B401	Cathodic protection design.
NAS 1638	Requirements of parts used in hydraulic systems (class 6).
API RP 17H	Remote operated vehicle (ROV) interfaces for subsea equipment.
NACE MR0175/ISO 15156	Sulfide stress cracking resistant metallic material for oilfield equipment.
DNV 2.7.1	Offshore freight containers – design and certification.
AS 1666	Wire rope slings.
Testing requirement	Hydrotesting, gas testing and function testing.
Certification	Lloyds certified design verification package.

Table 2-9 lists the standards and codes relevant to the pipeline, umbilical and subsea structures and were drawn from the project Basis of Design codes and standards. Where no Australian Standard provides coverage, international codes and standards were used.

Table 2-9 Pipeline and umbilical codes and standards

Code/Standard	Description
API 17A	Recommended practice for the Design and Operation of Subsea Systems.
ISO 13628-5	Specification for Subsea Production Control Umbilicals.
API 17F	Specification for Subsea Production Control Systems.
API 17G	Recommended Practice for the Design and Operation of Completion/Workover Riser Systems.
API 17I	Installation Guidelines for Subsea Umbilicals.
AS/NZS 2885.4	Pipelines – Gas and liquid petroleum – Offshore submarine pipeline systems.
BS 4832	Specification for compatibility between elastomeric materials and hydraulic fluids.
PR-178-9731 (AGA)	Submarine Pipeline on-bottom Stability Analysis and Design Guidelines (Volume 1).
DNV-OS-F101	Submarine pipeline systems.
DNV RP B401	Cathodic Protection Design.

DNV RP E305	On-Bottom Stability Design of Submarine Pipelines.
DNV RP F105	Free Spanning Pipelines.
DNV RP F103	Cathodic Protection of Submarine Pipelines by Galvanic Anodes.
Table 2ISO/DIN 10474	Material Testing Certificates.
NACE 1638	Cleanliness Requirements for Parts Used in Hydraulic Systems.
SAE J517	Hydraulic Hoses.
SAE J343	Tests and Procedures for Hydraulic Hoses.

3 Stakeholder Consultation

The SGHE HSEC Policy includes a commitment to communicating openly with the community regarding SGHE activities. This section outlines how SGHE (and formerly Nexus) has worked to achieve this commitment.

Consultation with stakeholders is also a requirement of offshore petroleum exploration and production legislation and is increasingly becoming a major requirement of operators' management systems. SGHE (formerly Nexus) has developed a good reputation as a responsible industry operator and has had active engagement with stakeholders, where a stakeholder is defined as:

'those who have an interest in a particular decision, either as individuals or representatives of a group. This includes people who influence a decision, or can influence it, as well as those affected by it' (MCMPR, 2005).

Stakeholders include fishing interests, conservation interests, non-government organisations, and government agencies.

3.1 Regulatory Requirements

Regulation 11A (Schedule 2, Division 2.2A) of the OPGGS (E) Regulations requires consultation with relevant authorities, persons and organisations. Specifically, Regulation 14(9) of the OPGGS (E) Regulations requires that:

The implementation strategy must provide for appropriate consultation with:
(a) Relevant authorities of the Commonwealth, a State or Territory; and
(b) Other relevant interested parties or organisations.

In addition, Regulation 16(b) of the OPGGS (E) Regulations requires that:

A report on all consultations between the operator and relevant authorities, interested persons and organisations in the course of developing the environment plan, is provided.

Provided in this section is a description of the consultative process applied, the list of relevant persons identified for consultation (previous and current) and the standard notifications proposed for these persons.

3.2 Stakeholder Consultation Objectives

The principal objectives of the project's stakeholder consultation activities are to:

- Identify all relevant stakeholders.
- Ensure relevant stakeholders are fully informed about the project and its potential environmental and social impacts.
- Provide timely information to relevant stakeholders to ensure adequate time to consider the information and ask questions or raise issues of concern to them.

- Establish an open and transparent process for input.
- Capture concerns raised by stakeholders so that they may be assessed in the relevant regulatory documentation (such as this EP).
- Demonstrate to NOPSEMA that stakeholders have been consulted in line with the requirements of the OPGGS (E) Regulations 2009.

3.3 Stakeholder Identification

A Stakeholder Consultation Log with associated documentation is provided in Attachment 4. Consultation on the project began in 2005 and has been maintained with specific rounds of consultation undertaken for the 2014 revision, for the offshore campaigns and this formal revision of the EP in July 2019.

Identified Stakeholders have been prioritised based on the known or assumed level of impact to their offshore activities or their known level of interest (see Table 3-1). Note that for this revision of the EP where there are no changes to the footprint of operations, there is considered to be no new impact to any of the stakeholders.

Table 3-1 Stakeholder prioritisation and engagement guide

Category	Definition	Consultation protocol
Primary	The stakeholder: • Is directly impacted by the project (e.g., fishery known to be active in the permit area); • Has a role in regulating some aspect of the project (e.g., providing Notice to Mariners). • Have a major role in an emergency response (such as a diesel or condensate spill).	Distribution of information flyer by email and follow up phone call if the email has not been responded to, prior to significant changes, i.e. physical drilling / tie-in of Longtom-5.. Follow-up emails, phone calls, teleconference or face-to-face meetings held as required. Additional requirements for ongoing consultation listed in the Consultation Log. For example LEFCOL and SETFIA are both notified of any vessel operations planned at Longtom.
Secondary	Stakeholder is indirectly impacted by the proposal (e.g., fishery licensed to operate in the permit but does not; port operator that will be hosting the support vessels, another operator in the EMBA).	Distribution of information flyer by email and follow up email or phone call if the email has not been responded to, where possible prior to significant changes, i.e. physical drilling / tie-in of Longtom-5. Follow-up emails, phone calls, teleconference or face-to-face meetings held as required.
Fringe	Will not in any way be impacted by the proposal, but is interested in being kept informed of regional activities.	Consultation via distribution of information flyer prior to significant changes, i.e. physical drilling / tie-in of Longtom-5. No follow up is required unless instigated by the stakeholder.

3.3.1 Identified Stakeholders

Stakeholders identified during previous consultations, including the recent consultation undertaken for this EP revision, are given below:

3.3.1.1 Primary Stakeholders

Commonwealth Government

- Australian Fisheries Management Authority (AFMA).
- Australian Maritime Safety Authority (AMSA).
- Department of Environment and Energy.
- National Offshore Petroleum Titles Administrator (NOPTA).
- Department of Industry.

Victorian Government

- Department of Transport (DOT), DOT now (2019) manage the consultation with the following agencies
    - DJPR
    - DELWP
    - DoT
    - EPA
    - MSV
    - VFA.

Oil Spill Response

- AMSA.

Commercial Fishing

- Lakes Entrance Fishing Co-operative (LEFCOL).
- South East Trawl Fishery Industry Association (SETFIA).

3.3.1.2 Secondary Stakeholders

Commercial Fishing

- Commonwealth Fisheries Association.
- Scallop Fishermen's Association, Lakes Entrance.
- Victorian Scallops Industry Association.
- San Remo Fisherman's Co-operative.
- Seafood Industries Victoria.
- Small Pelagics Fishery.
- East Zone Rock Lobster Association.
- Southern Shark Industry Alliance.
- Victorian Abalone Divers Association.

Recreational Fishing

- Victorian Recreational Fishing Peak Body Ltd (VR Fish).

Oil and Gas Industry

- Oil and gas industry operators in Bass Strait (e.g., Esso Australia Pty Ltd).

3.3.1.3 Fringe Stakeholders

- Local community.

3.4 Mechanisms for Consulting

The stakeholder consultation process has, and will continue to, utilise a number of mechanisms to communicate with stakeholders, both formal and informal. These include:

- Project briefings – project briefings have been held with stakeholders at project milestone points.
- One-on-one technical discussions – one-on-one meetings with stakeholders for information dissemination and obtaining stakeholder input to technical issues.
- Information releases – provision of information to the wider community, including:
  - Media releases (e.g., information updates in the local and regional newspapers).
  - Information mail-outs (e.g., project brochures and notifications. A specific mail-out was undertaken in February 2014 to support that revision of this EP). No feedback was received, and alternate methods (SMS alerts from SETFIA) have since been used to communicate with the fishing industry.
- SMS alerts from SETFIA.

3.5 Ongoing Consultation

The Stakeholder Consultation Log was established to record the contact details of relevant stakeholders and to document the consultation undertaken and the relevant outcomes (i.e. project commitments and requirements).

The log was originally established for the drilling of Longtom-3 but has since been utilised to record consultation for drilling Longtom-4, the construction phase of the project, the Logtom-5 drilling EP and this current revision of the EP. The log is a live document and will continue to be maintained for future activities.

None of the organisations or persons consulted to date have raised any significant issues regarding this revision to the EP. Most of the organisations were pleased to receive the information and advised that they would like to receive further information prior to the installation of Longtom-5. Additional stakeholder consultation will take place prior to any significant activities being undertaken. The exact requirements will be determined as any offshore campaign is developed. Further details of the consultation required are provided in the consultation log provided as attachment 2 to this EP

3.6 Management of Objections and Claims

If any objections or claims are raised during Longtom operation these will be substantiated via evidence such as publicly available credible information and/or scientific or fishing data. Where the objection or claim is substantiated it will be assessed as per the risk assessment process and controls applied where appropriate to manage impacts and risks to ALARP and an acceptable level. Stakeholders will be provided with feedback as to whether their objection or claim was substantiated, and if not why, and if it was substantiated how it was assessed and what additional controls if any were put in place to manage the impact or risk to ALARP and an acceptable level. If the objection or claim triggers a revision of the EP this will be managed and communicated to the stakeholder.

4 Existing Environment

This chapter describes the physical, biological and socio-economic environment in the project area and surrounds, including the values and sensitivities of the region.

As a result of significant oil and gas exploration and production in the eastern part of Bass Strait for several decades, significant physical and ecological data has been collected for the region, which has been referenced in this chapter (including Longtom-specific surveys). SGHE has determined that this information is comprehensive and indicative of the existing environment within the project area and surrounds, and does not warrant the collection of additional field data to support this EP.

4.1 Environment that may be affected (EMBA)

SGHE has identified the environment that may be affected (EMBA) by the project (6.2.1). The EMBA has been used to describe the extent of the existing environment included in this chapter and is based on the oil spill modelling and the consequences/impact of a Longtom condensate or marine diesel oil (MDO) spill on the environment (see Section 6.2.1 for further details).

The EMBA has been defined by stochastically modelling two hydrocarbon spill scenarios[1], taking into account the NOPSEMA bulletin on oil spill modelling (NOPSEMA, April 2019).

1. A 900 bbl/day subsea release of Longtom condensate over 90 days. This relates to an 81,000 bbl subsea release in the event of a loss of well control (blowout) where the release is halted after relief well drilling.
2. An 80m^3 MDO spill from an offshore vessel over 6 hours.

From these two scenarios the EMBA is defined by the area which is the greater extent of:

- Surface hydrocarbons floating on the sea equal to or above 1 g/m^2
- Shoreline stranded hydrocarbon equal to or above 10 g/m^2
- Entrained oil with instantaneous concentrations of 100 ppb
- Dissolved hydrocarbons within the water column with instantaneous concentrations of 50 ppb hydrocarbon

[1] For details on modelling parameters and metocean data used, refer Section 6.2.1.4, Oil Spill Modelling

This area is represented as Zone 1 in the figure below.

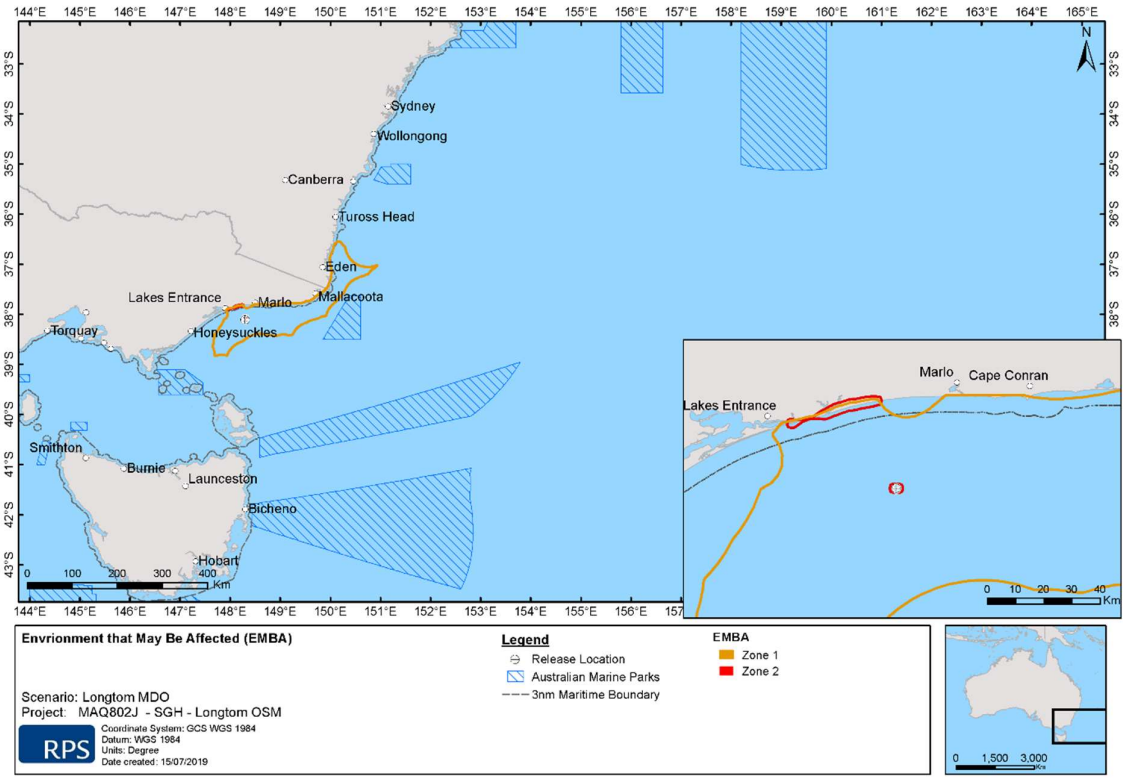


Figure 4-1 Indicative EMBA

Zone 2 represent the area potentially exposed to;

- Surface hydrocarbons floating on the sea equal to or above 10 g/m^2
- Shoreline stranded hydrocarbon equal to or above 100 g/m^2
- Entrained oil with concentrations of 100 ppb for at least 48hrs
- Dissolved hydrocarbons within the water column with concentrations of 50 ppb hydrocarbon for at least 48hrs

4.2 Physical Environment

4.2.1 Climate and Meteorology

4.2.1.1 Temperature

Lakes Entrance is the nearest meteorological station to the project area, located approximately 37 km northwest of the Longtom wells. Data collected from 1965 to 2006 indicates that the mean maximum temperature varies from 14.6°C in July to 23.8°C in February, with the mean minimum temperature being 6.0°C in July and 14.8°C in February (BoM, 2011).

4.2.1.2 Rainfall

Data collected from the Lakes Entrance meteorological station indicates that from 1965 to 2006 the average annual rainfall is 710 mm, with the highest total rainfall occurring in November and the lowest total rainfall occurring in February (BoM, 2011).

4.2.1.3 Winds

Bass Strait is located on the northern edge of the westerly wind belt known as the Roaring Forties. Wind direction and speed depend on the position and movement of synoptic systems.

High resolution wind data was sourced from the National Centre for Environmental Prediction (NCEP) Climate Forecast System Reanalysis from 2008 to 2012 (inclusive) [RPS, 2019]. The CFSR wind model includes observations from many data sources; surface observations, upper-atmosphere air balloon observations, aircraft observations and satellite observations and is capable of accurately representing the interaction between the earth's oceans, lands and atmosphere. The gridded wind data output is available at ¼ of a degree resolution (~33 km) and 1 hourly time intervals. Figure 4.2 illustrates the monthly wind rose distributions. Note that the atmospheric convention for defining wind direction, that is, the direction the wind blows from, is used.

The model wind data demonstrates that this region typically experiences strong wind all year round and although the monthly average wind speeds remain under 16 knots, winds can at times blow over 50 knots.

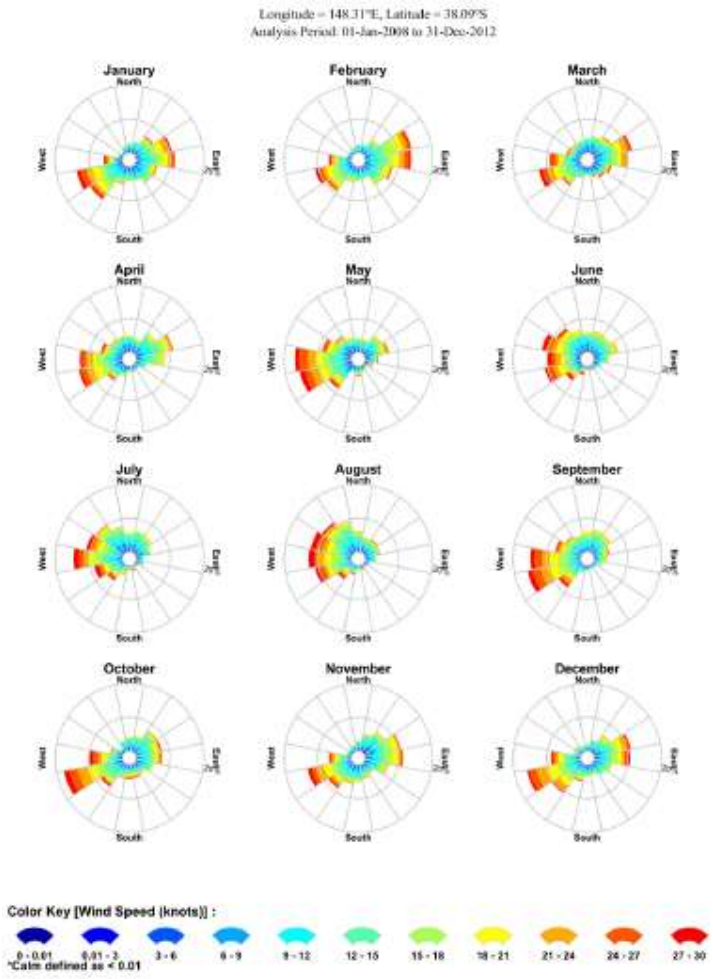


Figure 4-2 Monthly wind rose distributions

4.2.2 Bathymetry and Geology

4.2.2.1 Bathymetry

The seabed bathymetry across the Bass Strait region is highly variable. A steep inshore profile (0 to 20 m water depth) extends to a less steep inner (20-60 m water depth) and moderate profile (60 to 120 m water depth), concluding with a flat outer shelf plain (greater than120 m water depth). Seaward, the sediments are comprised primarily of sand (92%) and silt/clay (8%). They are composed of organic material, with a median of 64.5% calcium carbonate (GEMS, 2005).

The seabed in the project area is essentially flat with gently undulating bathymetry with no steep slopes or bathymetric anomalies. The direction of shoaling along the pipeline route is towards the north-northeast (Fugro, 2005).

4.2.2.2 Seabed Geology

The following acoustic patterns and interpreted seabed types have been recognised in the project area from the previous Longtom pipeline route survey (Fugro, 2005):

- Type A: Uniform moderate to highly reflective seabed – interpreted as fine to coarse sands with abundant shells and shell fragments, the major seabed type. Type A is present along the majority of the pipeline route.
- Type B: Moderately low reflectivity seabed – interpreted as fine to coarse sands with minor shells and shell fragments, present as relatively small, localised patches.

The main difference between seabed Types A and B is a decrease in shell concentration within Type B.

4.2.2.3 Shallow Geology

Surveys along the Longtom gas pipeline route show that overall, the shallow geology is characterised by a surface layer of fine to coarse unconsolidated sands with shells and shell fragments overlying more consolidated bedded sedimentary sequences (Fugro, 2005). This layer varies between 2.5 and 5.6 m in thickness, with an average of 2.5 m. This geology is indicative of a high-energy environment and is not conducive to forming more stable habitats where marine flora and fauna can establish itself.

4.2.3 Oceanography

The oceanography of the project area is similar to that of the eastern Bass Strait region due to the absence of seafloor anomalies that may influence local oceanographic conditions.

4.2.3.1 Currents and Tides

Currents in eastern Bass Strait are tide and wind-driven. Tidal movements in eastern Bass Strait are predominantly in a northeast-southwest orientation, with a 12.4-hour cycle. The main tidal constituents in Bass Strait vary in phase by about 3 to 4 hours from east to west. Most of this phase change occurs between Lakes Entrance and Wilson's Promontory. Timing of the high tide, for example, can vary by up to 3 hours across this region (GEMS, 2005). Tides in the area from Lakes Entrance to Gabo Island are, however, relatively weak in comparison to other areas of Bass Strait.

Wind-driven currents in the project area may be caused by the direct influence of weather systems passing over the Strait (wind and pressure-driven currents) and the indirect effects of weather systems passing over the Great Australian Bight.

The Gippsland Basin is also influenced by the southern extremity of eddies belonging to the East Australian Current (EAC) that travels southward, carrying warm equatorial waters (Director of National Parks, 2012). The currents were shown to vary from month to month with current speeds of close to 1 m/s encountered in some areas (APASA, 2012). The EAC is up

to 500 m deep and 100 km wide, and is strongest in summer when it can flow at up to 5 knots, and slower in winter flowing at 2-3 knots (Director of National Parks, 2012). The eddies rotate around warm central cores that persist for several months and can be up to 200 km across, forming more commonly off the southern NSW coast (Director of National Parks, 2012). Subsea currents of up to 1 knot or 0.5m/s can be experienced at the Longtom location but they are generally diurnal with a median bottom current of around 0.15m/s (Metocean Design Criteria 2006).

Waters of eastern Bass Strait are generally well mixed but surface warming sometimes causes weak stratification in calm summer conditions. Occasionally, mixing and interaction between varying water masses leads to variations in horizontal water temperature and temperature profiles.

4.2.3.2 Water Temperatures

Sea surface temperatures in the project area range from a minimum of 12.6°C in winter to a maximum of 18.4°C in summer (APASA, 2012).

4.2.3.3 Waves

Bass Strait is a high energy environment exposed to frequent storms and significant wave heights, with highest wave conditions generally associated with strong west to southwest winds caused by the eastward passage of low pressure systems across Bass Strait.

4.2.3.4 Coastlines

The coastline within the EMBA, stretching east from Lakes Entrance to just west of the Cape Howe Marine National Park near the Victorian/NSW border is herein briefly described in terms of its physical attributes. These descriptions are based largely on the Oil Spill Response Atlas (OSRA) mapping and Parks Victoria (2012) park notes (see OPEP for further details). The description of the coastline is discussed moving in an easterly direction from Lakes Entrance. Further detail on marine sensitivities along the coastline is provided in Section 4.6.

The coastline from Lakes Entrance east to Point Hicks is dominated by largely uninterrupted wide sandy beaches with tall, vegetated sand dunes (the Ninety Mile Beach). Behind the sand dunes (east to Marlo) are a series of wetlands and lakes (Gippsland Lakes). These sandy beaches and dunes provide nesting sites for the shorebirds such as the Hooded Plover, which is found along the entire Victorian coastline.

Sub-tidal rocky reefs are found around Point Ricardo, Cape Conran, Pearl Point, Thurra River Estuary, Petrel Point, Rame Head, The Skerries (haul out site for approximately 11,500 Australian fur seals and 300 New Zealand fur seals) through to Little Rame Head, Quarry Head, Bastion Point and Gabo Island (near Cape Howe). Areas between these rocky reefs are dominated by sandy beaches. Gabo Island itself is dominated by sandy dunes and has

Victoria's largest penguin colony (approximately 35,000 breeding penguins, about 50% of the state population) and is the haul out site for up to 50 Australian fur seals.

The Sydenham and Tamboon Inlet estuaries are only intermittently open (usually during spring flooding as a result of snow melts), with these estuaries providing nesting, roosting, and feeding sites for the colonies of several shorebird species.

Clinton Rocks is located immediately east of the Tamboon Inlet and is of State geological significance. Other intertidal rocky shorelines are present around the Thurra River estuary, east of the Mueller River estuary, Petrel Point and Sandpatch Point. Intertidal rocky habitats dominate the shoreline from Little Rame Head to Mallacoota Entrance. East of Mallacoota Entrance, the shoreline is once again dominated by sandy beaches.

The Giant Kelp Marine Forests of South East Australia ecological community is located on the coasts of Victoria, Tasmania and South Australia and is protected under the EPBC Act as a threatened ecological community. The ecological community is made up predominately of giant kelp (*Macrocystis pyrifera)* plants and reef associated fish and invertebrates that shelter, feed and reproduce within Giant Kelp Marine Forests (SEWPaC, 2012c).

The Giant Kelp Marine Forests of South East Australia ecological community is distinguished by giant kelp plants that have formed a forest with a closed or semi-closed canopy at or below the water's surface. Giant kelp plants grow on rocky reefs at depths generally greater than eight metres below sea level and in water conditions that are cool, relatively nutrient rich and moderately calm (SEWPaC, 2012c).

4.3 Biological Environment

4.3.1 Benthic Communities

The seascape of the Gippsland Basin is composed of a series of massive sediment flats, interspersed with small patches of reef, bedrock and consolidated sediment (Wilson and Poore, 1987). The sediment flats, such as those present in the project area, are generally devoid of emergent fauna but benthic invertebrates such as polychaetes, bivalves, molluscs and echinoderms are present (Wilson and Poore, 1987). There are also a number of burrowing species, which inhabit the soft seabed, including tubeworms, small crustaceans, nematodes, nemerteans and seapens (PBEES, 2001).

There is an absence of hard substrate or emergent reefs in the project area. Surveys of benthic invertebrates in Bass Strait (Poore et al., 1985; Wilson and Poore, 1987) have shown:

- Crustaceans and polychaetes dominate the infaunal communities, many of which are unknown species.
- The high diversity of a wide range of invertebrate groups has been a recurrent observation of all surveys in Bass Strait and diversity is high compared with equivalent areas of the northern hemisphere.
- Many species are widely distributed across the Strait, suggesting heterogeneous sediments and many microhabitats.
- Some invertebrate groups are allied with fauna from Antarctic seas. In winter, when the east coast of Tasmania is supplied with water from the sub-Antarctic, the overlap with the East Australia current contributes to the high diversity.

Parry et al (1990) also found high diversity and patchiness of benthos sampled off Lakes Entrance, where a total of 353 species of infauna was recorded. Crustaceans (53%), polychaetes (32%) and molluscs (9%) dominated sample results.

The relative homogeneity of seafloor sediment in the project area and across all areas surveyed during the Longtom pipeline route selection process (Fugro, 2005) suggests that the diversity of benthic invertebrates in the project area is low. There was no evidence of unusually high benthic invertebrate diversity in the sediment samples collected along the pipeline route. Sediment samples generally show a brown, coarse shelly sand, moderately well sorted with some shells.

4.3.2 Plankton

Plankton species, including both phytoplankton and zooplankton, are a key component in oceanic food chains. Phytoplankton are photosynthetic organisms that spend either part or all of their lifecycle drifting with the ocean currents. Phytoplankton biomass is greatest at the extremities of Bass Strait (particularly in the northeast) where water is shallow and nutrient levels are high.

Zooplankton are comprised of small protozoa, crustaceans (such as krill) and the eggs and larvae from larger animals. More than 170 species of zooplankton have been recorded in eastern and central Bass Strait, with copepods making up approximately half of the species encountered (Watson & Chaloupka, 1982). The high diversity may be due to considerable intermingling of distinctive water bodies and may be higher in eastern than in western Bass Strait. Although a high diversity of zooplankton has been recorded, Kimmerer and McKinnon (1984) found that seven dominant species make up 80% of individuals.

4.3.3 Fish and Shellfish

4.3.3.1 Commercial and Recreational Species

It is estimated that there are over 500 species of fish found in the waters of Bass Strait, including a number of species of importance to commercial and recreational fisheries (LCC, 1993). Representative species of recreational or commercial significance in Bass Strait are listed in Table 4-1.

Table 4-1 Major commercial fish species in eastern Bass Strait

Habitat	Typical Species
Pelagic	Pilchards (*Sardinops neopilchardus*)
	Anchovies (*Engraulis australis*)
	Sandy sprats (*Hyperlophus vittatus*)
Demersal and Benthic	200 species of bony fish including many of commercial value
	50 species of sharks and rays, including gummy sharks (*Mustelus antarcticus*) and school sharks (*Galeorhinus galeus*)
Nearshore	School whiting (*Sillago bassensis*)
	Sand flathead (*Platycephalus bassensis*)
	Yank flathead (*P. speculator*)
	Jack mackerel (*Trachurus declivis*)
	Silver trevally (*Pseudocaranx dentex*)
	Blue warhoo (*Seriolella brama*)
	Yellowtail scad (*Trachurus novaezelandiae* and *Trachurus declivis*)
Mid Continental Shelf	Tiger flathead (*P. richardsoni*)
	John dory (*Zeus faber*)
	Jackass morwong (*Nemadactylus macropterus*)
	Common saw shark (*Pristiophorus cirratus*) and southern sawshark (*P. nudipinnis*)
	Snapper (*Pagrus auratus*)
Continental Slope	Blue grenadier (*Macruronus novaezelandii*)
	Spotted warehou (*Seriolella punctata*) and blue warehou (*S. brama*)
	Ling (*Genypterus blacoides*)
	Mirror dory (*Zenopsis nebulaosus*)
	Ocean perch (*Helicolenus* sp.)

Habitat	Typical Species
	Blue eye trevalla (*Hyperglyphe antarctica*)
	Gemfish (*Rexea solandri*)
	Orange roughy (*Hoplosteths atlanticus*)

Species of shellfish of commercial and recreational importance include abalone, scallops, rock lobsters, prawns and squid. Abalone (*Haliotis rubra*) and rock lobster (*Jasus novaehollandiae*) occur mainly on rocky substrates, which are extensive on the coasts of Victoria, Tasmania and the Bass Strait islands. However, this habitat is absent in the project area. Scallops (*Pecten fumatus*) occur on sandy substrates in a number of areas throughout Bass Strait.

Commercial fishing activity in the project area targeting the above species is discussed in Section Table 4-1.

4.3.3.2 Listed Species

Fish species that may occur in the EMBA that are listed as threatened under the EPBC Act are the Australian Grayling (*Prototroctes maraena*) and the Black Rockcod (*Epinephelus daemelii*), both of which are listed as vulnerable. The remaining listed species that may occur in the EMBA are from the family signathidae (pipefish, seahorses and dragonfish). Table 4-2 identifies all fish species that may occur in the EMB (DoEE. 2019). A list of approved conservation advice and/or recovery plans for listed species, where they exist, with key threats relevant to petroleum activities, is shown in table Table 4-3.

Table 4-2 EPBC Act listed fish potentially occurring in the EMBA

Scientific Name	Common Name	Threatened Species	Migratory Species	Listed Marine Species	Type of Presence
Epinephelus daemelii	Black rockcod	V			MO
Heraldia nocturna	Upside-down pipefish			✓	MO
Hippocampus abdominalis	Big-belly seahorse			✓	MO
Hippocampus breviceps	Short-head seahorse			✓	MO
Hippocampus minotaur	Bullneck seahorse			✓	MO
Histiogamphelus briggsii	Briggs' crested pipefish			✓	MO
Histiogamphelus cristatus	Rhino pipefish			✓	MO
Hypselognathus rostratus	Knife-snout pipefish			✓	MO
Kaupus costatus	Deep-bodied pipefish			✓	MO
Kimblaeus bassensis	Trawl pipefish			✓	MO

Scientific Name	Common Name	Threatened Species	Migratory Species	Listed Marine Species	Type of Presence
Leptoichthys fistularius	Brushtail pipefish			✓	MO
Lissocampus runa	Javelin pipefish			✓	MO
Maroubra perserrata	Sawtooth pipefish			✓	MO
Mitotichthys semistriatus	Halfbanded pipefish			✓	MO
Mitotichthys tuckeri	Tucker's pipefish			✓	MO
Notiocampus ruber	Red pipefish			✓	MO
Phyllopteryx taeniolatus	Weedy seadragon			✓	MO
Prototroctes maraena	Australian grayling	V			LO
Solegnathus robustus	Robust spiny pipehorse			✓	MO
Solegnathus spinosissimus	Australian spiny pipehorse			✓	MO
Stigmatopora argus	Spotted pipefish			✓	MO
Stigmatopora nigra	Widebody pipefish			✓	MO
Stipecampus cristatus	Ringback pipefish			✓	MO
Syngnathoides biaculeatus	Double-ended pipehorse			✓	MO
Urocampus carinirostris	Hairy pipefish			✓	MO
Vanacampus margaritifer	Mother-of-pearl pipefish			✓	MO
Vanacampus phillipi	Port Phillip pipefish			✓	MO
Vanacampus poecilolaemus	Australian long-snout pipefish			✓	MO

Threatened Species:
V Vulnerable
CE Critically Endangered

Type of Presence:
MO Species or species habitat may occur within the area

Table 4-3 Conservation advice for threatened fish species and key threats potentially relevant to petroleum activities

Common Name	Conservation Advice or Recovery Plan	Key Threats potentially relevant to petroleum activities
Black Rock cod	Approved Conservation Advice for *Epinephelus daemelii* (black cod) (DoEE, 2012a)	None Identified
Australian Grayling	National Recovery Plan for the Australian Grayling Prototroctes maraena, 2008 (VDSE, 2008)	Reduction in water quality
Spotted Handfish	Approved Conservation Advice for *Brachionichthys hirsutus* (spotted handfish) (DoEE, 2012c). Australian national Recovery Plan for Three Handfish Species: spotted handfish (*Brachionichthys hirsutus*), red handfish (*Thymichthys politus*) and Ziebell's handfish (*Brachiopsilus ziebelli*) (DoEE, 2015e	None identified
Red Handfish	Australian national Recovery Plan for Three Handfish Species: spotted handfish (*Brachionichthys hirsutus*), red handfish (*Thymichthys politus*) and Ziebell's handfish (*Brachiopsilus ziebelli*) (DoEE, 2015)	None Identified

The Australian Grayling (*Prototroctes maraena*), listed as 'vulnerable' under the EPBC Act, is a dark brown to olive-green fish growing to 19 cm. In Victoria, this species has been most frequently collected in the Tambo, Barwon, Mitchell and Tarwin river systems. It occurs widely in Tasmania and is known from the northern, eastern and southern coastal river drainages. The Australian Grayling spends most of its life in freshwater (including spawning), migrating between freshwater streams and the ocean, and as such it is generally accepted to be a diadromous (migratory between fresh and salt waters) species and not anadromous (migrating from saltwater to freshwater to spawn) (DSE, 2008). Part of the larval and/or juvenile stages are spent in coastal seas, where they remain for about six months before moving back to freshwater where they spend the rest of their lives. Australian graylings are generally short-lived, with most fish dying after their second year. Threats to the species are related mostly to impacts to its freshwater habitat rather than offshore habitat, including barriers to movement, river regulation and declining water quality.

The Black Rockcod (*Epinephelus daemelii*) is a dark grey-black or blotched black and white cod species. It can grow to 200 cm in length, although most recent sightings of the species were 40 to 80 cm in length. The Black Rockcod generally inhabits near-shore rocky and offshore coral reefs and is distributed along inshore areas of the NSW coastline. Its entire range includes warm temperate and subtropical waters and therefore may be found in southern NSW however recordings in Victoria are rare. There is no known critical habitat for

this species in or around the project area or the Gippsland Basin in general. Targeted fishing of the species is banned and the main threat is bycatch (DoEE, 2012a).

Macro-algal (seaweed) habitat in shallow waters provides the key habitat for most species of signathids (pipefishes, seahorses and seadragons). Kelp species such as *Macrocystis angustifolia* and *Eklonia radiata* and the seagrass *Heterozostera tasmanica* (eel seagrass) are the three most common species that provide essential resources for the signathids (of which 30 species are listed as possibly occurring within the EMBA. Generally, signathid species are associated with this vegetation that grows in sheltered to moderately exposed reef areas at a range of depths 0 to 50 m depending on the species (Edgar, 1997), but usually at shallow depths of between 5 to 25 m. The lack of suitable habitat in the project area makes it unlikely that signathid species occur here.

4.3.4 Sharks and Rays

A number of chondrichthyans (sharks and rays) have been known to inhabit the Gippsland Basin. These include the gummy shark (*Mustelus antarcticus*), Port Jackson shark (*Heterodontus portusjacksoni*), school shark (*Galeorthchus milii*), white-spotted spurdog (*Squalus acanthias*), piked spurdog (*Squalus megalops*), common sawshark (*Pristiophorus cirratus*), draughtboard shark (*Cephaloscyllium laticeps*), southern sawshark (*Pristiophorus nudipinnis*), gulf catshark (*Asymbolus vincenti*), rusty catshark (*Parascyllium ferrugineum*), southern eagle ray (*Myliobatis australis*), broadnose sevengill shark (*Notorynchus cepedianus*), varied catshark (*Parascyllium variolatum*) and the Australian angel shark (*Squatina australis*) (Walker *et al*., 2001).

Shark species that may occur in the EMBA and that are listed as threatened under the EPBC Act are shown in Table 4-4 and include the great white shark (*Carcharodon carcharias*) (listed as vulnerable), the whale shark (*Rhincodon typus*) (listed as vulnerable) and the grey nurse shark (*Carcharis Taurus – east coast population*) (listed as critically endangered). These three species are briefly discussed below on the basis that they are known to migrate through eastern Bass Strait.

The grey nurse shark (*Carcharis Taurus – east coast population*) has been recorded from southern Queensland and around southeast Australia (NSW coast). The species is uncommon in Victorian, South Australian and Tasmanian waters. The grey nurse sharks are known to migrate up and down the east coast and are known to aggregate according to sex, with females predominately occurring off central NSW while males predominate in southern Queensland waters. Biologically important areas for migration are known to occur on the NSW coast as far down as Eden. Grey nurse sharks prefer warm temperatures and occur either alone or in small to medium sized groups.

The great white shark (*Carcharodon carcharias*) is normally found in inshore waters around the areas of rocky reefs and seal colonies, such as Wilsons Promontory. Biologically important areas for juveniles are found in coastal waters of Gippsland in areas off Ninety Mile

Beach, west of the project area, and pupping grounds are likely to be frequented between the months of December and June (Holliday, 2003). The distribution of this species extends over the project area and through the EMBA.

Whale sharks are oceanic and cosmopolitan in their distribution, generally found in warmer oceanic waters (where temperatures range from 21 to 25°C) and mainly in waters off the Northern Territory, Queensland and northern Western Australia. They are known to aggregate in the reef front waters adjacent to the Ningaloo Reef during the autumn months (mid-March through to early-June) (Colman, 1997). This behaviour is only known to occur in a few other places in the world. Whale sharks are not known to aggregate in or near Bass Strait. However, there have been a few isolated reports of immature male whale sharks (*Rhincodon typus*) from the southeast coast of Australia from New South Wales, Victoria, South Australia and the western fringe of the Great Australian Bight (Last & Stevens, 1994). There is no critical habitat for this species in or around the project area or the Gippsland Basin in general.

Two other species of shark were recorded as potentially migrating within the EMBA according to the DoEE EPBC Online Protected Matters Search Tool – the Shortfin Mako (*Isurus oxyrinchus*) and the Porbeagle/Mackerel Shark (*Lamna nasus*). There is no critical habitat for these species in or around the project area or the Gippsland Basin in general.

Table 4-5 lists the approved conservation advice and/or recovery plans for listed species, where they exist, with key threats potentially relevant to petroleum activities.

Table 4-4 EPBC Act listed sharks potentially occurring in the EMBA

Scientific Name	Common Name	Threatened Species	Migratory Species	Listed Marine Species	BIA	Type of Presence
Carcharias Taurus (east coast population)	Grey Nurse Shark (east coast population)	CE			d	LO
Carcharodon carcharias	Great White Shark	V	✓		b, d	BKO
Isurus oxyrinchus	Shortfin Mako		✓			LO
Lamna nasus	Porbeagle		✓			LO
Rhincodon typus	Whale Shark	V	✓			MO
Threatened Species: *V Vulnerable* *CE Critically Endangered* *Biologically Important Areas:* *b Breeding* *d Distribution* *f Foraging*	*Type of Presence:* *MO Species or species habitat may occur within the area* *LO Species or species habitat likely to occur within the area* *KO Species or species habitat known to occur within the area* *BKO Breeding known to occur within the area*					

Table 4-5 Conservation advice for threatened shark species and Key Threats

Common Name	Conservation Advice or Recovery Plan	Key Threats (potentially relevant to petroleum activities)
Grey Nurse Shark	Recovery Plan for the Grey Nurse Shark (*Carcharias Taurus*)	None identified
Great White Shark	Recovery Plan for the White Shark (*Carcharodon carcharias*)	None identified
Whale Shark	Approved Conservation Advice for *Rhincodon typus* (Whale Shark)	Vessel strike Habitat disruption from mineral exploration, production and transportation, Marine debris

4.3.5 Whales

A number of whale species occur in Bass Strait, most being seasonal visitors during migration. There are 22 whale species that may inhabit the waters within the EMBA according to the DoEE EPBC Online Protected Matters Search Tool, these are listed in Table 4-6. Table 4-7 lists the approved conservation advice and/or recovery plans for listed whale species, where they exist, with key threats potentially relevant to petroleum activities.

Five of these species are listed as nationally threatened under the EPBC Act – the blue (listed as endangered), southern right (listed as endangered), humpback (listed as vulnerable), sei (listed as vulnerable) and fin (listed as vulnerable) whales. These species are briefly discussed below on the basis that they are known to migrate through the Gippsland Basin. While they are known to migrate through the Gippsland Basin, there is little or no potential for interactions between project-related or inspection activities and whales, other than during the short periods of inspection or when Longtom-5 will be tied in, as all facilities (i.e., pipeline, umbilical and subsea trees) have been installed and are operating on the sea floor. As such, the potential presence of these whales in the project area is considered in Chapter 6 insofar as it relates to the inspection and Longtom-5 tie in activities.

Table 4-6 EPBC Act listed whales potentially occurring in the EMBA

Scientific Name	Common Name	Threatened Species	Migratory Species	Listed Marine Species	BIA	Type of Presence
Balaenoptera acutorostrata	Minke Whale					MO
Balaenoptera bonaerensis	Antartic Minke Whale		✓			LO
Balaenoptera borealis	Sei Whale	V	✓			FLO
Balaenoptera edeni	Bryde's Whale		✓			MO
Balaenoptera musculus	Blue Whale	E	✓		f*	LO
Balaenoptera physalus	Fin Whale	V	✓			FLO
Berardius arnuxii	Arnoux's Beaked Whale					MO
Caperea marginata	Pygmy Right Whale		✓			FLO
Eubalaena australis	Southern Right Whale	E	✓		m	KO
Globicephala macrorhynchus	Short-finned Pilot Whale					MO
Globicephala melas	Long-finned Pilot Whale					MO
Kogia breviceps	Pygmy Sperm Whale					MO
Kogia simus	Dwarf Sperm Whale					MO
Megaptera novaeangliae	Humpback Whale	V	✓		m	FKO
Mesoplodon bowdoini	Andrew's Beaked Whale					MO
Mesoplodon densirostris	Blainville's Beaked Whale					MO
Mesoplodon grayi	Gray's Beaked Whale					MO
Mesoplodon hectori	Hector's Beaked Whale					MO
Mesoplodon layardii	Strap-toothed Beaked Whale					MO
Mesoplodon mirus	True's Beaked Whale					MO
Physeter microcephalus	Sperm Whale		✓			MO
Ziphius cavirostris	Cuvier's Beaked Whale					MO

Threatened Species:
V Vulnerable

Type of Presence:
MO Species or species habitat may occur within the area
LO Species or species habitat likely to occur within the area

Scientific Name	Common Name	Threatened Species	Migratory Species	Listed Marine Species	BIA	Type of Presence
E Endangered *Biologically Important Areas:* *f Foraging* *m Migration* ** BIA for sub species*		*KO Species or species habitat known to occur within the area* *BKO Breeding known to occur within the area* *FKO Foraging, feeding or related behaviour known to occur within area*				

Table 4-7 Conservation advice for threatened whale species and Key Threats

Common Name	Conservation Advice or Recovery Plan	Key Threats (potentially relevant to petroleum activities)
Sei Whale	Approved Conservation Advice for *Balaenoptera borealis* (Sei Whale)	Anthropogenic noise and acoustic disturbance Habitat degradation including pollution Pollution (persistent toxic pollutants) Vessel strike
Blue Whale	Conservation Management Plan for the Blue Whale, 2015-2025	Noise interference Habitat modification from marine debris or chemical discharge Vessel strike
Fin Whale	Approved Conservation Advice for *Balaenoptera physalus* (Fin Whale)	Anthropogenic noise and acoustic disturbance Pollution (persistent toxic pollutants) Vessel strike
Southern Right Whale	Conservation Management Plan for the Southern Right Whale, 2011-2021	Entanglement Vessel strike Noise Interference Habitat modification
Humpback Whale	Approved Conservation Advice for *Megaptera novaeangliae* (Humpback Whale)	Noise interference Habitat degradation Entanglement Vessel disturbance and strike

Blue whales (*Balaenoptera musculus*) are likely to be present around November to December as a result of migration in the vicinity of the project area. They have extensive migration patterns that are not known to follow any particular coastlines or oceanographic features (Bannister *et al*., 1996). While eastern Bass Strait is not known as a feeding or aggregation area for this mammal species (DEH, 2004a), in the past, sightings of blue whales have occurred in southeast Victoria from February to March, but are reasonably rare in the Gippsland Basin (Bannister *et al*., 1996). There are two subspecies of Blue Whale that occur within Australian waters: Antarctic Blue Whale, and the Pygmy Blue Whale. The majority of Bass Strait and the coastal waters of Tasmania are biologically important foraging areas for

the Pygmy Blue Whale (NCVA. 2019). The relatively shallow water (50-55 m) of the project area may reduce the potential for blue whales to be present, as blue whales are known to feed on seasonally abundant krill along the shelf break in western Victoria in depths around 100 m (Gill, 2002).

Southern right whales (*Eubalaena australis*) migrate annually from high latitude feeding grounds to lower latitudes for calving and mating. Migration along the eastern coastline is expected to occur between mid-May and September (Environment Australia, 2001). Winter in particular is the peak for southern right whale abundance especially along the southern coast of Australia (Kemper *et al*., 1997). At this time, calving adult females are spotted frequently inshore, in shallow, northeast trending bays over sandy bottoms (Bannister *et al*., 1996). Although sighted along the Gippsland coast during migration, calving females are most often found off western Victoria near Warrnambool. In 2012, southern right whales were observed in July and August alongside beaches and cliffs around Portland, also in the western part of Victoria and outside of the EMBA.

The humpback whale (*Megaptera novaeangliae*) migrates annually along the east coast of Australia heading north to tropical calving grounds from June to August, and south to the Southern Ocean feeding areas from September to November. The exact timing of the migration period can change from year to year and may be influenced by water temperature, the extent of sea ice, predation risk, prey abundance and location of feeding grounds. While the main migration route of this species is along the east coast of Australia along the continental shelf to the east of Bass Strait, some animals migrate through Bass Strait and could pass through the region (DEH, 2004b).

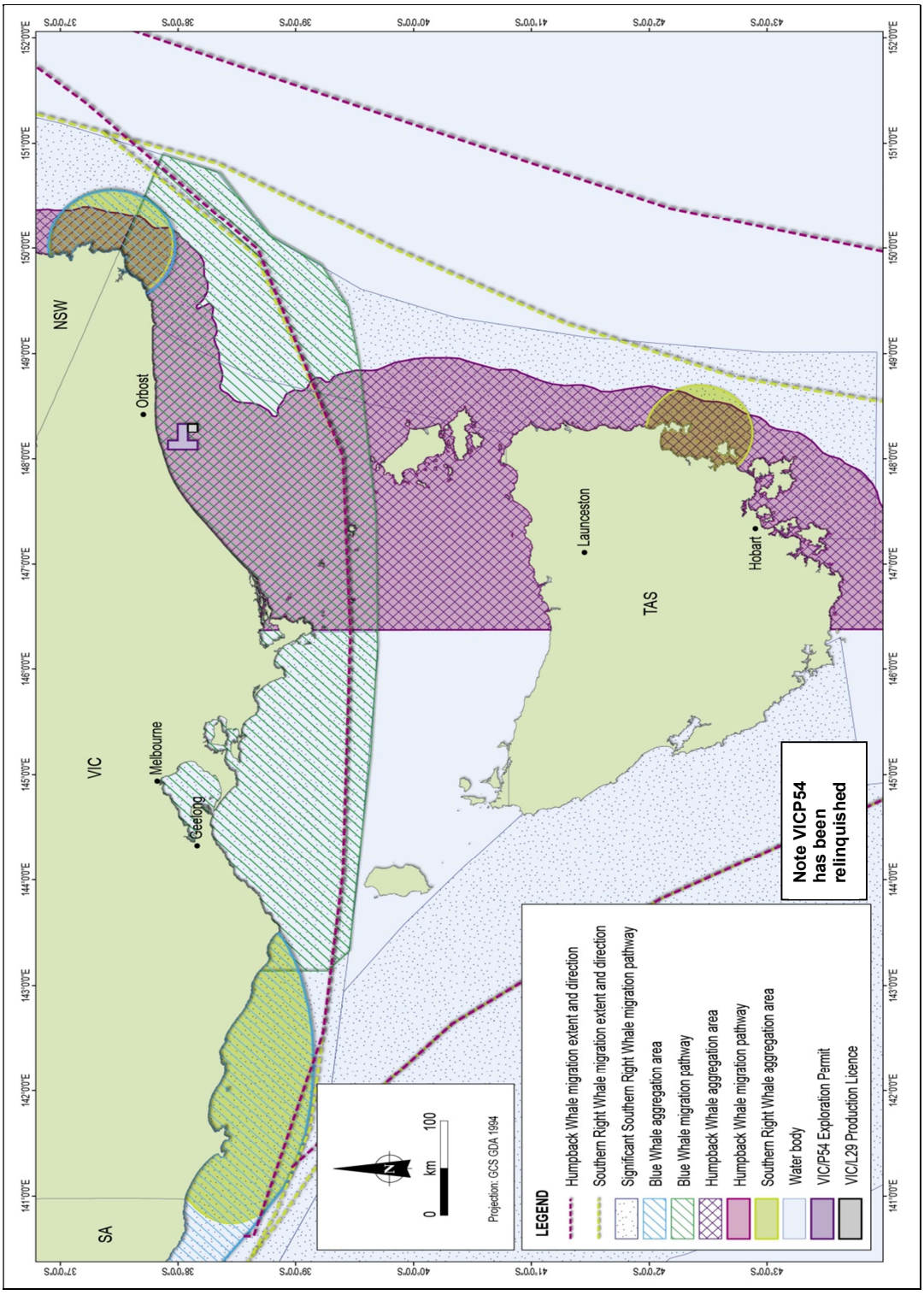
Sei whales (*Balaenoptera borealis*) have the same migration pattern as most other baleen whales, including blue and fin whales, although the timing is generally later. Sei whales are known to swim in small pods and their main breeding season is winter (April to August) Sei whales are not often found near coasts and the species is infrequently recorded in Australian waters, with records only occurring from Western Australia, South Australia, Tasmania and Queensland.

The fin whale (*Balaenoptera physalus*) is the second largest whale species, after the blue whale. It feeds in Australian Antarctic waters and has been sighted inshore in the proximity of the Bonney Upwelling, Victoria, along the continental shelf in the summer and autumn months.

A summary of threatened cetacean activity in Bass Strait is presented in Table 4-8 and a figure showing the migration and aggregation of blue, southern right and humpback whales is provided in Figure 4-3.

Table 4-8 Summary of threatened cetacean species activity in Bass Strait

Species/month	J	F	M	A	M	J	J	A	S	O	N	D
Blue whales, Sei whales, Fin whales	Migrating, feeding										Migrating, feeding	
Humpback whales						Northern migration			Southern migration			
Southern right whales					Southerly migration, calving							



Source: SEWPaC (formerly DEHWA) Currency, 2000

Figure 4-3 Whale aggregation and migration areas

4.3.6 Dolphins

There are eight dolphin species that may occur in the region according to the DoEE EPBC Act Online Protected Matters Search Tool, these are shown in Table 4-9 below:

Table 4-9 EPBC Act listed dolphins potentially occurring in the EMBA

Scientific Name	Common Name	Threatened Species	Migratory Species	Listed Marine Species	BIA	Type of Presence
Delphinus delphis	Common Dolphin			✓		MO
Grampus griseus	Risso's Dolphin			✓		MO
Lagenorhynchus obscurus	Dusky Dolphin		✓	✓		LO
Lissodelphiss peronii	Southern Right Whale Dolphin			✓		MO
Orcinus orca	Killer Whale		✓	✓		LO
Pseudorca crassidens	False Killer Whale			✓		LO
Tursiops aduncus	Indian Ocean Bottlenose Dolphin (Spotted Bottlenose Dolphin)			✓	b	LO
Tursiops truncatus s. str.	Bottlenose Dolphin			✓		MO

Threatened Species:
V Vulnerable
E Endangered

Biologically Important Areas:
b breeding, calving

Type of Presence:
MO Species or species habitat may occur within the area
LO Species or species habitat likely to occur within the area

Common dolphins (*Delphinus delphis*) are recorded in all Australian waters and are not thought to be migratory. The species is associated with high topographical relief of the ocean floor, escarpments and upwelling areas, and there are no known key localities in Australia.

Risso's dolphin (*Grampus griseus*) is distributed through all oceans, occurs inshore and offshore, but is generally considered pelagic and oceanic, and Fraser Island in Queensland has the only known 'resident' population.

The dusky dolphin (*Lagenorhynchus obscurus*) occurs only in the southern hemisphere with no recorded sightings from Victoria or Tasmania. There are no key localities for the species in Australia, and it occurs mainly in temperate and sub-antarctic zones (from about 55˚ to 26˚S) in inshore areas.

The bottlenose dolphin (*Tursiops truncatus*) is a cosmopolitan species found in all Australian waters (except the Northern Territory), and is coastal, estuarine, pelagic and oceanic in nature, with the closest key locality being Port Phillip Bay, Victoria.

With close resemblance to the bottlenose dolphin, the Indian Ocean bottlenose dolphin (*Tursiops aduncus)* occur continuously around the Australian coast and are generally restricted to inshore areas such as bays and estuaries, nearshore waters, open coast environments, and shallow offshore waters (DoEE. 2019b) Breeding, calving may occur in the coastal regions of NSW but not extending into Victoria (NCVA. 2019).

The remaining listed dolphins which may occur in the EMBA are oceanic, pelagic species. Of these the killer whale (*Orcinus orca*) is most likely to be encountered as they are recorded from all states, with concentrations reported around Tasmania. They are most often seen along the continental slope and on the shelf, particularly near seal colonies (DoEE. 2019c).

The distribution of the False killer whale (*Pseudorca crassidens*) and the Southern Right Dolphin (*Lissodelphiss peronii*) is less understood due to the paucity of sightings, however both species are known to have a large range. The False killer whales, recorded in Australia through strandings, prefer deep, tropical to temperate offshore waters (DoEE. 2019d). The Southern Right dolphins are a pelagic species, generally occurring between the Subtropical and Subantarctic Convergences. They are usually found well offshore but when inshore are usually in deep water, or on the outer edges of the continental shelf. In the northern parts of its distribution, it is found associated with cold currents and upwelling conditions (DoEE. 2019a).

4.3.7 Seals

Two seal species are identified in the EPBC database as occurring in the EMBA. These are shown in Table 4-10.

The Australian fur seal (*Arctocephalus pusillus*) has established five breeding areas on Tasmanian islands in Bass Strait (Shaughnessy, 1999), which are Tenth Island, Moriarty Rocks, West Moncoeur, Judgement Rocks and Reid Rocks, the latter two being the largest breeding colonies in Tasmania. The project area is remote from these seal colonies, however seals do use the nearby oil and gas platform structures for resting and were recorded during the Longtom installation campaign hauled out on the installation vessels. Satellite tracking of Australian fur seals in Bass Strait indicates that seals generally forage in waters slightly deeper than at the proposed project site, with movements originating from Wilsons Promontory and The Skerries in east Gippsland (Arnould and Kirkwood, 2008 in Esso, 2012). The preferred habitats for Australian fur seals include rocky islands in exposed places close to the sea, on open slopes, shore platforms and reefs, pebbled beaches and caves (Strahan, 1995). The Australian fur seal diet consists of fish, cephalopods and seabirds and they give birth to live young from late October to late December (Shaughnessy, 1999). The project area is not within close proximity to any breeding colonies.

The New Zealand fur seal (*Arctocephalus forsteri*) is found predominantly in coastal areas of New Zealand, South Australia and southern parts of Western Australia. In Tasmania, New Zealand fur seal numbers are comparatively low, and the species is mainly found off the south and west coasts with breeding restricted to Maatsuyker Islands and other remote islands to the south (DPIWE, 2011). Breeding occurs during the summer months from early December through to January. The species breed ashore (generally on remote islands) and feed at sea, mostly on cephalopods and fish. The project area is not within close proximity to any breeding colonies.

Table 4-10 EPBC Act listed seals potentially occurring in the EMBA

Scientific Name	Common Name	Threatened Species	Migratory Species	Listed Marine Species	BIA	Type of Presence
Arctocephalus forsteri	New Zealand Fur-seal			✓		MO
Arctocephalus pusillus	Australian Fur-seal			✓	b	BKO
Threatened Species: V - Vulnerable *Biologically Important Areas*: b – breeding	*Type of Presence*: *MO* *Species or species habitat may occur within the area* *BKO* *Breeding known to occur within the area* *KO* *Species or species habitat known to occur within the area*					

4.3.8 Seabirds

The Victorian coast and islands of Bass Strait provide feeding, breeding and nesting habitats for many important coastal and migratory bird species. There are no islands or seabird colonies in the immediate vicinity of the project area. Some species, such as cormorants, roost at Cape Conran (Norris and Mansergh, 1981), to the northeast of the project area. Colonies of seabirds occur to the west of the project in Corner Inlet and on the islands around Wilsons Promontory, and to the east at the Skerries, Tullaberga Island and Gabo Island (Harris and Norman, 1981); all of which are over 100 km from the project area.

Seventy-four EPBC Act-listed bird species may occur within the EMBA. Of these, six are listed as critically endangered. These are the Curlew sandpiper (Calidris ferruginea), the Great knot (Calidris tenuirostris), Northern Siberian Bar-tailed Godwit (*Limosa lapponica menzbieri*), Eastern Curlew (*Numenius madagascariensis*), Swift Parrot (*Numenius madagascariensis*) and the Orange-bellied Parrot (*Neophema chrysogaster*).

The Swift Parrot and the Orange-bellied Parrot are listed marine species whose primary breeding habitat is forest. They breed in Tasmania and migrate to the mainland for winter. The Orange-bellied parrot feeds almost exclusively on seeds and fruits, mainly of sedges and salt-tolerant coastal saltmarsh plants. They are threatened primarily from native predation and loss of habitat (TSSC. 2006).

The remaining critically endangered listed bird species are all migratory wetland species which breed in the northern hemisphere and migrate to the southern hemisphere for winter. Their primary threat is loss of wetland habitat, not only in Australia but in all their resting places on the migratory route from the northern to the southern hemisphere (TSSC. 2016, DoEE.2016a, DoEE. 2016b).

Albatross

There are fifteen species of albatross listed to occur in the EMBA, all of which are either endangered or vulnerable, with the majority being migratory species. The nearest breeding site to the project area is Albatross Island, off the northwest coast of Tasmania, 405 km southwest of the proposed project site. Because albatross have a broad range of diets and foraging behaviours, their at-sea distributions are diverse and combined with their ability to cover vast oceanic distances, all Australian waters can be considered foraging habitat, though the most critical is the waters south of 25°S (SEWPAC, 2011a and 2013a).

Petrels

There are six listed petrel species which may occur in the EMBA, two of which are listed as endangered. The Southern Giant Petrel is one of these species and withing Australia is limited to breeding colonies on Maquarie and Heard islands. it is marine bird that occurs in Antarctic to subtropical waters and in summer mainly occurs over Antarctic waters. It feeds and it is widespread south as far as the pack-ice and onto the Antarctic continent (Marchant & Higgins 1990). It is an opportunist scavenger and predator which will scavenge on penguin carcasses, a wide variety of smaller seabirds, will also eat crustaceans and feed on seal and whale carrion (DoEE. 2019f). Gould's petrel, also endangered is only known to breed in Australia on Cabbage Tree Island, offshore Port Stephens in NSW. Its non breeding and feeding range, however is extensive and recorded as far west as Eyre in WA and herefore may occur witning the EMBA (DEC NSW. 2006).

Plovers

Of the four plovers that are listed as occurring in the EMBA, the hooded plover (eastern) is listed as vulnerable. It is a small Australian beach nesting bird. It mainly occurs on wide beaches backed by dunes with large amounts of seaweed and jetsam, creek mouths and inlet entrances. Its distribution is along beaches throughout the Victorian, Tasmanian and the majority of the South Australian coast and extending up to approximately Nowra in NSW. The hooded plover builds its nest above the high water mark. Its greatest threat is disturbance by domestic dogs (DoEE. 2019g).

Scolopacidae

With the scolopacidae family 17 of the 19 listed species which may occur in the EMBA are migratory wetland species. The critically endangered species have been described above.

The Red Knot is endangered, and like the majority of the species in this goup is a stong migratory wetland species which breeds in the northern hemisphere and migrates south for the winter. In Australia the Red Knot mainly inhabits intertidal mudflats, sandflats and sandy beaches of sheltered coasts. Its closest sight of importance to the project area is in Corner Inlet (DoEE. 2019h).

Others

Of the remaining species the Australasian Bittern, Eastern Bristlebird, and the Australian Painted snipe are endangered. The Australasian Bittern is a secretive, stocky, heron-like bird, living primarily in freshwater wetlands and rarely in estuaries or tital wetlands. It has a distribution between south-east Queensland to south-east South Australia and is unlikely to be impacted by project activities (TSSC. 2011).

The Eastern Bristlebird is a ground dwelling bird whose habitat primarily occurs as coastal, subcoastal and coastal escarpment scrubland / grassland / sedgeland and as open grassy forest on inland ranges and can extend to coastal dunes where feeding also occurs. Of the four populations known, the southern population is found in the Nadgee Nature Reserve on the Vic /NSW border and in Croajingalong National Park. Its main threats are fragmentation of habitat, predation, particularly by feral species and especially after fire. This species is unlikely to be impacted by project activities (NSW OEH. 2012).

The Australian Painted snipe has been recorded in wetlands in all states of Australia and no specific areas of importance are known around the project area (DoEE. 2019).

Table 4-11 lists conservation advice for threatened bird species and key threats potentially relevant to petroleum activities.

Table 4-11 EPBC Act-listed bird species that may occur within the EMBA

Scientific Name	Common Name	Threatened Species	Migratory Species	Listed Marine Species	BIA	Type of Presence
Albatross						
Diomedia antipodensis	Antipodean Albatross	V	✓ (M)	✓	f	FLO
Diomedia epomophora	Southern Royal Albatross	V	✓ (M)	✓	f	FLO
Diomedia exulans	Wandering Albatross	V	✓ (M)	✓	f	FLO
Diomedia gibsoni	Gibson's Albatross	V		✓	f	FLO
Diomedia sanfordi	Northern Royal Albatross	E	✓ (M)	✓		FLO

Scientific Name	Common Name	Threatened Species	Migratory Species	Listed Marine Species	BIA	Type of Presence
Phoebetria fusca	Sooty Albatross	V	✓ (M)	✓		LO
Thalassarche bulleri	Buller's Albatross	V	✓ (M)	✓	f	FLO
Thalassarche bulleri platei	Northern Buller's Albatross	V		✓		FLO
Thalassarche cauta	Shy Albatross	V	✓ (M)	✓	f	FLO
Thalassarche chrysostoma	Grey-headed Albatross	E	✓ (M)	✓		MO
Thalassarche eremita	Chatham Albatross	E	✓ (M)	✓		FLO
Thalassarche impavida	Campbell Albatross	V	✓ (M)	✓	f	FLO
Thalassarche melanophris	Black-browed Albatross	V	✓ (M)	✓	f	FLO
Thalassarche salvini	Salvin's Albatross	V	✓ (M)	✓		FLO
Thalassarche steadi	White-capped Albatross	V	✓ (M)	✓	-	FLO
Petrels						
Fregetta grallaria grallaria	White-bellied Storm-Petrel	V			-	LO
Halobaena caerulea	Blue Petrel	V		✓		MO
Macronectes giganteus	Southern Giant Petrel	E	✓ (M)	✓	-	FLO
Macronectes halli	Northern Giant Petrel	V	✓ (M)	✓	-	MO
Pelagodroma marina	White-faced Storm Petrel			✓	f	BKO
Pterodroma leucoptera leucoptera	Gould's Petrel	E				MO
Plover						
Charadrius bicinctus	Double-banded Plover		✓ (W)	✓		RKO
Charadrius ruficapillus	Red-capped Plover			✓		RKO
Thinornis rubricollis	Hooded Plover			✓		KO
Thinornis rubricollis rubricollis	Hooded Plover (eastern)	V		✓		KO
Scolopacidae - Sandpipers						

Scientific Name	Common Name	Threatened Species	Migratory Species	Listed Marine Species	BIA	Type of Presence
Actitis hypoleucos	Common Sandpiper		✓ (W)	✓		KO
Calidris acuminata	Sharp-tailed Sandpiper		✓ (W)	✓		RKO
Calidris ferruginea	Curlew Sand-piper	CE	✓ (W)	✓		KO
Calidris melanotos	Pectoral Sandpiper		✓ (W)	✓		KO
Scolopacidae - Other						
Arenaria interpres	Ruddy Turn-stone		✓ (W)	✓		RKO
Calidris alba	Sanderling		✓ (W)	✓		RKO
Calidris canutus	Red Knot	E	✓ (W)	✓		KO
Calidris ruficollis	Red-necked Stint		✓ (W)	✓		RKO
Calidris tenuirostris	Great Knot	CE	✓ (W)	✓		RKO
Gallinago hardwickii	Latham's Snipe		✓ (W)	✓		RMO
Gallinago megala	Swinhoe's Snipe		✓ (W)	✓		RLO
Gallinago stenura	Pin-tailed Snipe		✓ (W)	✓		RLO
Limosa lapponica	Bar-tailed Godwit		✓ (W)	✓		KO
Limosa lapponica baueri	Bar-tailed Godwit (bau-era)	V				KO
Limosa lapponica menzbieri	Northern Si-berian Bar-tailed Godwit	CE				MO
Numenius madagas-cariensis	Eastern Cur-lew	CE	✓ (W)	✓		KO
Numenius minutus	Little Curlew		✓ (W)	✓		RLO
Numenius phaeopus	Whimbrel		✓ (W)	✓		RKO
Tringa nebularia	Common Greenshank		✓ (W)	✓		KO
Shearwaters						
Puffinus carneipes	Flesh-footed Shearwater		✓ (M)	✓	-	FLO
Puffinus tenuirostris	Short-tailed Shearwater		✓ (M)	✓	-	BKO
Terns						
Sterna albifrons	Little Tern		✓ (M)	✓		BKO

Scientific Name	Common Name	Threatened Species	Migratory Species	Listed Marine Species	BIA	Type of Presence
Sterna bergii	Crested Tern		✓ (M)	✓	-	BKO
Sterna caspia	Caspian Tern		✓ (M)	✓		BKO
Sterna fuscata	Sooty Tern			✓		BKO
Sterna nereis	Fairy Tern			✓		BKO
Sternula nereis nereis	Australian Fairy Tern	V				BKO
Others						
Apus pacificus	Fork-tailed Swift		✓ (M)	✓		LO
Ardea alba	Great Egret			✓		BKO
Ardea ibis	Cattle Egret			✓		MO
Botaurus poiciloptilus	Australasian Bittern	E				KO
Catharacta skua	Great Skua			✓		MO
Dasyomis brachyp-terus	Eastern Bris-tlebird	E				KO
Eudyptula minor	Little Penguin			✓	f	BKO
Haliaeetus leuco-gaster	White-bellied Sea Eagle			✓		BKO
Himantopus himan-topus	Black-winged Stilt			✓		RKO
Hirundapus caudacu-tus	White-throated Needletail		✓ (T)	✓		KO
Larus novaehollan-diae	Silver Gull			✓		BKO
Lathamus discolor	Swift Parrot	CE		✓		KO
Merops ornatus	Rainbow Bee-eater			✓		MO
Monarcha melanopsis	Black-faced Monach		✓ (T)	✓		KO
Monarcha trivirgatus	Spectacled Monach		✓ (T)	✓		KO
Myiagra cyanoleuca	Satin Fly-catcher		✓ (T)	✓		KO
Neophema chryso-gaster	Orange-bel-lied Parrot	CE		✓		MO
Pachyptila turtur	Fairy Prion			✓		KO
Pachyptila turtur sub-antartica	Fairy Prion (southern)	V				KO
Pandion haliaetus	Osprey		✓ (W)	✓		KO

Scientific Name	Common Name	Threatened Species	Migratory Species	Listed Marine Species	BIA	Type of Presence
Rhipidura rufifrons	Rufous Fan-tail		✓ (T)	✓		LO
Rostratula australis	Australian Painted Snipe	E		✓		LO

Threatened Species: *V Vulnerable* *E Endangered* *CE Critically Endangered* *Migratory Species*: *M Marine* *W Wetland* *T Terrestrial* *Biologically Important Areas*: *b Breeding* *f Foraging*		*Type of Presence*: *MO Species or species habitat may occur within the area* *LO Species or species habitat likely to occur within the area* *KO Species or species habitat known to occur within the area* *FMO Foraging, feeding or related behaviour may occur within the area* *FLO Foraging, feeding or related behaviour likely to occur within the area* *FKO Foraging, feeding or related behaviour known to occur within the area* *BKO Breeding known to occur within the area* *RMO Roosting may occur within the area* *RLO Roosting likely to occur within the area* *RKO Roosting known to occur within the area*

Table 4-12 Conservation advice for threatened bird species and Key Threats

Common Name	Conservation Advice or Recovery Plan	Key Threats (potentially relevant to petroleum activities)
Antipodean Albatross	National Recovery Plan for Threatened Albatrosses and Giant Petrels, 2011-2016	Marine pollution, including marine debris
Southern Royal Albatross		
Wandering Albatross		
Gibson's Albatross		
Northern Royal Albatross		
Sooty Albatross		
Buller's Albatross		
Pacific Albatross		
Shy Albatross		
Chatham Albatross		
Campbell Albatross		
Black-browed Albatross		
Salvin's Albatross		
White-capped Albatross		
Grey-headed Albatross	National Recovery Plan for Threatened Albatrosses and Giant Petrels, 2011-2016	Marine pollution, including marine debris

Common Name	Conservation Advice or Recovery Plan	Key Threats (potentially relevant to petroleum activities)
	Approved Conservation Advice for *Thalassarche chrysostoma* (Grey-headed Albatross)	
White-bellied Storm-Petrel	Lord Howe Island Biodiversity Management Plan	None identified
Blue Petrel	Approved Conservation Advice for *Halobaena caerulea* (Blue Petrel)	None identified
Southern Giant Petrel	National Recovery Plan for Threatened Albatrosses and Giant Petrels, 2011-2016	Marine pollution, including marine debris
Northern Giant Petrel		
Gould's Petrel	Gould's Petrel (*Pterodroma leucoptera leucoptera*) Recovery Plan	Oil spills Note: oil spills in the vicinity Cabbage Tree Island are not considered a threat because the Gould's Petrel does not feed in coastal waters however, oceanic oil spills may pose some risk (NSW DEC, 2006)
Hooded Plover (eastern)	Approved Conservation Advice for *Thinornis rubricollis* (Hooded Plover, Eastern)	Oil spills Entanglements and ingestion of marine debris
Curlew Sandpiper	Approved Conservation Advice for *Calidris ferruginea* (Curlew Sandpiper)	Habitat loss and degradation from pollution Environmental pollution
Australian Fairy Tern	Approved Conservation Advice for *Sternula nereis nereis* (Fairy Tern)	Oil spills, particularly in Victoria, where the close proximity of oil facilities poses a risk of oil spills that may affect the species' breeding habitat
Australasian Bittern	Approved Conservation Advice for *Botaurus poiciloptilus* (Australasian Bittern)	Reduced water quality as a result of increasing salinity, siltation and pollution
Red Knot	Approved Conservation Advice for *Calidris canutus* (Red Knot)	Habitat loss and degradation from environmental Pollution Pollution or contamination impacts
Great Knot	Approved Conservation Advice for *Calidris tenuirostris* (Great Knot)	Habitat loss and degradation from environmental Pollution Pollution or contamination impacts
Red knot, Great knot, Bar-tailed godwit, Greater sand plover	Wildlife conservation plan for migratory shorebirds	Habitat loss and degradation from environmental Pollution Pollution or contamination impacts
Eastern Bristlebird	National Recovery Plan for Eastern Bristlebird (*Dasyornis brachypterus*)	None identified
Swift Parrot	Approved Conservation Advice for *Lathamus discolour* (Swift Parrot)	None identified
Bar-tailed Godwit (baueri)	Approved Conservation Advice for *Limosa lapponica bauera* (Bar-tailed Godwit)	Habitat loss and degradation from pollution Pollution/contamination

Common Name	Conservation Advice or Recovery Plan	Key Threats (potentially relevant to petroleum activities)
Orange-bellied Parrot	National Recovery Plan for the Orange-bellied Parrot (*Neophema chrysogaster*)	None identified
Eastern Curlew	Approved Conservation Advice for *Numenius madagascariensis* (Eastern Curlew)	Habitat loss and degradation from pollution Environmental pollution
Fairy Prion (southern)	Approved Conservation Advice for *Pachyptila turtur subantartica* (Fairy Prion Southern)	None identified
Australian Painted Snipe	Approved Conservation Advice for *Rostratula australis* (Australian Painted Snipe)	None identified

The little penguin (*Eudyptula minor*) is a flightless seabird that breeds in colonies along the southern coast of Australia. Very little is known about their populations, and Tasmanian estimates range from 110,000 to 190,000 breeding pairs, of which less than 5% are found on mainland Tasmania. Little penguins spend most of their time at sea when not breeding. Male penguins return to coastal colonies between June and August (which is also breeding time) to ready their nests for the egg laying season, which usually peaks in September and October (NOO, 2002). The nearest colonies of little penguins to the project area are located at Phillip Island in Western Port Bay (334 km to the west), Gabo Island (155 km to the east).

4.3.9 Reptiles

There are five reptile species listed in the EPBC Act as potentially occurring in the EMBA. These are shown in Table 4-13. Table 4-14 lists the approved conservation advice and/or recovery plans for listed turtle species, where they exist, with key threats potentially relevant to petroleum activities. One is known to regularly occur in Bass Strait, the leathery or leatherback turtle (*Dermochelys coriacea*), and is discussed further below. Four other potential, but rare, visitors to Bass Strait include the loggerhead turtle (*Caretta caretta*) (listed as endangered), the green turtle (*Chelonia mydas*) (listed as vulnerable), the hawksbill turtle (*Eretmochelys imbricata*) (listed as vulnerable) and the flatback turtle (*Natator depressus*) (listed as vulnerable).

The leathery turtle is listed as endangered under the EPBC Act. The loggerhead and green turtles are listed as endangered and vulnerable respectively, under the EPBC Act. No turtles are known to nest in the EMBA.

Adult Leathery Turtles are oceanic and are rarely found close to the shore in Australia (DSE, 2009). They follow warm water currents while migrating vast distances between their tropical nesting sites to the north of Australia and their temperate water feeding grounds to the south (where they are capable of inhabiting waters of 10 °C or possibly less). Juveniles (< 100 cm) are confined to tropical waters warmer than 26 °C and remain near the coastline (IUCN, 2003). There are no breading beaches within Victoria or the EMBA and the closest known breeding beach was near Balina in northern NSW.Their movement to temperate waters is generally associated with seasonal increases in sea surface temperatures (SSTs). In Victoria,

most sightings occur between January and May when SSTs are 15 °C – 21 °C in northern Bass Strait. Nearly 50 % of Victorian sightings are from April and May.

Bass Strait is considered to have one of the three largest concentrations of feeding Leathery Turtles in Australia (the others being central and southern New South Wales and across the Great Australian Bight) (C. Limpus pers. comm.).

Table 4-13 EPBC Act-listed turtle species that may occur within the EMBA

Scientific Name	Common Name	Threatened Species	Migratory Species	Listed Marine Species	Type of Presence
Caretta caretta	Loggerhead Turtle	E	✓	✓	BLO
Chelonia mydas	Green Turtle	V	✓	✓	FKO
Dermochelys coriacea	Leatherback Turtle	E	✓	✓	FKO
Eretmochelys imbricata	Hawksbill Turtle	V	✓	✓	FKO
Natator depressus	Flatback Turtle	V	✓	✓	FKO
Threatened Species: *V Vulnerable* *E Endangered*	*Type of Presence:* *FKO Foraging, feeding or related behaviour known to occur within the area* *BLO Breeding likely to occur within the area*				

Table 4-14 Conservation advice for threatened turtle species and Key Threats

Common Name	Conservation Advice or Recovery Plan	Key Threats (potentially relevant to petroleum activities)
Loggerhead Turtle	Recovery Plan for Marine Turtles in Australia, 2017-2027	Marine debris Chemical discharge Light pollution Habitat modification Vessel disturbance Noise interference
Green Turtle		
Hawksbill Turtle		
Flatback Turtle		
Leatherback Turtle	Recovery Plan for Marine Turtles in Australia, 2017-2027 Approved Conservation Advice for *Dermochelys coriacea* (Leatherback Turtle)	As above

4.3.10 Introduced Marine Species

In the South-east Marine Region, 115 introduced marine species have been recorded (NOO, 2002). Limited information exists on the nature and extent of introduced marine species, and it is assumed the species described below potentially exist within the EMBA.

The New Zealand screw shell (*Maoricolpus roseus*) is one species that has a well-documented history in Bass Strait. It is likely to have been introduced after 1920 with live oysters imported from New Zealand or within semi-dry ballast in timber vessels. It was first identified in southeast Tasmania and has since expanded its territory into eastern Bass Strait and further up the east coast of Australia (NOO, 2002). It forms extensive and dense beds on the sandy seafloor in eastern Bass Strait. The screw shell can tolerate water depths ranging from 1 to 130 m. An unusually high abundance (more than 90% of the total biomass of infauna) of the invasive New Zealand screw shell was recorded by Heislers and Parry (2007) at Point Hicks in eastern Bass Strait. Where this invasive species was most abundant, the diversity of infauna was reduced, suggesting that this exotic species poses a serious threat to the high diversity of infauna that is characteristic of much of Bass Strait (Heislers & Parry, 2007).

The northern pacific seastar (*Asterias amurensis*) also has the potential to impact Bass Strait. This species is believed to have arrived in Australia in ships' ballast water from Japan 20 years ago. The seastar feeds on a wide range of native animals and can have a major effect on the recruitment of native shellfish populations that form important components of the marine food chain. This species is already common in southeast Tasmanian waters and in Port Phillip Bay in Victoria and has the potential to cause environmental and economic harm in coastal waters from Sydney to Perth (DSE, 2012).

Abalone viral ganglioneuritis, a highly virulent herpes-like virus, has been recorded in Victoria. The virus affects the nervous tissue of abalone and rapidly causes death. The virus can be spread through direct contact, through the water column without contact and in mucus that infected abalone produce before dying. Originating from aquaculture farms, the virus has spread in wild populations in southwest Victoria since May 2006 (Parks Victoria, 2009).

4.4 Cultural Environment

There are no World Heritage or National Heritage listed places within the project area or within the EMBA. Similarly there are no cultural or natural Commonwealth Heritage listed places within the EMBA. The only Commonwealth Heritage historic listed places occurring within the EMBA are lighthouses (e.g., Gabo Island Lighthouse) however these are not considered relevant.

4.4.1 Indigenous protected Areas

Another form of protected area for indigenous culture is Native title. The Gunai-Kurnai people hold native title over much of Gippsland. The native title determination area (Tribunal file no. VCD2010/001) covers approximately 45,000 hectares and extends from west Gippsland near Warragul, east to the Snowy River, and north to the Great Dividing Range. It also includes 200 metres of offshore sea territory between Lakes Entrance and Marlo. The area includes 10 parks and reserves that are jointly managed by the Victorian government and the Gunai-Kurnai people (NNTT. 2010).

Native title rights do not confer exclusive rights of possession, use and enjoyment of the land or waters. Native title does not exist in minerals, petroleum or groundwater.

4.4.2 Maritime Heritage

The Australian National Shipwreck Database (SEWPAC, 2011b) indicates there are no shipwrecks registered as occurring within or near the project area (Longtom petroleum safety zones and pipeline). Likewise, there are no historic shipwreck protected zones in or near the project area (SEWPAC, 2011c).

There are approximately 57 historic shipwrecks within the EMBA. The majority of which are dotted on the coastline. Approximately 16 are located at or near Lakes Entrance and another approximately 20 shipwrecks are located around Cape Howe on the border of NSW and Victoria (DoEE. 2019e). None of these shipwrecks are within protected zones.

4.4.3 Archaeological Heritage

The Commonwealth Heritage List indicates there are no records of archaeological sites in or around the project area (SEWPAC, 2012a).

4.5 Socio-economic Environment

The South East Regional Marine Plan (NOO, 2002) forms the basis of the description of the socio-economic environment in the region.

4.5.1 Settlements

The communities of Lakes Entrance, Orbost and Marlo are closest to the project area (see Figure 4.4). They are located approximately 37 km, 38 km and 44 km northeast, respectively, in the Shire of East Gippsland.

The 2016 Australian census reveals that the total population for East Gippsland was approximately 47,000, with 11.5% of the population employed within the retail trade sector, 15.08% employed in health care and social assistance, and 9.15% employed in the agriculture, forestry and fishing sectors (East Gippsland Shire Council. 2019).

In NSW within the EMBA, Eden is the largest settlement with a population of approximately 3,100 people. Eden is a part of the Bega Valley Shire in NSW (ABS. 2019). Tourism employment accounts for 11% of the total in the shire and agriculture, forestry and fishing sectors account for 19% of total employment.

4.5.2 Tourism and Recreational Fishing

4.5.2.1 Victoria

The key towns servicing the tourist trade of the region are Lakes Entrance, Metung, Loch Sport, Paynesville and Mallacoota, the (coastal) half-way point between Melbourne and Sydney. The Ninety Mile Beach is a key draw card to the region, with this stretch of sand and dunes separating the ocean from the Gippsland Lakes. Lakes Entrance has a fishing port that supports offshore commercial (South East Trawl) and recreational fishing. Gippsland Lakes (the southern hemisphere's largest network of inland waterways) being a key draw card for tourists, offering boating, fishing, water sports and nature-based tourism. The Gippsland Lakes consist of three lakes – Wellington, Victoria and King, fed by the Mitchell, Tambo and Nicholson rivers. In 2016-17, tourism was estimated to be worth $785 million to the region's economy in direct and indirect Gross Regional Product or 6.6 per cent of the region's economy. Tourism generated employment of approximately 8,900 people or 8.6 per cent of the region's employment (direct and indirect jobs) (TEVE. 2019).

Recreational fishing is a significant activity in the nearshore area along Ninety Mile Beach, comprising beach-based fishing and boat-based fishing. Rocky reefs near Marlo, Cape Conran and Lakes Entrance are the main sites for boat angling (and also recreational diving), with boat ramps located at Port Albert, Port Welshpool, McLoughlins Beach, Manns Beach and Lakes Entrance. Species such as gummy shark (*Mustelus antarcticus*) and snapper (*Pagrus auratus*) are fished from the surf beaches and from boats, with other species targeted including sand flathead (*Platycephalus bassensis*), black bream (*Acanthopagrus butcheri*) and Australian salmon (*Arripis trutta*). Most marine recreational fishing in the area is coastal, surf, inland lakes and estuary fishing with only a small proportion of recreational boating activities venturing offshore. Discussions with the recreational fishing body indicated that there is virtually no recreational fishing activity within the projects licence area.

4.5.2.2 NSW

Tourism in the Bega Valley Shire, inclusive of the town of Eden at its southern end, was estimated at $251M in 2017-2018 (Bega Valley Shire Council. 2019). The coast is referred to as the Sapphire Coast and recreational fishing offered in the forms of game, reef, sport, estuary, rock and beach fishing are all popular from Eden. Tuna and kingfish fishing are popular as well as freshwater fishing, prawning, trapping and diving. Facilities for access are well developed and maintained throughout the coast (NSW DPI. 2016).

4.5.3 Oil and Gas Production

The Gippsland Basin is the most prolific hydrocarbon province in Australia. Oil production peaked in 1985 at about 500kbd or 90% of the total Australian crude oil output that year. Of more than 4 billion barrels (BSTB) of estimated initial oil and condensate reserves and 9.8 trillion cubic feet (TSCF) of initial sales gas reserves in the developed fields, more than 86% and 49% respectively, had been produced by the end of June 1998. As of 2018, Victoria (mostly the offshore Gippsland Basin), accounted for 11.29% of Australia's oil and condensate production, and 9.75% of Australia's gas production, second behind WA (APPEA, 2019). Oil and gas reserves from the Gippsland Basin are currently on the decline. However, the relatively unexplored Sorell and Bass Basins, indicate that there may be future production potential in the region.

The National Offshore Petroleum Titles office recorded 28 production licences and 15 exploration permits/retention leases as at April 2019 (NPPTA. 2019).

A network of subsea pipelines transports oil and gas from platform and subsea facilities to onshore processing plants at Longford and Orbost (Figure 4-4). Esso operated facilities are located within the EMBA.

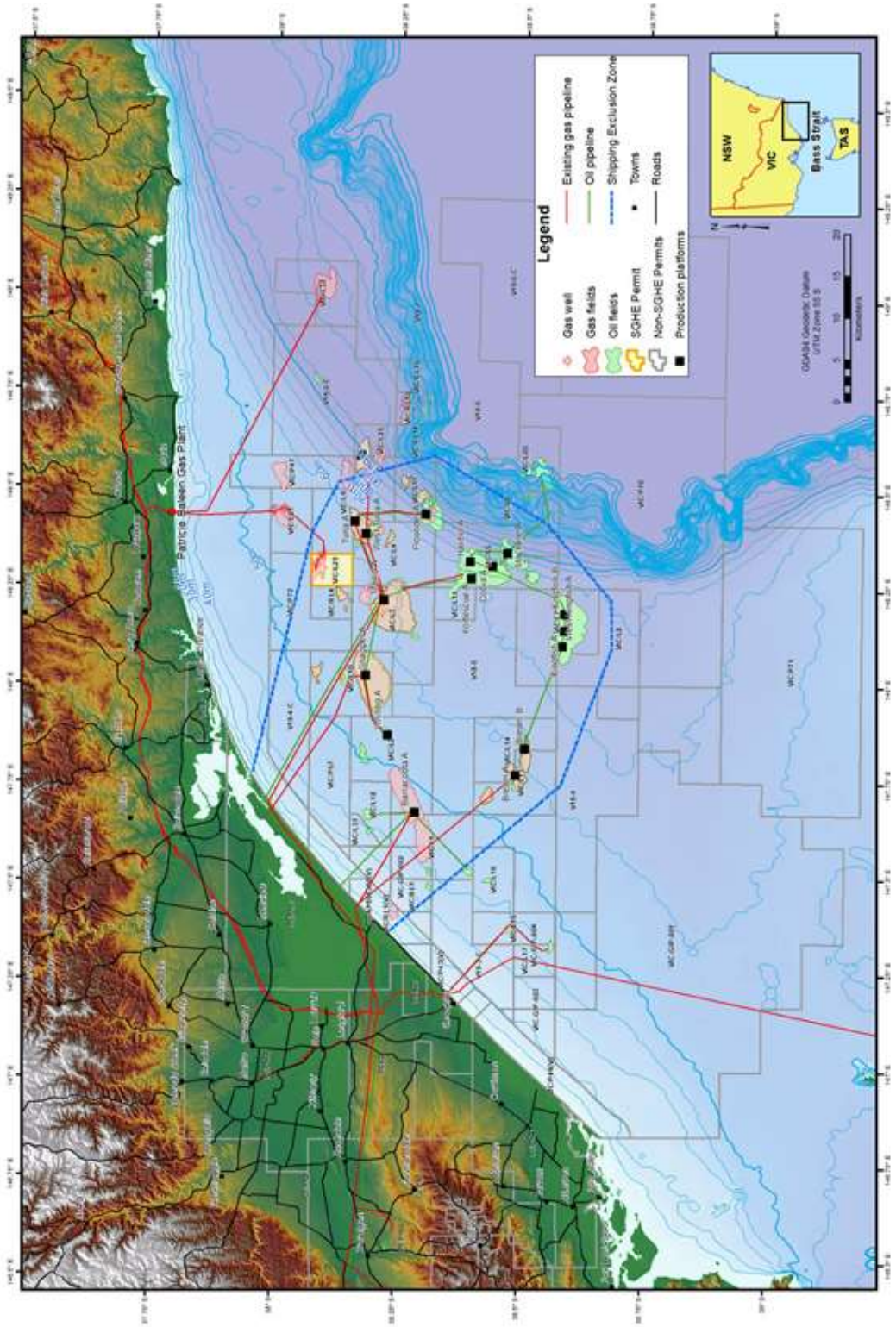


Figure 4-4 Existing oil and gas infrastructure in relation to VICL29

4.5.4 Shipping

Bass Strait is one of the busiest shipping routes in Australia, with more than 3,000 vessels transiting through the area each year (NOO, 2002). Under the Navigation Act 2012 (Cmlth), all vessels operating in Australian waters are required to report their location on a daily basis to the Rescue Coordination Centre (RCC Australia). Shipping patterns can be deciphered on this basis.

By volume, most heavy shipping movements in Bass Strait are east-west and west-east, quite a way south of the project area, between the ports of Fremantle, Western Australia, and Melbourne and Sydney (NOO, 2002; 2004). An 'Area to be Avoided' exclusion zone exists around the operating oil and gas platforms in the Gippsland Basin, whereby unauthorised vessels larger than 200 gross tonnes are excluded. The project area is located within this 'Area to be Avoided' (near the eastern boundary).

Two traffic separation schemes were implemented to enhance safety of navigation around the 'Area to be Avoided' by separating shipping into one-direction lanes for vessels heading north eastwards and those heading south westwards. One separation area is located south of Wilson's Promontory, and the other south of the Kingfisher B platform (DAFF, 2002) (see Figure 4.5). The project area is located approximately 60 km northwest of the main shipping lane (south of Kingfish B) and therefore interaction between commercial shipping vessels and project activities is expected to be negligible.

4.5.5 Commercial Fishing

The project area is overlapped by the jurisdiction of several Commonwealth and State-managed fisheries, as outlined below.

4.5.5.1 Commonwealth-managed Fisheries

Commonwealth fisheries are managed by the AFMA under the *Fisheries Management Act 1991*. Their jurisdiction covers the area of ocean from 3 nm from the coast out to the 200 nm limit (the extent of the Australian Fishing Zone). Fisheries with jurisdictions to fish over the project area include the:

- Southern and Eastern Scalefish and Shark (SESS), incorporating;
  - Southern Shark Fishery.
  - Southeast Trawl Fishery.
  - Southeast Non-trawl Fishery.
  - Great Australian Bight Trawl Fishery.
- Bass Strait Central Zone Scallop.
- Southern Squid Jig.
- Southern Bluefin Tuna.

- Eastern Skipjack (Tuna).
- Eastern Tuna and Billfish.
- Small Pelagic fisheries (AFMA, 2012).

Table 4-15 provides a summary of each of these fisheries and whether their operations interact with the project area and occur within the EMBA. Consultation undertaken with the fishery groups indicates that the only Commonwealth-managed fisheries likely to operate around the project area are the SESS and Small Pelagic fisheries.

4.5.5.2 Victorian-managed Fisheries

Victorian fisheries are managed by the fisheries department of the DEWLP (formerly DEPI) under the *Fisheries Act* 1995. Although Victorian state waters extend only from the coastal baseline (generally the high water mark) out to 3 nm, Victoria's fisheries do extend into Commonwealth waters. Victorian-managed fisheries with jurisdictions to fish over the Longtom area include the:

- Abalone.
- Rock lobster (incorporating giant crab – note there is no giant crab fishing undertaken within the EMBA).
- Scallop.
- Snapper.
- Shark.
- Squid fisheries.

Table 4-15 provides a summary of each of these fisheries and whether their operations interact with the project area and occur within the EMBA. Consultation undertaken with the fishery groups indicates that the only Commonwealth-managed fisheries likely to operate around the project area are the Danish Sein fishers operating out of Lakes Entrance.

Most fishing vessels operating in eastern Bass Strait operate from Lakes Entrance, although not exclusively; trawl, shark and scallop vessels may come from other Victorian and interstate ports.

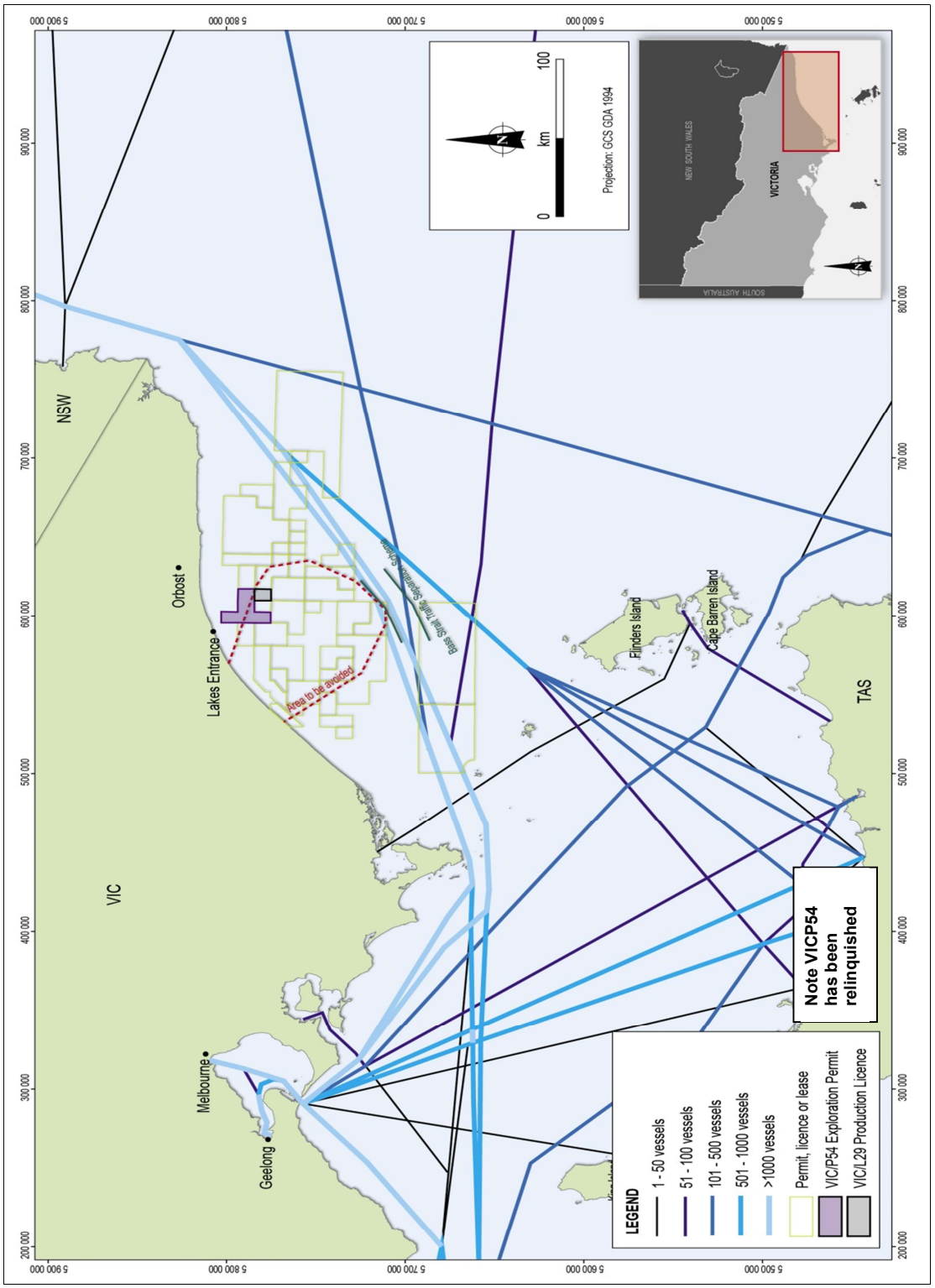


Figure 4-5 Shipping Routes and 'Area to be Avoided' in relation to VICL29

Table 4-15 Commonwealth-managed fisheries with jurisdiction to operate in the project area

Fishery	Area fished/Season	Intersects project site?	Within EMBA?	Main species targeted	Catch/Value	Fishing method	Fishing concession
Southern and Eastern Scalefish and Shark (Shark Gillnet and Shark Hook sector)	Large area, operators are limited to specific areas based on historical fishing methods, as specified on their fishing permits. **Season:** Open all year. Current closure through much of Bass Strait for all demersal otter trawling and automatic longlining inside the 183 m depth contour in order to protect school and gummy sharks and their habitat.	AFMA mapping = YES. SETFIA indicates that central Bass Strait has a trawl exclusion zone in place. SESS fishing possible in general area.	Yes	34 species, subject to quota management based on historical fishing methods. Target species include: Scalefish – blue eye trevlla, pink ling. Shark hook – gummy shark. Shark gillnet – gummy shark. Trap – pink ling.	$25.29 million (2016-17). 4,785 tonnes (2007-08).	Scalefish – demersal longline, automatic longline and dropline. Shark hook – demersal longline. Shark gillnet – bottom set gillnet. Trap – fish trap.	Gillnet – 62. Shark hook – 13. Scalefish hook – 58 Trap – 2.
Southern and Eastern Scalefish and Shark (Commonwealth Trawl and Scalefish hook sectors))	The fishery covers the area of the Australian Fishing Zone extending southward from Barranjoey Point (north of Sydney) around the NSW, Victorian and Tasmanian coastlines to Cape Jervis in South Australia. **Season:** Open all year.	AFMA mapping = YES. Fishing possible in general area.	Yes	Blue grenadier, tiger flathead, pink ling, eastern school whiting and silver warehou.	$47.01 million (2016-17).	Predominantly otter trawl and Danish seine, with some midwater trawling.	statuatory fishing rights: 57 trawl, 37 scalefish hook
Bass Strait Central	All of Bass Strait, between the zones managed by Victoria and	AFMA mapping = YES.	Yes	Commercial scallop (*Pecten fumatus*).	TAC for commercial scallops in	Towed dredge in muddy to	455,000 commercial scallop SFRs.

Fishery	Area fished/Season	Intersects project site?	Within EMBA?	Main species targeted	Catch/Value	Fishing method	Fishing concession
Zone Scallop	Tasmania that lie within 20 nm of their respective coasts. The Victorian Scallop Fishermans Association indicates a maximum fishing depth of about 45 m. **Season:** 11 July to 31 December (2017), closure allows for peak spat settlement. Managed under a harvest strategy by setting of total allowable catch combined with seasonal and area closures.	Project site is deeper than current maximum scallop fishing depth and historically not subject to scallop fishing = NO		Doughboy scallop (*Chlamys asperrimus*) as a by-catch.	2017 set at 3,000 tonnes; 100 tonnes for doughboy scallops. 2016-17 $6.00 million	coarse sandy bottoms. Victorian vessels operate out of Lakes Entrance.	455,000 doughboy scallop SFRs. 63 permits in 2017 (12 active vessels)
Southern Squid	Includes Commonwealth waters adjacent to NSW, Victoria, South Australia, Tasmania and Queensland up to Sandy Cape. The major fishing grounds are off the southeast corner of Australia. Squid jig catches are mainly taken between Queenscliff and Portland, off the Victorian coastline, and south of Kangaroo Island off the South Australian coast with some historical activity reported from Tasmanian waters. **Season:** Mostly from Jan to June.	AFMA mapping = YES. Fishing is mainly west of the project site (Port Phillip Bay heads and west) = NO.	No	Gould's squid (*Nototodarus gouldi*)	213 tonnes 2016-17 Value $0.57 million	Squid jigging	4,900 SFRs in 2017 8 active vessels
Eastern Tuna and Billfish	Extends from Cape Yok (Qld) to the Vic/SA border, out to 200 nm. AFMA indicates that it is the continental shelf and slope waters	AFMA mapping = YES.	No	Yellowfin tuna (*Thunnus albacares*), bigeye tuna (*T. obesus*), albacore tuna (*T. alalunga*), broadbill swordfish	For 2016-17: Yellowfin – 1,713 tonnes ($12.6 million).	Pelagic longline, minor line (handline, troll, rod and reel).	86 longline permits and 93 minor line only permits.

Fishery	Area fished/Season	Intersects project site?	Within EMBA?	Main species targeted	Catch/Value	Fishing method	Fishing concession
	that are targeted – central Bass Strait is too shallow. **Season**: Open all year. Management methods Total allowable catch and individual transferable quotas	AFMA consultation = NO.		(*Xaphias gladius*) and striped marlin (*Tetrapturus audax*).	Bigeye – 449 tonnes ($7.3 million). Albacore – 992 tonnes (4.1 million). Billfish – 1,461 tonnes ($10.3 million). Value 2016-17 $35.67M		
Skipjack Tuna (Eastern)	On the east coast, extends from far north Queensland to Tasmania. Main fishing grounds are off southeast NSW. AFMA indicates that it is the continental shelf and slope waters that are targeted – central Bass Strait is too shallow. **Season**: Open all year.	AFMA mapping = YES. AFMA consultation = NO.	No	Skipjack tuna (*Katsuwonus pelamis*) By-catch accounts for less than 2% of total landings.	no catch in 2016-17 Value – no fishing in 2016-17	Purse seine (~98%) and pole catch (~2%).	17 licence holders in Eastern Skipjack Fishery.
Southern Bluefin Tuna	All waters in the Australian Fishing Zone (out to 200 nm from the 3nm limit). AFMA indicates that it is the continental shelf and slope waters that are targeted – central Bass Strait is too shallow. **Season**: Open all year.	AFMA mapping = YES. AFMA consultation = NO. Main area is the Great Australian Bight.	No	Southern bluefin tuna (*Thunnus maccoyii*).	Purse seine 4,684 T ($31.4 million) Pelagic Line 650 T ($7.17 million), Total $38.54 milion (2016-17).	Purse seine.	89 SFR owners 6 purse seine vessels 16 longline vessels

Fishery	Area fished/Season	Intersects project site?	Within EMBA?	Main species targeted	Catch/Value	Fishing method	Fishing concession
Small Pelagic (Zone C)	Extends from the Queensland/NSW border, typically outside 3 nm, around southern Australia to a line at latitude 31° south (near Lancelin, north of Perth) **Season**: Uncertain, likely all year. Management of the SPF is operationalised through a harvest strategy – leading to TAQs and ITQs	Yes, can occur.	Yes	Jack mackerel (*Trachurus declivis*, *T. symmetricus*, *T. murphyi*), blue mackerel (*Scomber australasicus*), redbait (*Emmelichthys nitidus*) and Australian sardine (*Sardinops sagax*).	Value - confidential	Purse seine and mid-water trawl.	30 entities held quota SFRs in 2017–18

Sources: SIV (2011); AFMA (2011).
Acronyms: Commonwealth Victorian Inshore Trawl (CVIT), Commonwealth Trawl Sector (CTS), South East Trawl Fishery (SETF), Statutory Fishing Rights (SFR), Total Allowable Catch (TAC), Australian Fishing Zone (AFZ).

Table 4-16 Victorian-managed fisheries with jurisdiction to operate in the project area

Fishery	Area fished/Season	Intersects project site?	Within EMBA?	Main species targeted	Catch/Value (2017/18)	Fishing method	Fishing licences (2018)
Abalone	All Victorian coastal and offshore waters. **Season** – open all year.	Occurs close to shore and on reefs = NO.	Yes	Blacklip abalone (*Haliotis rubra*), greenlip abalone (*H. laevigata*).	721 tonnes $20.499 million.	Diving – highly selective with no by-catch.	23 licences in the eastern zone.
Rock lobster	The entire Victorian coastline is available for rock lobster fishing, divided into a western and eastern zone. **Season** – closed from 15 September to 15 November for males, 1 June to 15 November for females, to protect spawning stock.	YES – Eastern Zone (Lakes Entrance region) however no known rock lobster fishing in Longtom Permit area = NO.	Yes	Eastern rock lobster (*Jasus verreauxi*), southern rock lobster (*J. edwarsii*).	287 tonnes $23.277 million.	Baited lobster pots.	36 licences in the eastern zone.
Giant crab	Linked to the rock lobster fishery. Only Western Zone rock lobster licence holders with a giant crab endorsement are eligible for a giant grab licence. **Season** – closed from 15 September to 15 November for males, 1 June to 15 November for females, to protect spawning stock.	NO – western zone only.	No	Giant crab (*Pseudocarcinus gigas*).	Insufficient data	Baited lobster pots.	14
Scallop	Extends 20 nm from the coast (37 km). Maximum diving depth is about 45 m.	Technically yes, but site is too deep for scallop fishing = NO.	Yes	Commercial scallop (*Pecten fumatus*).	Insufficient data	Box-shaped harvester dragged or towed along seabed.	88

	Season – all year, generally no fishing during December to February.						

Fishery	Area fished/Season	Intersects project site?	Within EMBA?	Main species targeted	Catch/Value (2017/18)	Fishing method	Fishing licences
Snapper	Most snapper are caught in bays, inlets and coastal waters to the west of Wilsons Promontory, with some small fisheries east of Wilsons Promontory, but catches are low. **Season** – May to end of November.	NO	Yes	Snapper (*Pagrus auratus*)	64 tonnes. Value unknown.	Long-lines with 200 hook limit is the main method, haul seine and mesh nets also used.	162 licences (open fishery access).
Shark (Shark Gillent and the Shark Hook Sector (SGSHS))	An agreement between Victoria and AFMA means that all gummy and school sharks caught in the Southern Shark Fishery are managed by AFMA.	See Table 4.15. YES.	Yes	Gummy (*Mustelus antarcticus*), school (*Galeorhinus galeus*), dog (Family squalidae), whiskery sharks (*Furgaleus macki*).	See Table 4.15.	See Table 4.15.	See Table 4.15.
Squid	Found in water depths from 50 to 200 m. Season starts in February and ends in June, moving westwards from Port Phillip Bay heads. An agreement between Victoria and AFMA means that this fishery is now managed by AFMA.	See Table 4.15. NO.	Yes	Gould's squid (*Nototodarus gouldi*) (previously known as Arrow squid).	See Table 4.15.	See Table 4.15.	See Table 4.15.

Sources: SIV (2012), DPI (2012), AFMA (2011) consultation with various fisheries stakeholders.

4.6 Conservation Areas and Sensitivities

This section provides a description of the marine conservation areas established by the Commonwealth and Victorian governments. The EMBA intersects several of these marine reserves, as outlined below.

Australia has developed a marine reserve system through the establishment of a National Representative System of Marine Protected Areas (MPAs). Marine bioregional planning has been implemented in five areas across Australia, these being the south-east, east, north, north-west and south-west. Bass Strait falls within the South-east Marine Region (Figure 4.6).

The conservation of natural and anthropological heritage in Commonwealth marine areas is grouped into the following categories (with the nearest sites listed):

- Commonwealth marine reserves – East Gippsland, Beagle and Flinders Marine Reserves.
- Ramsar sites – Gippsland Lakes.
- World heritage – none in or abutting Bass Strait.
- Commonwealth heritage places – none in or abutting Bass Strait.
- National heritage – none in or abutting Bass Strait.

Brief descriptions of the marine conservation areas and RAMSAR sites closest to the project area or within the EMBA are described below.

4.6.1 Commonwealth Marine Reserves

4.6.1.1 East Gippsland Commonwealth Marine Reserve

The East Gippsland Commonwealth Marine Reserve lies to the east and just beyond the fringe of the EMBA and covers 4137 km^2 of Commonwealth ocean territory.

The reserve contains a large network of canyons, continental slope and escarpment at depths from 600 m to more than 4000 m. The reserve also contains warm and temperate waters, which may create a habitat for free-floating aquatic plants or phytoplankton communities. Oceanic seabirds are known to forage in these waters, including albatrosses, the great-winged petrel, wedge-tailed shearwater and cape petrel. Humpback whales are also known to pass by during their migrations (SEWPAC, 2013b). Table 4-17 describes the marine park, its values and assigned zones.

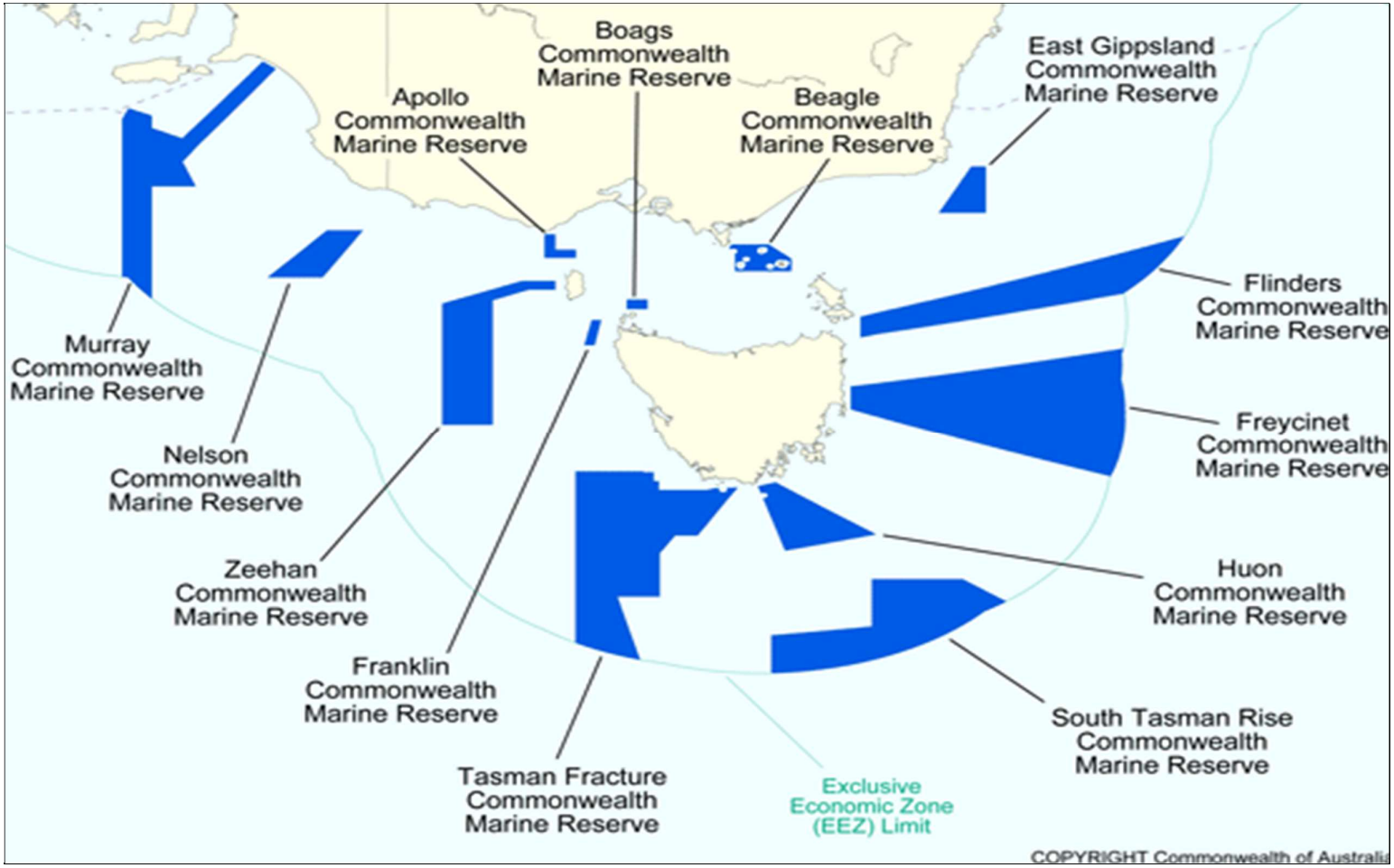


Figure 4-6 South-east Marine Region Marine Reserves

Table 4-17 East Gippsland Commonwealth Marine Reserve Description and Values (DNP. 2013)

Proclaimed	28 June 2007			
IUCN category assigned by this Management Plan and reserve management zone name	IUCN VI—Multiple Use Zone			
Assigned zones in reserve:	IUCN Ia	IUCN II	IUCN IV	IUCN VI
				Multiple Use Zone
Depth of reserve below seabed	100 m			
Total area	4,137 km^2 (413 700 ha).			
Major conservation values	Examples of ecosystems, habitats and communities associated with: • the Southeast Transition and associated with sea-floor features: o abyssal plain/deep ocean floor o canyon o escarpment o knoll/abyssal hill o slope Features with high biodiversity and productivity: • Bass Cascade • upwelling east of Eden Important foraging area for: • Wandering, Black-browed, Yellow-nosed and Shy albatrosses; Great-winged petrel; Wedge-tailed shearwater; and Cape petrel Important migration area for: • Humpback whale			
Location	The East Gippsland Commonwealth Marine Reserve is off the north-east corner of Victoria, on the continental slope and escarpment.			
General description of the reserve	The East Gippsland Commonwealth Marine Reserve contains representative samples of an extensive network of canyons, continental slope and escarpment at depths from 600 m to more than 4000 m. The geomorphic features of this reserve include rocky-substrate habitat, submarine canyons, escarpments and a knoll, which juts out from the base of the continental slope. The reserve includes both warm and temperate waters, which create habitat for free-floating aquatic plants or microscopic plants (i.e. phytoplankton) communities. Complex seasonality in oceanographic patterns influences the biodiversity and local productivity. The East Australian Current brings subtropical water from the north, and around Cape Howe the current forms large eddies, with a central core of warm water. Around the outside of the eddies, cooler, nutrient-rich waters mix with the warm water creating conditions for highly productive phytoplankton growth, which supports a rich abundance of marine life. During winter, upwellings of cold water may occur and bring nutrient-rich waters to the surface, boosting productivity. Many oceanic seabirds forage in these waters, including albatrosses (e.g. Wandering, Black-browed, Yellow-nosed and Shy albatrosses), the Great- winged petrel, Wedge-tailed shearwater and Cape petrel. Humpback whales pass by during their migrations north and south along the eastern seaboard.			

4.6.1.2 Beagle Commonwealth Marine Reserve

The Beagle Commonwealth Marine Reserve, located approximately 150 km southwest of the project area, lies just to the west of the EMBA and covers 2,928 km^2 of Commonwealth ocean territory. The reserve has a depth range between 50 to 70 metres. It was proclaimed in June 2007 and represents an area of shallow continental shelf ecosystems in the major biological zone that extends around south-eastern Australia to the east of Tasmania (SEWPAC, 2011d). The reserve surrounds a collection of Bass Strait islands, containing deep rocky reefs and provides a feeding ground for a variety of seabirds, little penguins and Australian fur seals. The Beagle Commonwealth Marine Reserve is designated as a Multiple Use Zone. Table 4-18 describes the marine park, its values and assigned zones.

Table 4-18 Beagle Commonwealth Marine Reserve Description and Values (DNP. 2013)

Proclaimed	28 June 2007			
IUCN category assigned by this Management Plan and reserve management zone name	IUCN VI—Multiple Use Zone			
Assigned zones in reserve:	IUCN Ia	IUCN II	IUCN IV	IUCN VI
				Multiple Use Zone
Depth of reserve below seabed	100 m			
Total area	2,928 km^2 (292 800 ha)			
Major conservation values	Ecosystems, habitats and communities associated with: • the Southeast Shelf Transition and associated with sea-floor features: o basin o plateau o shelf o sill Important migration and resting on migration area for: • southern right whale Important foraging area for: • Australian fur seal • Killer whale • Shy albatross, Australasian gannet, Short-tailed shearwater, Pacific and Silver gulls, • Crested tern, Common diving petrel, Fairy prion, Black-faced cormorant and Little penguin • White shark Cultural and heritage sites: • the wreck of the steamship SS Cambridge • the wreck of the ketch Eliza Davies			
Location	The Beagle Commonwealth Marine Reserve lies entirely within Bass Strait, with its north-western edge abutting Victorian waters south-east of Wilson's Promontory. It is a shallow-water reserve surrounding a collection of Bass Strait islands.			

General description of the reserve	The Beagle Commonwealth Marine Reserve represents an area of shallow continental shelf ecosystems in depths of about 50–70 m that extends around south-eastern Australia to the east of Tasmania. The sea floor that it covers formed a land bridge between Tasmania and Victoria during the last ice age 10 000 years ago. Its boundary encloses Tasmania's Kent Group Marine Reserve and the Hogan and Curtis Island groups. Nearby to the north-east is Victoria's Wilsons Promontory Marine National Park. The reserve encompasses the fauna of central Bass Strait, which is expected to be especially rich based on studies of several sea floor–dwelling animal groups. Its ecosystems are similar to those documented for the deeper sections of the Kent Group Marine Reserve, especially those based around habitats of rocky reefs supporting beds of encrusting, erect and branching sponges, and sediment composed of shell grit with patches of large sponges and sparse sponge habitats. Islands encompassed by the reserve and nearby islands support important breeding colonies for many seabirds and for the Australian fur seal. The waters of the reserve provide an important foraging area for those species breeding nearby. The rich marine life also attracts top predators, such as the great white shark and killer whales. The SS Cambridge, a British freighter, which lies in the reserve to the east of Wilson's Promontory, was sunk in 1940 by a WWII mine. The trading ketch Eliza Davies, which lies in the reserve to the east of Wilson's Promontory, sunk under tow in 1924.

4.6.1.3 Flinders Commonwealth Marine Reserve

The Flinders Commonwealth Marine Reserve covers a depth range from about 40 metres on the shallow continental shelf to abyssal depths of 3,000 m or more. The reserve spans the continental shelf, slope and deeper water ecosystems of the major biological zone that extends around south-eastern Australia to the east of Tasmania. Sea bottom dwelling habitats include sheer rocky walls and large rocky outcrops that support a rich diversity of small seabed animals such as lace corals and sponges. These and the large expanses of sandy and muddy sediments are habitats to a wide variety of fishes and to populations of the giant crab.

A prominent feature of this reserve is a large off-shore seamount believed to be too deep to have been fished. Seamounts are generally considered to be important centres of deep ocean biodiversity. Although little is known about the fauna of this seamount, based on information from other better known, offshore seamounts, seabed animals are expected to include endemic species. Table 4-19 describes the marine park, its values and assigned zones.

Table 4-19 Flinders Commonwealth Marine Reserve Description and Values (DNP. 2013)

Proclaimed	28 June 2007
IUCN category assigned by this Management Plan and reserve management zone name	IUCN II—Marine National Park zone

Assigned zones in reserve 2	IUCN Ia	IUCN II	IUCN IV	IUCN VI
		Marine National Park Zone		Multiple Use Zone
Depth of reserve below seabed	100 m			
Total area	27 043 km^2 (2 704 300 ha)			
Major conservation values	Examples of ecosystems, habitats and communities associated with: • the Tasmania Province • the Tasmanian Shelf Province • the Southeast Transition • the Southeast Shelf Transition And associated with sea-floor features: • abyssal plain/deep ocean floor • canyon • plateau • seamount/guyot • shelf slope Features with high biodiversity and productivity: • east Tasmania subtropical convergence zone Important foraging area for: • wandering, black-browed, yellow-nosed and shy albatrosses, northern giant petrel, Gould's petrel and cape petrel • killer whale • white shark • Harrison's dogfish Important migration area for: • humpback whale			
Location	The Flinders Commonwealth Marine Reserve is east of the north-east tip of Tasmania and Flinders Island and extends over 400 km eastward.			
General description of the reserve	The Flinders Commonwealth Marine Reserve covers a depth range from about 40 m on the shallow continental shelf to abyssal depths of 3000 m or more near the edge of Australia's exclusive economic zone. Key features of this area are the continental shelf, and a long section of steep continental slope, incised by a series of deep submarine canyons. Sea bottom habitats include sheer rocky walls and large rocky outcrops that support a rich diversity of small seabed animals, such as lace corals and sponges. These and the large expanses of sandy and muddy sediments are habitats to a wide variety of fishes and to populations of the giant crab. Areas between 400 m and 600 m of the continental slope sea floor are habitat for dogfish and gulper sharks, and Harrison's dogfish has been recently recorded in the reserve. The biodiversity of the reserve is influenced by summer incursions of the warm East Australian Current and associated large-scale eddies. Another prominent feature is a large offshore seamount believed to be too deep to have been fished. Seamounts are generally considered to be important centres of deep ocean biodiversity, offering a wide range of habitats at different depths and orientations to currents. The large seamounts to the east of Tasmania are believed			

	to be individually important, providing habitat to species that may be unique to each seamount and to a range of more widely occurring species that make their homes only on their rocky slopes. Presently, little is known about the fauna of these seamounts, but based on information from other better known offshore seamounts, seabed animals are expected to include endemic species.

4.6.2 Wetlands of International Importance

Australia currently has 64 Ramsar wetlands that cover around 8.1 million hectares (SEWPaC, 2012e). Ramsar wetlands are those that are representative, rare or unique wetlands, or are important for conserving biological diversity. These are included on the List of Wetlands of International Importance.

4.6.2.1 Ramsar Wetland Sites - Eastern Victorian Coast

Gippsland Lakes Ramsar Site

The nearest wetland of international significance to the project area is the Gippsland Lakes, located on the coast of the Ninety Mile Beach, 54 km northwest.

The Gippsland Lakes Ramsar site was listed in December 1982 and covers an area of 60,015 ha. The lakes are a series of large, shallow, coastal lagoons approximately 70 km in length and 10 km wide, separated from the sea by sand dunes (SEWPaC, 2012f).

The Gippsland Lakes form the largest navigable inland waterway in Australia and create a distinctive regional landscape of wetlands and flat coastal plains of considerable environmental significance. The Ramsar site contains three main habitat types: marine subtidal aquatic beds, coastal brackish or saline lagoons and fringing wetlands. A significant quantity of threatened, endangered, vulnerable or rare native fish communities, mammal, amphibian, and plant species exist within these habitats. The bird diversity of the Ramsar wetland is also high with 48 species of waterbirds being recorded, including the blue-billed duck, fairy tern, and magpie goose. A summary of critical components, processes and services/benefits of the Gippsland Lakes Ramsar Site is shown in Table 4-20 and the limits of acceptable change for the Ramsar site are described in Table 4-21.

Table 4-20 Gippsland Lakes Ramsar site: Summary of critical components, processes and services/benefits (SEWPAC. 2010)

Critical components	Critical processes	Critical services/benefits
Wetland habitats: grouped as follows (C1) marine subtidal aquatic beds (seagrass/aquatic plants). (C2) coastal brackish or saline lagoons (open water phytoplankton-dominated habitats). fringing wetlands that can occur within the site as– (C3) predominantly freshwater wetlands (C4) brackish wetlands (C5) saltmarsh/ hypersaline wetlands. **Wetland flora and fauna:** (C6) abundance and diversity of waterbirds. (C7) presence of threatened frog species (green and golden bell frog; growling grass frog). (C8) presence of threatened wetland flora species.	Hydrological regime: (P1) patterns of inundation and freshwater flows into the wetland system, groundwater influences and marine inflows that affect habitat structure and condition. Waterbird breeding functions: (P2) critical breeding habitats for a variety of waterbird species.	Threatened species: (S1) the site supports an assemblage of vulnerable or endangered wetland flora and fauna that contribute to biodiversity. Fisheries resource values: (S2) the site supports key fisheries habitats and stocks of commercial and recreational significance.
Supporting Components	**Supporting Processes**	**Supporting services/benefits**
Other wetland habitats: supported by the site (sand/pebble shores, estuarine waters, etc.). Other wetland fauna: supported by the site (for example, fish, aquatic invertebrates).	Climate: patterns of temperature, rainfall and evaporation. Geomorphology: key geomorphologic/ topographic features of the site. Coastal and shoreline processes: hydrodynamic controls on coasts and shorelines through tides, currents, wind, erosion and accretion. Water quality: water quality influences aquatic ecosystem values, noting the key water quality variables for Gippsland Lakes are salinity, dissolved oxygen, nutrients and sediments. Nutrient cycling, sediment processes and algal blooms: primary productivity and the natural functioning of nutrient cycling/flux processes in waterbodies. Biological processes: important biological processes such as primary productivity.	Tourism and recreation: the site provides and supports a range of tourism and recreational activities that are significant to the regional economy. Scientific research: the site supports and contains features important for scientific research.

Table 4-21 Gippsland Lakes Ramsar site: Limits of acceptable change (LAC) (SEWPAC. 2010)

Number	Indicator for Critical Component / Process/Service for the LAC	Relevant timescale[1]	Limit(s) of Acceptable Change	Spatial scale/temporal scale of measurements	Underpinning baseline data	Secondary critical C,P,S addressed through LAC
Critical components						
C1	Marine sub-tidal aquatic beds (for example, within Lake King, Lake Victoria, Lake Tyers, Bunga Arm and Lake Bunga)	Long Term	Total seagrass extent will not decline by greater than 50 per cent of the baseline value of Roob and Ball 1997 (that is, 50 per cent of 4330 hectares = 2165 hectares) in two successive decades at a whole of site scale. Total mapped extent of dense and moderate *Zostera* will not decline by greater than 80 per cent of the baseline values determined by Roob and Ball (1997) in two successive decades at any of the following locations: Fraser Island Point Fullerton, Lake King Point King, Raymond Island, Lake King Gorcrow Point – Steel Bay, Lake Victoria Waddy Island, Lake Victoria	Sampling to occur at least twice within the decade under consideration. Baseline mapping against which this LAC can be tested is within Roob and Ball 1997. Note that the seagrass assessment by Hindell (2008) did not produce mapping but did use similar sampling sites to Roob and Ball.	Level B – Recent quantitative data describes seagrass condition at various sites but over a limited timeframe. There is no available seagrass condition data prior to listing.	P1
C2	Coastal brackish or saline lagoons (for example, Lake King, Lake Victoria, Lake Wellington, Lake Tyers)	Long Term	No change in wetland typology from the 1980 classification of Corrick and Norman (1980), as presented in Figure 2-3.	To be determined based on expert review.	Level B – VMCS mapping data describes wetland extent. This is coarse scale mapping and should be considered as indicative only.	P1, S2
		Long Term	A long-term change in ecosystem state at Lake King, Lake Victoria or Lake Tyers from relatively clear, seagrass- dominated estuarine lagoons to turbid, algae dominated system (characteristic of Lake Wellington) will represent a change in ecological character.	To be determined based on expert review.		

Number	Indicator for Critical Component / Process/Service for the LAC	Relevant timescale[1]	Limit(s) of Acceptable Change	Spatial scale/temporal scale of measurements	Underpinning baseline data	Secondary critical C,P,S addressed through LAC
		Short Term	No single cyanobacteria algal bloom event will cover greater than 10 per cent of the combined area of coastal brackish/saline lagoons (that is, Lake King, Victoria, Wellington and Tyers) in two successive years.	Algal bloom extent (per cent lakes area and location) and number should be reported annually, but assessed on an ongoing basis.	Level A – The occurrence of cyanobacteria algal blooms are well documented. The extent of algal blooms historically has not been assessed, including at the time of site declaration.	
C3	Fringing wetlands – predominantly freshwater marsh at Macleod Morass and Sale Common	Long Term	No change in wetland typology from the 1980 classification (Corrick and Norman 1980; See Figure 2-3). In this regard, the conversion of vegetation communities at Sale Common and Macleod Morass from a predominantly freshwater character (for example, giant rush, common reed, cumbungi) to those of a brackish water character (brackish or swamp scrub/saltmarsh species) will represent a change in ecological character.	To be determined based on expert review.	Level B – VMCS mapping data describes wetland extent during 1980. This is coarse scale mapping and should be considered as indicative only. There is no available community data prior to listing.	P1, P2, C6, C7, C8
			The total mapped area of freshwater marshes (shrubs and reed wetland types) at Sale Common and Macleod Morass will not decline by greater than 50 per cent of the baseline value outlined in VMCS for 1980 (that is, 50 per cent of 402 hectares = 201 hectares) in two successive decades.	Sampling to occur at least twice within the decade under consideration.		
		Short Term	In existing freshwater wetland areas, the annual median salinity should not be greater than one grams per litre in two successive years. Note that where ambient water quality characteristics fall outside the range of these baseline levels, and ecosystem health indicators shows no signs of impairment, the LAC may need to be adjusted accordingly.	Annual median based on at least eight sampling periods per year, encompassing wet and dry periods.	Level C – No available baseline data. Value based on species salinity tolerances.	
C4	Fringing wetlands – brackish marsh (for example, Dowd	Long Term	For all fringing brackish wetlands: No change in wetland typology from the 1980 classification (Corrick and Norman 1980).	To be determined based on expert review.	As for C3.	P1, P2, C6, C7, C8

Number	Indicator for Critical Component / Process/Service for the LAC	Relevant timescale[1]	Limit(s) of Acceptable Change	Spatial scale/temporal scale of measurements	Underpinning baseline data	Secondary critical C,P,S addressed through LAC
	Morass; The Heart Morass; Clydebank Morass, Lake Coleman {Tucker Swamp})	Medium Term	For Dowd Morass and the Heart Morass: The annual median salinity will be less than four grams per litre in five successive years. Note that where ambient water quality characteristics fall outside the range of these baseline levels, and ecosystem health indicators shows no signs of impairment, LAC may need to be adjusted accordingly.	Annual median based on at least eight sampling periods per year, encompassing wet and dry periods.	Level C – No available baseline data. This value is based on species tolerances and requirement for salinity to be less than four grams per litre to allow reproduction (refer Tilleard and Ladson 2010).	
		Long Term	The total area of common reed at Dowd Morass will not decline by greater than 50 per cent of the 1982 baseline value (that is, 50 per cent of 480 hectares = 245 hectares) outlined in Boon et al. (2007) in two successive decades.	Sampling to occur at least twice within the decade under consideration.	Level A – Boon et al. (2007) provides good quality mapping data relevant to time of listing.	
C5	Fringing wetlands – saltmarsh/hypersaline marsh (for example, Lake Reeve)	Medium Term	No change in wetland typology from the 1980 classification (Corrick and Norman 1980). The total mapped area of salt flat, saltpan and salt meadow habitat at Lake Reeve Reserve will not decline by greater than 50 per cent of the baseline value outlined in VMCS for 1980 (that is, 50 per cent of 5035 hectares = 2517 hectares) in two successive decades.	To be determined based on expert review. Sampling to occur at least twice within the decade under consideration.	As for C3.	P1, C6

Number	Indicator for Critical Component / Process/Service for the LAC	Relevant timescale[1]	Limit(s) of Acceptable Change	Spatial scale/temporal scale of measurements	Underpinning baseline data	Secondary critical C,P,S addressed through LAC
C6	Abundance and diversity of waterbirds	Medium Term	The number of standard 20 minute searches (within any ten year period) where waterbird abundance is less than 50 individuals will not fall below 50 per cent of the 'baseline' value (based on Birds Australia count data – 1987-2010), for the following species: black swan = 15 per cent of surveys chestnut teal = 10 per cent of surveys Eurasian coot = 11 per cent of surveys. The absence of records in any of the following species in five successive years will represent a change in character: red- necked stint, sharp-tailed sandpiper, black swan, chestnut teal, fairy tern, little tern, musk duck, Australasian grebe, grey teal, Eurasian coot, great cormorant, red knot, curlew sandpiper. Median abundance (derived from at least three annual surveys {summer counts} over a 10-year period) falls below the 20th percentile baseline value. *Note: An adequate baseline will need to be established to assess this LAC (for example, at least three annual surveys (summer counts) over a 10-year period).*	Sampling to be undertaken at least twice a year over any 10 year period at stations containing favourable habitat for these species (see Table E8 for locations). Surveys should consist of standardised 20 minute counts. Sampling to be undertaken at least twice a year (during summer) at stations containing favourable habitat for these species (see section 3.4.1 for important locations). Recommended baseline monitoring program should include: A combination of aerial and ground surveys. Representative coverage of primary habitats within the site.	Level A – Birds Australia data, while standardised in terms of sampling effort per site, is not standardised in terms of frequency of sampling events at any given sampling location. Data should be considered indicative only. Level A – Records for these species are reliable. Birds Australia and DSE data can be used to assess this qualitative LAC. There are no baseline data available for this LAC.	P1, P2

Number	Indicator for Critical Component / Process/Service for the LAC	Relevant timescale[1]	Limit(s) of Acceptable Change	Spatial scale/temporal scale of measurements	Underpinning baseline data	Secondary critical C,P,S addressed through LAC
C7	Presence of threatened frogs	Medium Term	The site will continue to support suitable habitat for growling grass frog and green and golden bell frog. In this regard, the LAC for Component 3 applies. There is insufficient data to develop a LAC relating directly to site usage by these species, which represents a critical information gap. Should baseline data become available in the future, the following LAC will apply: a significant reduction (greater than 25 per cent over a period of 5 years) in the local adult population within the site, especially for important local populations (for example, within Macleod Morass, Sale Common, Ewings Marsh, Roseneath wetlands (Morley Swamp and Victoria Lagoon), the Heart Morass and freshwater pools on Rotamah Island).	Refer to C3. Recommended baseline monitoring program should comprise a minimum two annual sampling periods separated by at least one year (and within a 5 year period).	Level C – Surveys for these species have been opportunistic. The most recent record for growling grass frog is 2007, whereas the green and golden bell frog was recorded at the site in 1998. There are no empirical data describing abundances at the site.	P1
C8	Presence of threatened wetland flora species	Long Term	The three threatened flora species (*Rulingia prostrata*, *Thelymitra epipactoides* and *Xerochrysum palustre*) continue to be supported within the boundaries of the Gippsland Lakes Ramsar site.	Based on opportunistic searches.	Level C – Setting of empirical limits of acceptable change is not possible at present, given the absence of quantitative estimates of population size of threatened species within the site, and more importantly the viability of populations (and their key controls) within the site.	P1
Critical processes						
P1	Hydrological regime	Short Term – Medium Term	Wetland wetting frequency, flushing frequency and flushing volume are maintained as follows:	Refer to LAC for details. Values measured at existing gauging stations in the lower reaches of the Rivers or otherwise in	LAC have been identified for these wetlands on the basis that they are the best indicators of freshwater flows into the broader Gippsland Lakes system.	C1 – C8 S1, S2

<table>
<tr><th>Number</th><th>Indicator for Critical Component / Process/Service for the LAC</th><th>Relevant timescale[1]</th><th>Limit(s) of Acceptable Change</th><th>Spatial scale/temporal scale of measurements</th><th>Underpinning baseline data</th><th>Secondary critical C,P,S addressed through LAC</th></tr>
<tr><td></td><td></td><td></td><td>
<table>
<tr><th>Wetland</th><th>Wetting Frequency</th><th>Flushing Frequency</th><th>Required Flushing Volume</th></tr>
<tr><td>Sale Common</td><td>Annual with 100 per cent reliability</td><td>2-3 times/decade</td><td>4 GL</td></tr>
<tr><td>Dowd Morass</td><td>5-7 times/decade</td><td>2-3 times/decade</td><td>15GL</td></tr>
<tr><td>The Heart Morass</td><td>5-7 times/decade</td><td>2-3 times/decade</td><td>15GL</td></tr>
</table>
From Tilleard and Ladson (2010); note that larger flushing volumes (~20GL) are identified as being needed for Dowd and the Heart Morasses following saline flood events in the Lake Wellington system (for example, when the wetlands are filled with saline water from Lake Wellington and this corresponds with low flows in the Latrobe River).</td><td>the wetlands themselves.</td><td>Level C – LAC based on Tilleard and Ladson (2010) ‘Hydrological Analyses to Support Determination of Environmental Water Requirements in the Gippsland Lakes’. This is a threshold-based LAC that is based on modelling and ecological assessments.
Note that these values should be considered as indicative only at this stage, and should be constantly reviewed.
Tilleard and Ladson (2010) indicate no work has been done for wetlands on the Mitchell (Macleod Morass); McLennan Straits (Morley Swamp, Lake Betsy); or Jones Bay.</td><td></td></tr>
</table>

Number	Indicator for Critical Component / Process/Service for the LAC	Relevant timescale[1]	Limit(s) of Acceptable Change	Spatial scale/temporal scale of measurements	Underpinning baseline data	Secondary critical C,P,S addressed through LAC
P2	Waterbird breeding	Short Term	Abandonment or significant decline (greater than 50 per cent) in the productivity of two or more representative breeding sites (based on two sampling episodes over a five year period) within any of the following site groupings: Lake Coleman, Tucker Swamp and Albifrons Island – Australian pelican. Bunga Arm and Lake Tyers – little tern and fairy tern. Macleod Morass, Sale Common and Dowd Morass – black swan, Australian white ibis, straw-necked ibis, and little black cormorant.	Recommended baseline monitoring program should comprise a minimum two annual sampling periods separated by at least one year (and within a 5 year period).	Level C – The use of the site by these species is well documented. However, there are no empirical data describing breeding rates. Baseline data will need to be collected to assess this LAC.	C6
Critical services/benefits						
S1	Threatened species	N/A	No LAC are proposed for painted snipe and Australasian bittern at the current time until greater information is available about patterns of usage and populations in the Ramsar site. Other threatened species are dealt with in the critical components above.	N/A	Level C – Site records are not recent, uncommon and the location within the Ramsar boundary not known.	P1, C3
		Long Term	Australian grayling continues to be supported in one or more of the catchments draining into the Gippsland Lakes.	Setting of more empirical limits of acceptable change not possible at present, given the absence of quantitative population data for this species for any of the rivers and creeks that drain into the site.	Level C – This species has been recorded in the major drainages that drain into the site. Juveniles have an apparent obligate estuarine phase, and therefore must use the site in order for this species to persist in these drainages. There are no data describing the population status of this species in these drainages.	P1, C1, C2

Number	Indicator for Critical Component / Process/Service for the LAC	Relevant timescale[1]	Limit(s) of Acceptable Change	Spatial scale/temporal scale of measurements	Underpinning baseline data	Secondary critical C,P,S addressed through LAC
S2	Fisheries resource values	Medium Term	Total annual black bream commercial fishing catch per unit effort will not fall below the 10th percentile historical baseline value of 6.1 (see Section 3.8.2) in a five successive year period.	Median measured over five years.	Level B – While some commercial fish data has been accessed and reviewed as part of the current study, the abundance and usage of the Gippsland Lakes by key fish species of commercial and recreational significance is not well quantified. The baseline data used in this LAC has limited duration (five years), and is unlikely to be representative of patterns in abundance over longer timeframes. This LAC will need to reviewed and refined. Level C – based on conditions outlined in Tilleard (2009).	C1, C2, C3, C4, C5
			Sub-optimal black bream spawning conditions should not occur in any successive five year period within key spawning grounds (that is, mid-lower estuaries and adjacent waters of main lakes) during the peak spawning period (October to December). Based on Tilleard (2009), optimal conditions are as follows:	Annual median value for the period October to December.		
			Water column salinity is maintained in brackish condition (for example, between 17-21 grams per litre median value) in the middle of the water column in the mid-lower estuaries and adjacent waters of the main lakes	As above.		
			The salt wedge is located within the mid-lower section of the estuarine river reaches or just out into the main lakes as opposed to far upstream or well-out into the Lakes.			

C – component, P – process , S/B – service/benefit

Corner Inlet Ramsar Site

Corner inlet is located to the west of the EMBA, bounded by Wilsons Promontory to the west and a series of barrier islands and sandy splits to the east. Corner inlet valued for being a breeding habitat for many waterbirds, including threatened and listed species, for example the Curlew sandpiper and Eastern curlew. Corner inlet also contains the most extensive intertidal mudflats in Victoria. The critical components, processes and benefits of the wetland are provided in Table 4-22. The limits of acceptable change for the critical components /processes are described in Table 4-23.

Table 4-22 Corner Inlet summary of critical components, processes and benefits.

Critical Components	Critical Processes	Critical Services/Benefits
Several key wetland mega-habitat types are present: • seagrass • intertidal sand or mud flats • mangroves • saltmarshes • permanent shallow marine water (C2). Abundance and diversity of waterbirds	**P1.** Waterbird breeding is a key life history function in the context of maintaining the ecological character of the site, with important sites present on the sand barrier islands	S1. The site supports nationally threatened fauna species including: • orange-bellied parrot • growling grass frog • fairy tern • Australian grayling S2. The site supports outstanding fish habitat values that contribute to the health and sustainability of the bioregion
Supporting Components	**Supporting Processes**	**Supporting Services/Benefits**
Important **geomorphological features** that control habitat extent and types include: • sand barrier island and associated tidal delta system • the extensive tidal channel network • mudflats and sandflats. **Invertebrate megafauna** in seagrass beds and subtidal channels are important elements of biodiversity and control a range of ecosystem functions. The **diverse fish communities** underpin the biodiversity values of the site	**Climate**, particularly patterns in temperature and rainfall, control a range of physical processes and ecosystem functions Important hydraulic and hydrological processes that support the ecological character of the site includes**:** • Fluvial hydrology. Patterns of inundation and freshwater flows to wetland systems • Physical coastal processes. • Hydrodynamic controls and marine inflows that affect habitats through tides, currents, wind, erosion and accretion. • Groundwater. For those wetlands influenced by groundwater interaction, the level of the groundwater table and groundwater quality. **Water quality** underpins aquatic ecosystem values within wetland habitats. The key water quality parameters for the site are salinity, turbidity, dissolved oxygen and nutrients. Important **biological processes** include nutrient cycling and food webs.	The site supports recreation and tourism values (scenic values, boating, recreational fishing, camping, etc.) that have important flow-on economic effects for the region. The site provides a range of values important for **scientific research**, including a valuable reference site for future monitoring.

Table 4-23 Corner Inlet limits of acceptable change for critical components

Number	Indicator for Critical Component / Process/Service for the LAC	Relevant timescale[2]	Limit(s) of Acceptable Change	Spatial scale/temporal scale of measurements	Underpinning baseline data	Secondary critical C,P,S addressed through LAC
Critical Components						
C1	Seagrass extent	Long Term	• Total mapped extent of dense Posidonia will not decline by greater than 10 percent of the baseline value outlined by Roob et al. (1998) at a whole of site scale (baseline = 3050 hectares; LAC = mapped area less than 2745 hectares) on any occasion. (Note: the small degree of allowable change recognises that this seagrass species is a critical habitat resource and generally shows low natural variability.) • Total mapped extent of the dense and medium density Zosteraceae will not decline by greater than 25 percent of the baseline values outlined by Roob et al. (1998) at a whole of site scale on two sampling occasions within any decade. • Dense Zostera - Baseline = 5743 hectares (LAC = mapped area less than 4307 hectares) • Medium Zostera - Baseline = 1077 hectares (LAC = mapped area less than 807 hectares) (Note: the moderate degree of allowable change recognises that these seagrass species generally show moderate degrees of natural variability)	Sampling to occur at least twice within the decade under consideration. Note that the seagrass assessment by Hindell (2008) did not produce mapping but did use similar sampling sites to Roob *et al*.	Recent quantitative data describes seagrass condition at various sites but over a limited timeframe. It is thought that the Roob *et al*. (1998) study underestimated the total available seagrass habitat (J. Stevenson, Parks Victoria, pers. comm. February 2011), hence a 10 per cent change from this baseline value would represent a larger actual change from the true baseline. ***Note***: Prior to declaration, *Posidonia* covered approximately 44 per cent (11,900 hectares) of the site (Poore 1978). Morgan (1986) estimated that *Posidonia* meadows covered 11,900 hectares in 1965 and 9,000 to 9,500 square kilometres in 1983–84. There is uncertainty regarding these mapping data and therefore empirical LACs have not been developed from these data.	S2

[2] *Short Term – measured in years; Medium Term – five to 10 year intervals; Long term – 10+ year intervals.*

Number	Indicator for Critical Component / Process/Service for the LAC	Relevant timescale[2]	Limit(s) of Acceptable Change	Spatial scale/temporal scale of measurements	Underpinning baseline data	Secondary critical C,P,S addressed through LAC
	Mangrove forest extent	Long term	Based on EVC mapping, it is estimated that mangroves presently cover an area of 2137 hectares within the site (see Section 3.3.1). A 10 percent reduction in the total mapped mangrove area, observed on two sampling occasions within any decade, is an unacceptable change. (LAC – mapped area less than 1924 hectares). (Note: the small degree of allowable change recognises that mangroves are a critical habitat resource and generally shows low natural variability)	Sampling to occur at least twice within the decade under consideration.	No available data to determine changes in extent over time. It is unlikely that this has changed markedly since Ramsar listing. Note that there are uncertainties regarding the quality of existing mapping, and therefore the baseline value should be considered as indicative only.	S2
	Saltmarsh extent	Long term	Based on EVC mapping, it is estimated that intertidal saltmarsh presently covers an area of 6500 hectares within the site (see Section 3.3.1). A 10 percent reduction in the total mapped saltmarsh area, observed on two sampling occasions within any decade, is an unacceptable change (LAC – mapped area less than 5850 hectares). (Note: the small degree of allowable change recognises that saltmarsh is a critical habitat resource and generally show low natural variability)	Sampling to occur at least twice within the decade under consideration.	No available data to determine changes in extent over time. It is unlikely that this has changed markedly since Ramsar listing. The note regarding data quality for mangroves applies also to saltmarsh.	S2
	Shallow subtidal waters	Long term	A greater than 20 percent reduction in the extent of subtidal channel (areas mapped by NLWRA = 16 349 hectares), observed on two sampling occasions within any decade, will represent a change in ecological character (LAC – mapped area less than 13 079 hectares). (Note: the moderate degree of allowable change recognises that shallow subtidal waters represent a critical habitat resource, generally show low natural variability, but data reliability is low)	Sampling to occur at least twice within the decade under consideration.	NLWRA mapping data describes wetland extent. This is coarse scale mapping and should be considered as indicative only. ***Note***: there is a need to develop a condition-based LAC for this critical component. While some water quality data exists, this is presently insufficient to derive a LAC (i.e. whether a change in water quality represents a true	S2

Number	Indicator for Critical Component / Process/Service for the LAC	Relevant timescale[2]	Limit(s) of Acceptable Change	Spatial scale/temporal scale of measurements	Underpinning baseline data	Secondary critical C,P,S addressed through LAC
					change in ecological character of the wetland)	
	Inlet waters (intertidal flats)	Long term	A greater than 20 percent reduction in the extent of permanent saline wetland – intertidal flats (areas mapped by DSE = 40 479 hectares, see Figure 3-1), observed on two sampling occasions within any decade, will represent a change in ecological character (LAC – mapped area less than 36 431 hectares). (Note: the moderate degree of allowable change recognises that intertidal flats represent a critical habitat resource and generally show low natural variability. A loss of intertidal flat would also result in changes in seagrass)	Sampling to occur at least twice within the decade under consideration.	VMCS mapping data describes wetland extent. This is coarse scale mapping and should be considered as indicative only. ***Note***: there is a need to develop a condition-based LAC for this critical component. While some water quality data exists, this is presently insufficient to derive a LAC (i.e. whether a change in water quality represents a true change in ecological character of the wetland)	S2
C2	Abundance and of waterbirds	Short term (All species)	Mean annual abundance of migratory bird species - Birds Australia (2009c) notes that there is a maximum annual abundance of migratory species of 42 811 birds, with a mean annual abundance of migratory species being 31 487 birds (deriving from 28 years of data collection to September 2008). The annual abundance of migratory shorebirds will not decline by 50 per cent of the long-term annual mean value (that is, must not fall below 15 743 individuals) in three consecutive years. (Note: the large degree of allowable change recognises that these species can show high levels of natural variability, and that limitations of existing baseline data)change recognises that these species can show high levels of natural variability, and that limitations of existing baseline data)	At least four annual surveys (summer counts) within the decade under consideration.	Bird count data are available from a variety of programs, most notably Birds Australia monitoring programs	P2

Number	Indicator for Critical Component / Process/Service for the LAC	Relevant timescale[2]	Limit(s) of Acceptable Change	Spatial scale/temporal scale of measurements	Underpinning baseline data	Secondary critical C,P,S addressed through LAC
		Short term (individual species)	Mean annual abundance of migratory species that meet the one per cent criterion will not be less than 50 per cent of the long-term annual mean value in five years of any ten year period. These values are follows: • curlew sandpiper – baseline = 2588 birds, LAC = 1294 birds • bar tailed godwit – baseline = 9727 birds, LAC = 4863 birds • eastern curlew – baseline = 1971 birds, LAC = 985 birds • pied oystercatcher – baseline = 893 birds, LAC = 446 birds • sooty oystercatcher – baseline = 285 birds, LAC = 142 birds • double-banded plover– baseline = 523 birds, LAC = 261 birds There are insufficient baseline data to determine long-term average abundance of fairy tern and Pacific gull. (Note: the large degree of allowable change recognises that these species can show high levels of natural variability, and that limitations of existing baseline data)	At least five annual surveys (summer counts) within the decade under consideration.	Bird count data are available from a variety of programs, most notably Birds Australia monitoring programs	P2
Critical Processes						
P1	Waterbird breeding	Short Term	A greater than 50 per cent decrease in nest production at two or more monitoring stations (based on two sampling episodes over a five year period) within any of the following locations and species: • Clomel Island - fairy tern, hooded plover, Caspian tern, crested tern • Dream Island - fairy tern, hooded plover, crested tern	Recommended baseline monitoring program should comprise a minimum two annual sampling periods separated by at least one year (and within a five year period).	The use of the site by these species is well documented. However, there are no empirical data describing nest or egg production rates. Baseline data will need to be collected to assess this LAC.	C2

Number	Indicator for Critical Component / Process/Service for the LAC	Relevant timescale[2]	Limit(s) of Acceptable Change	Spatial scale/temporal scale of measurements	Underpinning baseline data	Secondary critical C,P,S addressed through LAC
			• Snake Island and Little Snake Island - pied oystercatcher			
Critical Services/Benefits						
S1	Threatened Species	N/A	For orange-bellied parrot and growling grass frog, an unacceptable change will have occurred should the site no longer support these species.	Based on multiple targeted surveys at appropriate levels of spatial and temporal replication (at least four annual surveys in preferred habitats) over a 10 year period.	Most site records are based on opportunistic surveys	P1, C3
		Short Term	For Australian grayling, an unacceptable change will have occurred should all of the drainages that drain into Corner Inlet no longer support this species.	Based on four annual surveys in a 10 year period at multiple sites located in all major catchments.	This species has been recorded in the major drainages that drain into the site. There are no data describing the population status of this species in the site. Abundance data are available for drainages that discharge into the site (Ecowise 2007; O'Connor *et al*. 2009). O'Connor *et al*. (2009) notes that collection of this species is difficult and requires targeted survey techniques. Few targeted empirical surveys have been undertaken in the site's drainages to date	P1, C1, C2
S2	Fish abundance (using fish catch of key species as a surrogate)	Medium term	An unacceptable change will have occurred if the long term (greater than five years) median catch falls below the 20th percentile historical baseline values in standardised abundance or catch-per unit effort of five or more commercially	Annual fish catch measured over a greater than five year period.	Commercial fish catch data. Note that there are presently no fisheries-independent baseline data (collected using empirical, systematic methods) describing	S2

Number	Indicator for Critical Component / Process/Service for the LAC	Relevant timescale[2]	Limit(s) of Acceptable Change	Spatial scale/temporal scale of measurements	Underpinning baseline data	Secondary critical C,P,S addressed through LAC
			significant species (relative to baseline) due to altered habitat conditions within the site. The 25th percentile pre-listing baseline commercial catch per unit effort values for the site are as follows (units are tonnes per annum per number of boats): • Australian salmon 379 • rock flathead 316 • southern sand flathead 373 • greenback flounder 514 • southern garfish 1452 • yelloweye mullet 740 • gummy shark 167 • King George whiting 1347		patterns in the distribution and abundance of key species. Therefore, the limits of acceptable change should be treated with caution, noting socio-economic factors should be taken into account when assessing catch data underpinning this LAC.	

4.6.2.2 Ramsar Wetland Sites - Tasmania

The Logan Lagoon Ramsar site, on the southeast coast of Flinders Island, is outside of the EMBA, to the south west. It is low lying with the water table very close to the soil surface, and water flows into the lagoons mainly from groundwater. The site covers an area of 2,257 ha and includes dominant vegetation types such as saline aquatic herbland, saline sedgeland and rushland, succulent saline herbland, coastal grass and herbfield and coastal scrub. When full, the lagoon provides feeding and resting habitat for a number of migratory waders.

The critical components, processes benefits and limits of acceptable change for the wetland is described in Table 4-24

Table 4-24 Logan Lagoon summary of critical processes, benefits and limits of acceptable change

Critical Component/Process / Service	Baseline / supporting evidence	Limit of acceptable change
Climate: Understanding the interactions between the physical conditions at the site and its subsequent use by flora and fauna is important. For example, waterbirds may use the site for breeding only in years when water levels are moderate and there is adequate area for nesting on the shores.		
Climate	The particular attributes of climate that are important in maintaining the ecological character of the site are rainfall, temperature, wind and evaporation. Climate predictions for north-eastern Tasmania suggest a generally warmer climate which is wetter in all seasons. Mean daily temperatures are projected to be warmer (both minimum and maximum temperatures) with increased solar radiation, relative humidity in summer, and increased evaporation (ACE CRC 2010).	The links between climatic conditions, the hydrological responses to such conditions, and their impact on the biological components are poorly understood and should be further investigated. No LAC can be determined due to a lack of understanding of the impact of climatic processes on other critical components, processes and services, such as, hydrology, geomorphology, flora and fauna.
Geomorphology: Protecting the geological features, including the integrity and structure of the dunes, is important for the purposes of geoconservation and maintaining the ecological character which contributes to the site's listing under Criterion 1.		
Holocene Shorelines and dune systems	There are approximately 54 hectares of shorelines, spits and dune systems that are important for maintaining the geoconservation value of the site under Criterion 1. The area of shorelines, spits and dunes defined in the TASVEG mapping layers require ground-truthing.	Currently there are 54 hectares of high quality shorelines, dune systems and spits mapped within the site. In the absence of studies detailing impacts from human disturbance, a common-sense approach has been adopted, setting a limit of acceptable change at not more than 3 hectares (2 percent) of the area of the Holocene shoreline and dune systems showing evidence of human disturbance through vehicle use or foot traffic. Because the wetland map was made without proper ground-truthing, verification of areas will be required.
Hydrology: The hydrological regime is a major driver in the vegetation communities at the site, particularly for wetland-dependent communities. The availability of water plays a key role in the attractiveness of the site for resting and breeding of resident and migratory fauna, especially birds.		
Surface water flow	Flow regimes are poorly understood: Historically, the lagoon mouth has been artificially breached by local landowners. Alterations to the natural hydrological regime impacts on other components such as geomorphology, water quality, vegetation and fauna. Surrounding farmland drains into the lagoon via a series of channels. High water levels in the lagoon have previously been blamed for inundated pasture on surrounding farms. The link between climate and hydrology is poorly understood. For example, the amount of rainfall required to maintain the natural hydrology.	No unnatural opening of the lagoon mouth. Site observations indicate that fluvial inflows are a significant input of surface water to the lagoon. Whilst this inflow is beneficial in maintaining water in the lagoon, poor water quality in inflow waters could offset this benefit. Site specific hydrology data and further water quality data is therefore required before LAC can be set that takes into account these factors.

Critical Component/Process / Service	Baseline / supporting evidence	Limit of acceptable change
Tidal exchange	Historical information on lagoon mouth opening is anecdotal. Future monitoring should include the status of the lagoon entrance (open/closed) because parameters such as salinity may be highly variable when the lagoon is open to the ocean.	No unnatural opening of the lagoon mouth. The lagoon is rarely open to the ocean. However, when the hydrological regime shifts to a marine system, advice on appropriate parameters should be sought.
Water Quality: provides suitable water quality to support the persistence of wetland dependent flora and fauna. The ecological character of the site currently depends on the quality of water entering and being retained within the lagoon. Baselines need to be set before LAC can be set.		
Water quality	Only two water samples recorded from the site. pH: Limited data indicates pH of 7.2-7.7 in Logan Lagoon waters. Potential for acid sulphate soils to impact on pH of lagoon waters. Salinity: Limited data indicates salinity (as Total Dissolved Solids) ranging between 2,600-35,700 mg/L: Salinity highly variable depending on seasonal climatic and hydrological processes. Dissolved Oxygen: No data available. Turbidity: Limited data indicates range between 0.5 and 4.9 NTU: Turbidity varies with freshwater inflows, wind and tidal influences. Nutrients: Limited site data indicates Total P (0.09 – 0.2 mg/L and Total N (1.4-1.5 mg/L).	Cannot determine LAC due to insufficient data.
Vegetation: the hydrology, climate, water quality and soil quality of Logan Lagoon influence the vegetation that is supported at the site. The threatened wetland-dependent vegetation communities contribute to the regional biodiversity and selection of Criterion 1 and 3.		
Holocene Shorelines and dune systems	There are currently three threatened wetland-dependent plant species mapped at the site.	In the absence of accurate mapping, a common sense approach has been adopted, setting a limit of acceptable change as the persistence of the following threatened species within the Logan Lagoon boundary: Swamp fireweed (*Senecio psilocarpus*) Large-fruit seatassel *(Ruppia megacarpa*) Northern leek orchid (*Prasophyllum secutum*) These three species are cryptic and therefore seasonally specific surveying will be required to identify them. Species should be observed during two out of every three surveys.

Critical Component/Process / Service	Baseline / supporting evidence	Limit of acceptable change
Threatened plant communities	Poor quality information on the current distribution and abundance of threatened plant communities because maps based on TASVEG Mapping Layers have not been ground-truthed. The areas of threatened wetland-dependent vegetation communities are: Saline aquatic herbland = 9.23 hectares Freshwater aquatic herbland = 1.28 hectares Lacustrine herbland = 3.71 hectares.	There are 14.22 hectares of threatened wetland-dependent vegetation communities at the site. Common sense would suggest no loss greater than 10 percent for each wetland type based on TASVEG mapping layers. Because the wetland map was made without proper ground-truthing, verification of areas will be required. Based on current estimates made for this ECD, the maximum areas of threatened wetland vegetation that could be lost before causing unacceptable change to the site are: Saline aquatic herbland: 0.9 hectares Freshwater aquatic herbland: 0.5 hectares Lacustrine herbland: 4 hectares.
Fauna: Logan Lagoon supports and large number of birds, many with conservation significance locally, nationally, and internationally which justifies the selection of Ramsar criteria 3, 4 and 6.		
Number of waterbird species counted at the site annually	Annual counts of waterfowl carried out at Logan Lagoon during February 1985 - 2009, excluding 1987, 1989, 1994 and 2008. The area counted varied among years and data are not comparable, making it difficult to detect population trends.	No LAC can be determined due to insufficient data. To be defined once population trends for waterfowl are clear from systematic annual counts.
Number of shorebirds recorded in annual surveys	There has been no systematic, long term monitoring of shorebirds within the Ramsar site to enable a numerical baseline to be set, although Birds Tasmania conducted counts along the ocean coastline of the site in 2008 and 2010, and is planning future work.	No LAC can be determined due to insufficient data. To be defined once population trends for shorebirds are clear from systematic annual counts.
Threatened mammals, reptiles, amphibians	Very little systematic data. Poor information on the current distribution and abundance of threatened species.	No LAC can be determined due to insufficient data. To be defined once systematic surveys undertaken for a range of species.

4.6.3 Victorian Areas of Interest

In Victoria, the government has created a system of 13 Marine National Parks and 11 smaller Marine Sanctuaries. These parks and sanctuaries protect 5.3% of Victoria's coastal waters (DSE, 2011). Victoria's marine conservation reserves are managed by Parks Victoria under the *Parks Victoria Act* 1998 and the *Victorian National Parks (Marine National Parks and Marine Sanctuaries) Act* 2002. Marine conservation reserves in Victoria are classified as:

- Marine National Park.
- Marine Sanctuary.
- Coastal Parks.

The marine conservation reserves closest to the project area are all located along the coast a significant distance away, as illustrated in Figure 4-7. Table 4-25 lists the Victorian marine conservation areas located within the EMBA, which are described below.

Table 4-25 Marine conservation areas located within the EMBA (Victoria)

Conservation category	Location	Distance from project area[1] (km)
Marine National Park	Point Hicks	87
	Cape Howe	150
Marine Sanctuary	Beware Reef (Cape Conran)	40
Coastal Park*	Gippsland Lakes	54
Coastal Reserve*	Marlo	38
	Gabo Island	155
Special Management Area	Gabo Island Harbour	155
	Mallacoota Inlet	140
	The Skerries	112

Notes:

* The coastal parks and reserves are terrestrial conservation reserves and are not relevant to the project (except for the sandy beach sections of these reserves that are within the EMBA).

[1] Distance measured from the Longtom-3 subsea well surface location.

4.6.3.1 Point Hicks Marine National Park

Point Hicks Marine National Park is located approximately 40 km east of Cape Conran and 70 km northeast of the project area. The National Park is approximately 4,000 ha in size, with fauna including intertidal and shallow subtidal invertebrates, diverse sessile invertebrates living on subtidal reefs, kelps and sponges, and a high diversity of reef fish, such as butterfly perch, silver sweep, and banded morwongs. Point Hicks Marine National Park also contains the remains of two shipwrecks (the *SS Kerangie* and *SS Saros*), providing a drawcard for recreational divers (Parks Vic, 2012).

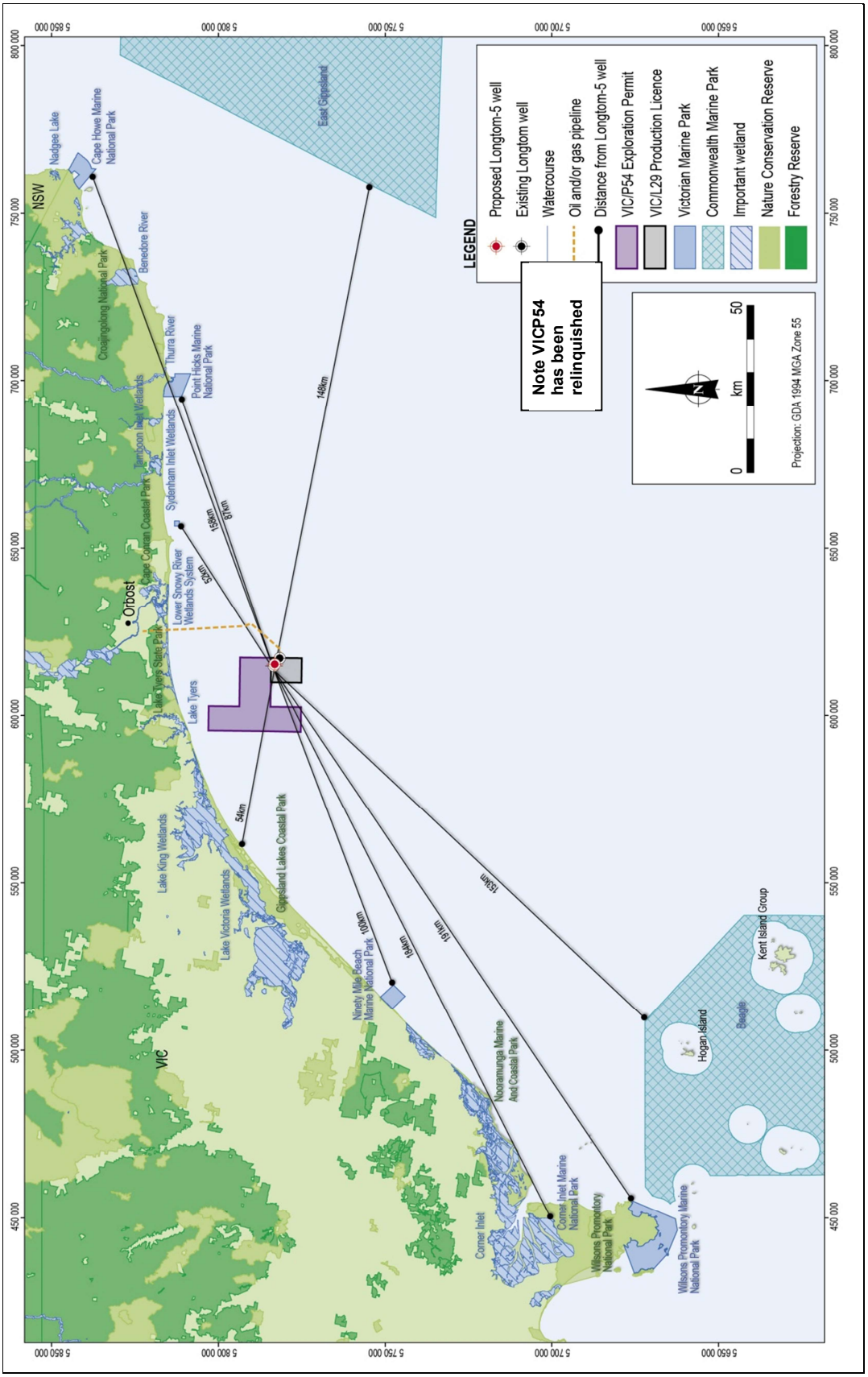

LEGEND
Proposed Longtom-5 well
Existing Longtom well
Watercourse
Oil and/or gas pipeline
Distance from Longtom-5 well
VIC/P54 Exploration Permit
VIC/L29 Production Licence
Victorian Marine Park
Commonwealth Marine Park
Important wetland
Nature Conservation Reserve
Forestry Reserve
Note VIC54 has been relinquished
Projection: GDA 1994 MGA Zone 55
0
50
km
N
NSW
Vic
Orbost
Nadgee Lake
Cape Howe Marine National Park
East Gippsland
Croajingolong National Park
Benedore River
Thurra River
Point Hicks Marine National Park
Tamboon Inlet Wetlands
Sydenham Inlet Wetlands
Cape Conran Coastal Park
Lower Snowy River Wetlands System
Lake Tyers State Park
Lake Tyers
Lake King Wetlands
Lake Victoria Wetlands
Gippsland Lakes Coastal Park
Ninety Mile Beach Marine National Park
Nooramunga Marine And Coastal Park
Corner Inlet
Corner Inlet Marine National Park
Wilsons Promontory National Park
Wilsons Promontory Marine National Park
Hogan Island
Beagle
Kent Island Group
148km
159km
87km
58km
54km
103km
76km
191km
153km
5 850 000
5 800 000
5 750 000
5 700 000
5 650 000
800 000
750 000
700 000
650 000
600 000
550 000
500 000
450 000

Figure 4-7 Commonwealth and Victorian marine reserves in relation to VICL29

4.6.3.2 Croajingolong Biosphere Reserve and National Park

The Croajingolong National Park is located alongside the Point Hicks Marine National Park in East Gippsland. The park covers 87,500 hectares and is a UNESCO World Biosphere Reserve. The park includes undisturbed forest foothills, a wilderness coastline and is home to more than 300 bird and animal species and over 1,000 native plant species.

Of the 52 mammal species recorded in the park, arboreal mammals such as possums, gliders and bats are common. Seals, whales and dolphins occur in coastal waters adjacent to the park.

4.6.3.3 Cape Howe Marine National Park

Cape Howe Marine National Park is located in the far east of Victoria alongside the border with New South Wales, covering 4,050 ha and established in November 2002. This park protects habitats that support a mixture of cool water southern marine species and warmer waters species more common in the north. These habitats include kelp forests, granite and sandstone reefs, sandy beaches and soft sediments. The reefs range from intertidal to sub-tidal, up to depths of approximately 50 m.

A dense canopy created of brown seaweed *Phyllospora* shelters sea squirts, coralline algae, sea tulips, sponges, seastars brittlestars and assorted crustaceans. In the deeper waters, there are dense sponge gardens composed of sponges, hydroids, gorgonian corals and sea whips, providing habitat for fish including wrasse, herring cale and sunfish. Little Penguins are known to forage at the rook on Gabo Island.

4.6.3.4 Beware Reef Marine Sanctuary

Beware Reef Marine Sanctuary, located approximately 5 km southeast of Cape Conran and 40 km northeast of the project area, comprises a granite outcrop covering an area of 220 ha and rises from a depth of approximately 28 m, and is 1 km long. It is exposed at low tide, providing a resting area for Australian fur seals. The reef is covered by outcrops of bull kelp (*Durvillaea* sp.) and supports a diverse range of marine life, including seahorses and leafy seadragons (Parks Vic, 2012). The reef is a popular location for recreational divers, with the remains of three shipwrecks adding interest to the many fish species hosted by the reef, including boarfish, morwongs, trumpeters and wrasses, with wobbegong and Port Jackson sharks also found in the sandy hollows.

4.6.3.5 Gippsland Lakes Coastal Park and Lakes National Park

The Gippsland Lakes Coastal Park is assigned the IUCN Category VI of the United Nations List. Category VI areas are predominantly unmodified natural systems managed to ensure long-term protection and maintenance of biodiversity. The park includes a unique combination of lakes, Ramsar wetlands (Refer 4.6.2.1), and marine and terrestrial

environments. Gippsland Lakes Coastal Park is a narrow coastal reserve covering 17,600 ha along approximately 90km of Ninety Mile Beach from Seaspray to Lakes Entrance. It has extensive coastal dune systems, woodlands and heathlands, as well as water bodies such as Lake Reeve and Bunga Arm.

The Lakes National Park covers 2390 ha bounded by Lake Victoria, Lake Reeve and the township of Loch Sport. The Lakes National Park contains large areas of diverse and relatively undisturbed flora and fauna communities representative of the inner barrier of the Gippsland Lakes system (ParksVic. 2019).

The parks are jointly managed by the Victorian State Government and the Gunaikurnai people under Native Title rights. The parks have multiple management zones ranging from conservation to special management, hunting and recreation (GKTOLMB. 2018).

Large parts of waters and shorelines of the Gippsland Lakes lie outside the Gippsland Lakes Coastal Park and The Lakes National Park, and are managed under various other land tenures and ownership.

4.6.4 Tasmanian and New South Wales Areas of Interest

The Tasmanian and New South Wales marine conservation areas located within the EMBA are given in Table 4-26.

Table 4-26 Marine conservation areas located within the EMBA (Tasmania and NSW)

Conservation category	Location	Distance from project area (km)
Tasmania		
Marine National Park & Reserve	Kent Group National Park and Kent Group Marine Reserve (Deal, Erith and Dover Islands). 2,374 ha of islands make up this park. They are surrounded by the Marine Reserve which covers 29,000 ha of marine habitat including shallow and deep reefs and sponge beds in deeper waters. A sanctuary zone is enforced by a Marine Protected Area. Judgement Rocks, an islet of the park, supports the largest of only five fur seal breeding sites in Tasmania. Two small islets, North East and South West islands, support large colonies of breeding seabirds including penguins, shearwater, fairy prion, Pacific gull, common diving petrel and sooty oystercatcher (Parks Tas. 2019). This park is unusually rich in fish species. Two shipwrecks exist within the park.	173
NSW		
National Park	Ben Boyd. This 10,485 ha park is located in southern NSW and spans three sections; a large southern section located south of Eden which intersects the EMBA and the central and northern sections beyond the EMBA located north of Eden and beyond the Pambula River. The park's vegetation	175

Conservation category	Location	Distance from project area (km)
	reflects it location in the driest, windiest part of the state's coastline. Open forest and woodland cover most of the park. The park's varied habitat supports a highly diverse bird population including the critically endangered hooded plover and the endangered Gould's petrel and about 50 species of mammal. Other values of the park include geological and geomorphical, aboriginal and historic heritage (DECCW. 2010).	
Nature Reserve and Wilderness Area	Nadgee. This park is located in the south eastern corner of NSW between Wonboyn Lake and the Victorian border and covers 20,671 ha. The park is adjacent to Ben Boyd National park to the north and Croajingalong National Park to the south. Dry open forest areas occur widely throughout this reserve with patches of rainforest occurring in creek catchments and low shrubby heaths being encountered at Mt Nadgee and along the coast. It contains the only declared coastal wilderness area in NSW and the most isolated beaches and undisturbed estuaries in NSW. The fresh and salt water wetlands and estuaries are important for the maintenance and populations of many fish species. The near-coastal areas are significant breeding and foraging habitat for various seabirds. Its isolation also provides value for scientific research as a control site providing a comparison against more disturbed environments (NSW NPWS. 2003).	157

4.7 Distances to Key Features

Table 4-27 summarises the distances to key features from the project area.

Table 4-27 Distances to key features in the region

Location	Distance
Environmental feature	
Nearest Victorian coastline	31 km to the north
Gippsland Lakes (entrance)	37 km to the northwest
Gippsland Lakes Coastal Park	54 km to the northwest
Point Hicks Marine National Park	87 km to the northeast
Croajingolong Biosphere Reserve and National Park	106 km to the northeast
Cape Howe Marine National Park	158 km to the east-northeast
Beware Reef Marine Sanctuary	52 km to the northeast
Ben Boyd National Park	175 km to the northeast
Nadgee Nature Reserve and Wilderness Area	157 km to the northeast
Gabo Island Harbour Special Management Area	155 km to the northeast
Mallacoota Inlet Special Management Area	140 km to the northeast
The Skerries Special Management Area	112 km to the northeast
Beagle Commonwealth Marine Reserve	153 km to the southwest

Location	Distance
East Gippsland Commonwealth Marine Reserve	148 km to the east
Flinders Island	185 km to the south-southwest
Kent Island Group (Deal, Dover & Erith islands)	173 km to the southwest
Towns	
Lakes Entrance	37 km to the northwest
Marlo	38 km to the northeast
Orbost	44 km to the northeast
Oil and gas production platforms	
Tuna	12 km to the southeast
West Tuna	13 km to the southeast
Marlin-A/-B	17 km to the south-southwest
Snapper	27 km to the southwest

Note: Distances measured from the Longtom-5 subsea well surface location.

Table 4-28 Marine conservation areas located within the EMBA (Tasmania and NSW)

Conservation category	Location	Distance from project area (km)
Tasmania		
Marine National Park	Kent Group (Deal, Erith and Dover Islands). This park is the largest of only five fur seal breeding sites in Tasmania and covers 29,000 ha of marine habitat including shallow and deep reefs and sponge beds in deeper waters. This park is unusually rich in fish species. Two shipwrecks exist within the park.	173
NSW		
National Park	Ben Boyd. This park is located in southern NSW. The park's vegetation reflects it location in the driest, windiest part of the state's coastline. Open forest and woodland cover most of the park. The park's varied habitat supports a highly diverse bird population and about 50 species of mammal.	175
Nature Reserve and Wilderness Area	Nadgee. This park is located in the south eastern corner of NSW adjoining the Croajingolong National Park. Dry open forest areas occur widely throughout this reserve with patches of rainforest occurring in creek catchments and low shrubby heaths being encountered at Mt Nadgee and along the coast. The	157

	reserve also contains fresh and salt water wetlands. The near-coastal areas are significant breeding and foraging habitat for various seabirds.	

5 Environmental Risk Assessment

This section describes the process by which SGHE has identified risks and developed risk reductions measures for preventing and mitigating impacts. Regulation 13 (3)(a) of the OPGGS (E) Regulations requires that an EP include the details of environmental impacts and risks for the activity. Environmental risk assessment consists of four broad steps, as outlined in HB 203:2012 (Managing Environment-related risk) and AS/NZS 31000: 2009 (Risk management – Principals and guidelines). SGHE has used these guidelines as the basis for formulating its own risk assessment protocol (CORP-HSE-027). The key components of this protocol are summarised below.

5.1 Identifying the hazard / risk

The aim of this first step is to compile a comprehensive list of risks based on the hazards or incidents (planned or unplanned) that could result in an environmental impact.

A hazard is an occurrence that can have an adverse impact on the environment and is associated with the proposed activity.

The outcomes of the risk assessment process is summarised in Table 6-1, and each of the identified hazards are described in more detail in each of the summary tables in Section 6.

5.2 Analysing the risk

Risk analysis requires an assessment of the likelihood of a hazard occurring, and the consequences of that hazard on the environment. The likelihood of a hazard occurring has to be assessed considering the:

- Frequency of the event / occurrence expressed as the amount of times the event has occurred in a given time (i.e., infrequently in the industry); and / or
- Probability of a specific consequence expressed as a percentage measurement of the event happening in a given time (i.e. x% chance of occurrence).

5.2.1 Determining Likelihood

The likelihood category is determined based on the worst credible risk and is the likelihood of a specific consequence being realised. SGHE determines the likelihood with consideration of the existing controls and effectiveness of those controls that are in place, the nature of materials or substances that contribute to the impact and the frequency with which the activity may occur and the probability that the specific consequence eventuates.

Table 5-1 outlines the qualitative measures used to determine the likelihood of an impact occurring.

Table 5-1 Qualitative measures for determining likelihood of impact

Level	Description	Description	Guide Range
A	Almost Certain	The event is expected to occur once a year	Every year
B	Likely	The event will probably occur between once a year and once in ten years. Will happen at least once during the life of the facility.	Every 3 years
C	Moderate	The event will probably occur between once in ten years and once in a hundred years. Unlikely but may happen during the life of the facility.	Every 30 years
D	Unlikely	The event will probably occur between once a century and once every thousand years. Very unlikely to occur during the life of the facility. Scenario occurs occasionally world wide	Every 300 years
E	Rare	The event will probably occur less frequently than every thousand years. Virtually impossible. Remote occurrence worldwide.	Every 3,000 years

Note: Facility life is considered to be 20 years.

5.2.2 Determining Consequence

The consequence category is also determined based on the worst credible risk. For example the quantities, concentration and toxicity of the release, time scale of release and the sensitivity of the receiving environment all need to be considered. Consequence is the outcome of an event and it is important to note that there may be a range of outcomes.

The consequence category is expressed as a measure of the:

- Size of the impact and the timeframe for recovery (e.g., localised, rapid recovery within days to months); or
- Length of the impact and timeframe for recovery (e.g., long term impact, recovery measured in decades).

These parameters determine the consequence that the event poses and enable a qualitative measure from ‘insignificant’ to ‘catastrophic’ as shown in Table 5-3 to be selected.

For some hazards SGHE has determined that based on the nature and scale of the activity there is no credible consequence or impact. As there is no consequence or impact there is no risk, SGHE have only included these for completeness as they have been previously raised by the regulator as questions in previous EP submissions.

5.2.3 Determining Risk Level

Risk evaluation helps to prioritise the risks (i.e. determine if the risk of an event or incident is acceptably low), or if management actions are required to further reduce the risk to as low as reasonably practicable (ALARP).

The SGHE risk matrix (Table 5-2) has been used to analyse the impacts arising from the project activities. The environmental risk ranking is determined by a combination of the

expected frequency (or likelihood, as given in Table 5-1) of the impact (or consequence, as given in Table 5-3) leading to the worst case credible risk from the risk matrix provided in Table 5-2.

Management actions to treat the risks are incorporated into the individual risk assessments (Chapter 6). SGHE' management actions aim to reduce the environmental risks of all its activities to ALARP and to an acceptable level.

Table 5-2 Qualitative risk analysis matrix – level of risk

		Consequence				
		1 Insignificant	2 Minor	3 Moderate	4 Major	5 Catastrophic
Likelihood	A: Almost certain	S	H	H	H	H
	B: Likely	M	S	H	H	H
	C: Moderate	L	M	S	H	H
	D: Unlikely	L	L	M	S	H
	E: Rare	L	L	L	M	S

For credible hazards SGHE has also determined the consequence and risk with no project specific controls in place to provide an inherent understanding of the issues. This allows the importance of the controls to be better understood and ensures that the ALARP effort is appropriate to the nature and scale of the impact.

Table 5-3 Qualitative measures for determining consequence

Consequence level/descriptor				
1 – Insignificant	**2 – Minor**	**3 - Moderate**	**4 – Major**	**5 - Catastrophic**
Environmental Effects				
No lasting effect. Low-level impacts on biological or physical environment. Limited damage to minimal area of low significance.	Minor effects on biological or physical environment. Minor short-medium term damage to small area of limited significance.	Moderate effects on biological or physical environment but not affecting ecosystem function. Moderate short-medium term widespread impacts (e.g. oil spill causing impacts on shoreline).	Serious environmental effects with some impairment of ecosystem function (e.g. displacement of a species). Relatively widespread medium-long term impacts.	Very serious environmental effects with impairment of ecosystem function. Long term, widespread effects on significant environment (e.g. unique habitat, National Park). Large clean-up costs.
Social / Cultural Heritage				
Low-level social or cultural impacts. Low-level repairable damage to commonplace structures.	Minor medium-term social impacts on local population. Minor damage to structures/ items of some significance. Minor infringement of cultural heritage. Mostly repairable.	Ongoing social issues. Permanent damage to structures/ items of cultural significance, or significant infringement of cultural heritage/ sacred locations.	On-going serious social issues. Significant damage to structures/ items of cultural significance, or significant infringement and disregard of cultural heritage.	Very serious widespread social impacts. Irreparable damage to highly valued structures/items/ locations of cultural significance. Highly offensive infringements of cultural heritage.
Public concern restricted to local complaints. Ongoing scrutiny/ attention from regulator.	Minor, adverse local public or media attention and complaints. Significant hardship from regulator. Reputation is adversely affected with a small number of site-focused people.	Attention from media and/or heightened concern by local community. Criticism by NGOs. Significant difficulties in gaining approvals. Environment credentials affected.	Significant adverse national media/ public/ NGO attention. May lose licence to operate or not gain approval. Environment/ management credentials are significantly tarnished.	Serious public or media outcry (international coverage). Damaging NGO campaign. Licence to operate threatened. Reputation severely tarnished. Share price may be affected.

5.3 HAZID Workshops

A series of hazard and risk identification workshops (HAZID) have been conducted over the life of the project. Environmental hazards relating to the scope of this EP have been reviewed, re-assessed and re-ranked in a hazard identification workshop conducted between SGHE (formerly Nexus) personnel in June 2013. These hazards are assessed as part of this EP.

Prior to the tie-in of Longtom-5, an additional workshop will be held between SGHE personnel and key contractors to review and confirm the hazards identified in this EP, the controls in place and to identify additional risk reduction measures to ensure the risks are managed to ALARP and to an acceptable level.

5.4 Demonstrating ALARP

In general, risk management and risk acceptance should be based around the ALARP Principal (Figure 5-1). The ALARP principal is that at some point in the risk reduction process the cost involved in reducing the risk further will be grossly disproportionate to the benefit gained. The ALARP principal makes note of the fact that infinite time, effort and money could be spent attempting to reduce a risk to zero and that this is not practical or appropriate.

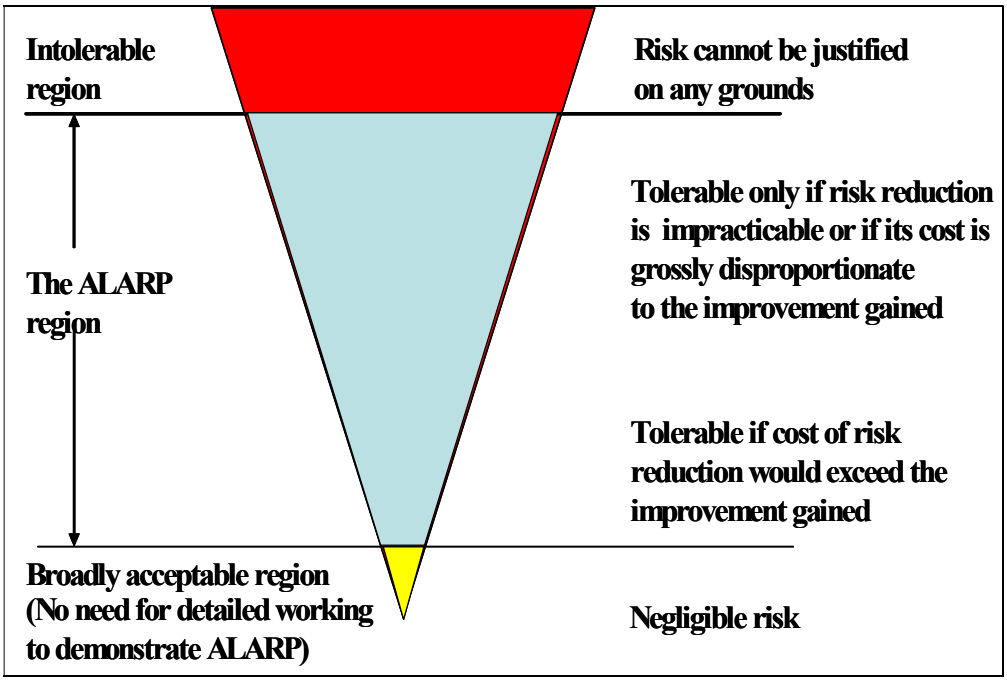


Figure 5-1 The ALARP principal triangle

As part of the ALARP and acceptability assessment SGHE has examined the controls for effectiveness. Individual controls have been qualitatively assigned effectiveness's of Very High, High or Moderate. During the HAZID workshop and the review of ALARP the controls are also

reviewed to ensure that the overall effectiveness is sufficient, that there are sufficient layers of protection and independence of the controls. Finally as part of the ALARP assessment hazards are reviewed for potential additional risk reduction measures

Hazards that are deemed to be:

- Low risk - requires no special risk reduction effort but the principles of ALARP and continuous improvement still apply, such that obvious improvement opportunities should be taken where they are applicable and practicable. This level of risk equates to 'negligible' in the ALARP triangle. It is an expectation that effective planning and management system tools are used to manage tasks and operations at all levels of risk.
- Moderate or significant risk - requires additional preventative measures where possible and where the cost of the control does not disproportionately outweigh the benefit. This level of risk equates to 'tolerable' in the ALARP triangle. All reasonably practicable measures must be taken to reduce the risk.
- High risk - requires additional preventative measures to reduce the risk to an acceptable level (i.e., tolerable or negligible in the ALARP triangle). This level of risk is not considered justifiable under normal conditions. Additional preventative measures must be identified to reduce the risk to ALARP or lower.

The descriptions for the categories of risk presented in the ALARP triangle and the associated management requirements are also listed in Table 5-4.

Table 5-4 Definition of risk

ALARP Definition	Risk Level	Risk Definition
Broadly acceptable - no requirement for detailed working to demonstrate ALARP	Low	Generally acceptable – manage by routine procedures.
Tolerable risk - only if further risk reduction is impracticable or its cost is grossly disproportionate to improvement gained	Moderate	ALARP – management responsibility must be specified. Reduce risk where possible, monitor and review.
	Significant	ALARP – senior management attention and sign off needed, reduce risk as a priority, closely monitor and review.
Unacceptable risk	High	Unacceptable – detailed research and management planning required to reduce the level of risk.

Table 5-5 presents the ALARP 'Hierarchy of Control', which is the preferred order of control methods. This hierarchy is applied when considering additional safeguards/controls or improving existing safeguards/controls to ensure a risk is ALARP (i.e., applied to any residual risk that is not at Risk Level 1). Elimination is the first control method to be considered, with protective control methods considered last.

Table 5-5 ALARP hierarchy of control

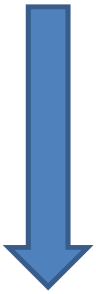
Control	Effectiveness	Example
Eliminate		Refueling of helicopters only carried out from onshore eliminates the risks of an aviation spill from offshore.
Substitute		The use of low-toxicity hydraulic fluids that perform the same task as a higher-toxicity additive.
Engineering		Designing the pipeline and subsea equipment to withstand impacts of trawl gear.
Isolation		Soundproofing of plant, erection of physical barriers, etc.
Administrative		The use of JHAs to assess and minimise the environmental risks of an activity.
Protective		The provision and use of personnel protective equipment (PPE).

Table 5.5 has been used to help demonstrate the ALARP principal for each of the environmental hazards resulting from the project, which are assessed in Section 6.

The level of effort involved with demonstrating and assessing whether the hazard is at ALARP has been commensurate with the level of risk, the inherent consequences of the hazard and a comparison with the impacts and actions from other marine users in the area. For example, low risk–low inherent consequence hazards that are also created by other marine users (such as commercial fishing and merchant vessel activities) and that are accepted by the community have been subject to a lower level of assessment effort than a high risk–high consequence hazard from a non-routine marine activity.

In general, the ALARP process has been based on assessing the hazard, confirming the effectiveness of the controls and determining if there is anything additional that could be done to control the hazard. In identifying additional controls, the ‘Hierarchy of Control’ principal has been used.

Figure 5-2 summarises the risk assessment process.

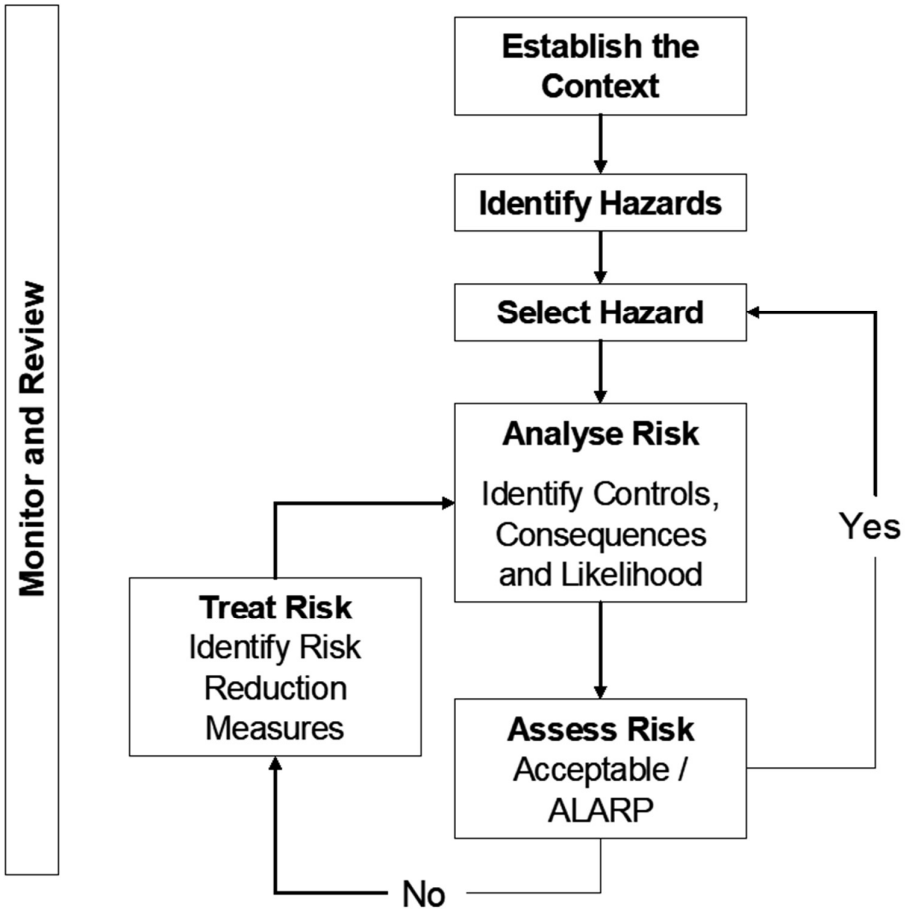


Figure 5-2 The risk assessment process

For a number of hazards, such as hydrocarbon release, the pipeline or vessel safety case will also be applicable to the demonstration of ALARP as these are generally considered Major Accidental Events. The project's safety case addresses these hazards and demonstrates that the safety risks have been managed to ALARP for NOPSEMA acceptance. As the potential safety consequences of these events are likely to exceed the environmental consequences, (note multiple fatalities on the SGHE risk matrix are classed as a catastrophic consequence) the measures implemented and described in the safety case to manage the risk to ALARP will also help manage the environmental risks to ALARP. The safety case and compliance with the safety case is one of the key controls in preventing some of the more significant hazards associated with Longtom operations. The safety case addresses the adequacy of the design, the operating procedures and systems and the training and competency of site personnel at Patricia Baleen.

Risk reduction measures (RRMs) identified during the risk assessment process generally have the following questions asked of them to determine if they are practicable and should be implemented:

1. Will they reduce the level of risk

2. Will they not introduce additional risks
3. Are they supported by industry codes, standards and practices
4. Will they be supported by personnel
5. Will they be cost effective.

If the answer is yes to all then the RRM should be implemented. Conversely if the answer is no to most of them then it should be rejected. Ones that are unclear may require additional assessment and review and should be kept for further consideration.

5.5 Demonstrating Acceptability

The risk assessment process must also demonstrate that that all identified environmental impacts and risks of the project are of an 'acceptable level'. This is done by comparing the impact and risks with defined acceptable levels. SGHE has defined what they consider to be broadly acceptable risks (low risk), tolerable risks (moderate and significant risk) and unacceptable risks (high risk) in Table 5-4.

SGHE assesses acceptability based on, but not limited to, the following factors:

- ALARP has been demonstrated.
- Consideration of the level of risk and the SGHE risk matrix (Table 5-2 and Table 5-4).
- Consideration of the potential extent of the impact on the environment.
- Comparison with other oil and gas companies practices and developments.
- Comparison with other activities/industries that are currently taking place in the area / or similar areas and which are accepted by the community (i.e., the fishing and shipping industries).
- Results from community consultation.

5.6 Monitor and Review

The final part of the risk assessment process is to monitor and review the performance of the controls, to ensure that the assessment is valid and that the controls have reduced the risk to ALARP and are of an acceptable level and continue to be so.

To this end, SGHE has defined and developed environmental performance standards for each of the identified credible hazards and their control measures. Environmental performance standards have been set at a level to ensure control measures perform at the level relied upon to demonstrate the related impact or risk is reduced to ALARP and at an acceptable level.

Similarly to the ALARP demonstration, a greater focus has been on the development of effective performance standards for the high risk/high consequence activities than for the low risk/low consequence activities. In all cases, the performance standards have been selected/reviewed for usefulness and have also been assessed against the SMART (Specific,

Measureable, Achievable, Relevant, Time-based) principal. The environmental performance objectives, standards and measurement criteria for the project are detailed in Section 7.

5.7 Communicate and Consult

As described in Section 3.5, communication and consultation with external stakeholders is ongoing and will continue to be maintained for future activities. A copy of the key risk and controls were distributed to identified stakeholders in February 2014 and in July 2019, details of the consultation is provided in the consultation log.

Consultation will be undertaken in accordance with the consultation log and the project's Implementation Strategy (Section 8).

6 Environmental Impact Assessment

This chapter outlines the environmental risk assessment (ERA) for the project, using the methodology described in Chapter 5 and in accordance with Regulations 13 (3) and 13 (3A) of the OPGGS (E) Regulations.

The prevention and mitigation measures, as well as the ALARP and acceptability justifications for each hazard, have been developed using the combined experience of SGHE staff and environmental advisors to SGHE.

The hazards in Table 6-1 have been identified and assessed for impacts and risks.

Table 6-1 Summary of project hazards and their inherent impact and risk rankings

#	Hazard	Inherent Impact	Inherent Risk
Routine			
1	Discharge of hydraulic fluid	Low	
2	Physical presence of offshore facilities – impact on marine fauna and seabed	Low	
3	Physical presence of offshore facilities – impact on other users	Low	
Non Routine			
4	Loss of containment of hydrocarbons – subsea equipment damage		Low
5	Loss of containment of hydraulic fluid, MEG and methanol – subsea equipment damage		Low
Vessels/ROV Operations/Longtom-5 tie-in			
6	Vessel collisions with marine fauna	No credible impact	
7	Noise emissions	No credible impact	
8	Light emissions	No credible impact	
9	Atmospheric emissions	No credible impact	
10	Discharge of sewage and grey water	Low	
11	Discharge of putrescible waste	Low	
12	Discharge of contaminated deck/bilge water		Low
13	Discharge of non-hazardous waste		Low
14	Discharge of hazardous waste		Low
15	Discharge of cooling water	No credible impact	
16	Discharge of desalination brine water	No credible impact	
17	Introduction of invasive marine species		Low
18	Vessel diesel spill		Low
19	ROV discharges		Low
20	Discharges during Longtom-5 tie-in	Low	Low

SGHE has provided an inherent impact or risk ranking for each of the hazards to comply with NOPSEMA's guidance to present the risk pre-treatment. SGHE has considered the 'inherent impact risk' to mean the risk from the activity if the project specific controls were not in place.

Removing all controls in the assessment of inherent impact risk is not considered practical or appropriate, for example, to avoid a vessel diesel spill, vessels must comply with marine legislation and have controls in place, as described in Section 6.3.13.2, if they are to operate. For this reason, SGHE has assessed the inherent impact risk of each hazard with the inherent controls or considerations in mind (see 'basis of inherent impact risk assessment' section in each of the risk assessment tables).

The hazards given a 'no credible impact' risk ranking in Table 6-1 were deemed to have **no credible impact** due to their having no credible environmental consequence of significance.

SGHE has used the boundary of the EMBA (see Figure 4.1) for the purposes of assessing the environmental impacts of the project.

6.1 Routine Impacts

This section describes the project's routine environmental impacts, including:

- Discharge of hydraulic fluid.
- Physical presence of offshore facilities - impact on marine fauna.
- Physical presence of offshore facilities - impact on other users.

6.1.1 Discharge of hydraulic fluid

6.1.1.1 Hazards

Hydraulic fluid is used to control subsea valves. The original selected hydraulic fluid was MacDermid Oceanic HW525. Oceanic HW525 is a water-based fluid, with 25% MEG and additional additives to provide a higher degree of protection against wear, corrosion and microbiological degradation and is the most commonly used hydraulic fluid in Bass Strait. The product was considered to be D ranked on the UK Offshore Chemical Notification Scheme (OCNS) ranking. Due to the biodegradability of the lubricant, a molybdenum-based chemical, the OCNS ranking has recently been revised to an "A". In early 2015 the decision was made to replace HW525 with Transaqua HT2. HT2 is a D rated hydraulic fluid with no substitution warnings and is compatible with the Longtom facilities and HW525. The umbilical contains a significant quantity of liquid and based on normal operations the complete replacement of HW525 with HT2 will take some time. Options to expedite the changeout were assessed however no practicable method was identified, the risk of the umbilical containing HW525 and operations continuing to use HW525 until flushed with HT2 was assessed to be ALARP.

During operations, a small amount (between 1 and 7 litres) of hydraulic fluid is discharged from the wellhead or HIPPS each time a valve or choke is activated remotely via the umbilical control as described above. This is normal for subsea gas production facilities throughout the world. It is estimated that the monthly discharge is up to approximately 200 litres per month, depending on the frequency of valve operations. When no valves are actuated, there is no hydraulic fluid is discharged in this manner. In addition to the operational discharge of hydraulic fluid described above, some small amount of seepage across valves also takes place in these

systems. This seepage rate is generally low and spread out across the subsea facilities. Cameron (now OneSubsea) are the designers and fabricators of the Longtom SCMs, of which there are 5, and undertake leak tests on their components as part of their QA checks. The specification for these SCMs allows for a leakage of up to 1.2 litres per day per SCM prior to offshore deployment.

A leak of hydraulic fluid to the marine environment was detected from the subsea facilities in 2009. A full description of the cause of the leak and remedial actions was provided in Incident Investigation Report (Document Number: LONG-HSE-051) to the then DPI now the DJPR.

A series of onshore tests were carried out in late June 2010 to try and identify the location of the leak. Tests indicated that the leakage was in one of the Subsea Control Modules (SCM). There are three SCMs, one at the HIPPS, one at the Longtom-3 well and another at the Longtom-4 well. Subsequent offshore investigations in 2012 confirmed the location and nature of the leak as being a leaking solenoid valve in the Longtom-4 SCM. Whilst the solenoid valve hasn't been replaced, software changes have significantly reduced or stopped this specific leak, during normal operations typically less than 200 litres of hydraulic fluid per month appears to be leaking and some to all of this may be the general seepage across all the various solenoid valves and the SCMs. The consumption of hydraulic fluid is monitored and recorded monthly to confirm the nature of the leak.

With the Longtom facilities currently shutdown there is no discharge of hydraulic fluid.

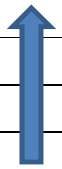
6.1.1.2 Description of OCNS, CHARM and the SGHE Chemical Selection Process

All products which are used in the North Sea offshore oil industry have to be evaluated under the requirements of international legislation established by the Oslo Paris (OSPAR) Convention in order to monitor their environmental impact. The OSPAR Convention has enabled the set-up of some of the most stringent chemical control legislation in the world. Under the Convention, a list of 'environmentally acceptable' substances has been published and are known as the 'PLONOR' list (OSPAR List of Substances/Preparations Used and Discharged Offshore which Are Considered to Pose Little or No Risk to the Environment (PLONOR) (Reference number: 2004-10)).

Under the Convention, organic based compounds are subject to the Chemical Hazard Assessment and Risk Management model known as CHARM. The CHARM model calculates the ratio of the Predicted Effect Concentration against the No Effect Concentration and is expressed as a Hazard Quotient (HQ), which is then used to rank the product. The HQ is converted to a colour banding (see Table 6-2), which is then published on the Definitive Ranked Lists of Approved Products (by the UK Offshore Chemical Notification Scheme - OCNS). The CHARM model requires the biodegradation, bioaccumulation and toxicity of the product to be calculated. Testing the effect of the product on three different species of aquatic organism is carried out including algae, crustaceans and fish.

Table 6-2 The OCNS HQ and Colour Bands

Minimum HQ Value	Maximum HQ Value	Colour Banding	Hazard
>0	<1	Gold	Lowest Hazard
>1	<30	Silver	
>30	<100	White	
>100	<300	Blue	
>300	<1000	Orange	
>1000		Purple	Highest Hazard



Products not applicable to the CHARM model (i.e., inorganic substances, hydraulic fluids or chemicals used only in pipelines) are assigned an OCNS grouping A – E, with A being the greatest potential environmental hazard and E being the least (see Table 6.3). Products that only contain substances termed PLONORs (Pose Little or No Risk) are given the OCNS E grouping. Data used for the assessment includes toxicity, biodegradation and bioaccumulation.

SGHE selects new chemicals only after undertaking a thorough chemical selection process that includes a risk assessment process (CORP-HSE-0093) that considers the requirements of the OSPAR Convention (as described above) and the review of various alternatives. Chemicals should be “D or E” or “Gold or Silver” rated and their potential impact and risk must be described and assessed. The risk assessment must be signed off by the SGHE HSEC Manager before use.

New chemicals will be added to an approved list of chemicals and this will be audited.

Table 6-3 The OCNS Environmental Ranking System for Inorganic Substances

OCNS Grouping	Result for Aquatic Toxicity (mg/l)	Result for Sediment Toxicity(mg/l)
A	<1	<10
B	>1 – 10	>10 – 100
C	>10 – 100	>100 – 1,000
D	>100 – 1,000	>1,000 – 10,000
E	>1,000	>10,000

6.1.1.3 Environmental Impacts

In the original development of the Longtom Environment Plan HW 525 was taken to be a “D” rated chemical. The impacts from valve operations and from the ongoing leak were considered to be insignificant and that they posed little immediate or long term risk of impact to the marine

environment. This was based on HW525 being “D” rated, of low toxicity, not bioaccumulating and that it would disperse rapidly.

Since this analysis was done the OCNS ranking of HW525 has changed to an “A” based on the toxicity of the molybdenum-based chemical used as the lubricant. The exact chemical is the proprietary information of Macdermid but is likely to be molybdenum disulfide or similar and it constitutes less than 0.25% of the hydraulic fluid. The Molybdenum lubricant has an aquatic toxicity of 0.85 mg/l (EC50 72h Skeletonema). The chemical will not bioaccumulate and its primary degradation begins within days-weeks and it is ultimately biodegradable within months.

The largest release of hydraulic fluid occurs when a HIPPS valve is closed and this is approximately 7 litres in approximately 30 seconds. While the leak has an ongoing discharge rate of 0.3 litres per hour, based on a monthly discharge of 200 litres, note that this value includes the general seepage across the 5 SCMs.

ROV footage of the main Longtom-4 leak, prior to the logic change, showed the dyed fluid rapidly mixing and dispersing with the current and eddies generated around the subsea structures. Subsea currents of up to 1 knot or 0.5m/s can be experienced at the Longtom location but they are generally diurnal with a median bottom current of around 0.15m/s.

Dispersion modelling for the largest release rate from the HIPPS indicates that within 200 meters the concentration will be below the toxicity value given above for the lubricant and that the plume width is only a few meters. Whilst some impact might be experienced within the immediate vicinity of the leak, the chemical will be rapidly diluted and due to the nature of the release (intermittent and typically less than once a month for HIPPS valves) marine organisms will not be continuously exposed to any significant level. Note the aquatic toxicity of 0.85mg/l is based on 72 hours of exposure while the HIPPS release is only about 30 seconds. Based on the modelling for the HIPPS discharge the ongoing leak can also be considered to be rapidly dispersed to below levels that would pose any significant risk. Note that this dispersion modelling is relatively conservative as it has also not taken into account the turbulence generated around the subsea equipment, evident from the ROV footage and hence a greater level of dispersion is likely to occur.

6.1.1.4 Impact and Risk Assessment

Table 6-4 outlines the assessment for the discharge of hydraulic fluid.

Table 6-4 Discharge of hydraulic fluid risk assessment

Hazard duration	Valve releases and seepage will occur throughout the operation of the Longtom facilities as will the minor leak.
Extent of hazard	Limited to the immediate area around the release point.
Basis of inherent impact and risk assessment	
• Hydraulic fluid is the only chemical that is routinely discharged to the marine environment. All other chemicals are contained within the subsea facilities. • The monthly volume of hydraulic fluid discharged through valve operations is small (typically between 0 and 200 litres).	

- The volume of hydraulic fluid lost via general seepage and the leak is also small (typically less than 200 litres)
- The hydraulic fluid does not bioaccumulate and will disperses rapidly to below significant levels.
- There are no known sensitive environments in the project area.

Inherent impact and risk analysis and ranking		
Consequence	**Likelihood**	**Inherent impact**
Insignificant (1)	n/a	Low
Project specific environmental controls and checks that will take place	Prevention • Longtom Pipeline Safety Case including: - Equipment design and validation (both in terms of ensuring the design is appropriate and that releases are minimised) – effectiveness considered Very High - Process controls, alarms and trips – effectiveness considered Moderate. - Training and competency of personnel to operate and maintain the facilities appropriately, including 24 hour continuous monitoring of production parameters – effectiveness considered moderate. - Procedures for operating and maintenance activities– effectiveness considered moderate. • The original hydraulic fluid - HW525 does not bioaccumulate - effectiveness considered moderate. • HW525 will be progressively replaced with Transaqua HT2. Mitigation • Not applicable.	

Residual risk analysis and ranking		
Consequence	**Likelihood**	**Residual Impact**
Insignificant (1)	n/a	Low

Demonstration of ALARP	
The key preventative controls are the design of the facilities and the low toxicity of the selected chemical the effectiveness of both these controls are considered at least high in preventing environmental impact. In the event of failure there are additional controls such as the process control system, alarms and trip and the presence of operators who would identify the problem and take action to prevent or minimise the loss of containment, their combined effectiveness is also considered high. The controls are considered sufficient, suitably robust, independent and effective to ensure the residual risk is Low and ALARP. The following ALARP analysis also confirms that all reasonable risk treatment options have been / or are being considered to reduce the environmental impact of hydraulic fluid discharges. The risk is currently deemed to be **ALARP,** while further risk reduction measures are further assessed options. A 'Low' residual risk ranking is **broadly acceptable** according to the SGHE definition of risk.	
Eliminate	Hydraulic fluid cannot be eliminated. It is required to operate the subsea valves at the wellheads. The valves need to be regularly tested to ensure they remain operational, meet critical function testing requirements and to alter Longtom production. Minor leakage across all the solenoid valves and SCMs also occurs due to their design and specification. Cameron (nowOneSubsea) is the manufacturer of the SCMs, and have an allowable leak of around 1 litre per SCM per day. This cannot be eliminated.

	The leak at LT4 has been largely eliminated by a software change and during the current shutdown phase there is no release. Undertaking an offshore campaign to specifically replace the solenoid valve has been examined as a risk reduction measure (RRM), Whilst this could stop the leak it wouldn't stop the general leakage and it has been rejected as the sole reason for an offshore campaign. The risk from the leaking hydraulic fluid is very low. Undertaking a campaign will in itself introduce additional risks that are considered to outweigh the benefit, these risks include all the environmental risks associated with vessel operations, safety risks associated with the campaign potentially including diver related issues and the operations also pose a risk of damaging the existing facilities leading to a commercial risk of loss of production. Replacing subsea equipment due to a leak of this nature is not considered normal industry practise and is unlikely to be supported. The cost of bringing in an offshore support vessel to carry out the works is likely to be at least several million dollars and as such the RRM is not considered cost effective. If a dive campaign is required for Longtom-5 or a dive support vessel is in Bass Strait for another job then opportunities to replace the solenoid will be examined. Shutting down the leaking equipment was also considered and whilst it may reduce the hydraulic fluid leak it was rejected as not being practical. The leaking solenoid valve cannot be individually isolated from onshore; the only means would be to shut in the entire Longtom and Patricia Baleen fields until an offshore campaign could be organised. As has already discussed this itself has been rejected as not being practical. Shutting the Longtom field in would have a very significant impact on SGHE financially and would pose a High risk. Additionally, if hydraulic pressure was not maintained sea water ingress through the leak could occur resulting it significant subsea equipment damage. A shut in for this type of leak is not standard industry practice and would not be supported by SGHE personnel or the operators of the Patricia Baleen gas plant. It is not considered a cost effective option.
Substitute	Whilst the selected hydraulic fluid (HW525) was a category 'D' OCNS chemical with low environmental impact, it was revised to an 'A' rated chemical due to the biodegradability of the molybdenum based lubricant in 2014.. SGHE have assessed alternatives and the plan is to progressively replace HW525 with Transaqua HT2, which is a D rated chemical.
Engineering	The subsea valves and control system have been installed and there is no practical way to re-engineer the system. The design is standard and was based on the existing Patricia Baleen umbilical – there was no opportunity to install a closed hydraulic system.
Isolation	The onshore inventory can be isolated from the umbilical and the pumps stop on low discharge pressure. During major outages the pumps are also stopped to reduce/prevent the leak.
Administrative	The volumes of hydraulic fluid discharged are monitored, recorded and compared with that predicted monthly.
Protective	Not applicable.
Demonstration of Acceptability	
Discharged hydraulic fluid will rapidly mix and disperse in the marine environment to levels that are not expected to have any impact on the marine environment. The selected hydraulic fluid (HW525) was a category 'D' OCNS chemical, which was considered to have a low environmental impact. While the ranking has changed to an 'A', due to the biodegradability of the lubricant the impact on the environment is still considered low.	

The ocean currents and depth of operations (approximately 57 m) will cause all fluid to be dispersed quickly through the water column in the high energy environment of Bass Strait. Hydraulic fluid is commonly discharged by the oil and gas industry and subsea systems are generally designed as open systems. HW525 is still used by many other operators. There have been no concerns raised regarding the discharge of hydraulic fluid during stakeholder consultation and the previous EP was accepted by the DSDBI. The leak at LT4 has been virtually eliminated by the software change and is probably significantly less than the general leakage across all the solenoid valves and SCMs that occurs. This risk is considered currently **acceptable** given the small volumes discharged the insignificant consequence that could eventuate and that this fluid is used by other oil and gas operators. As has already been discussed HW525 will be progressively replaced with Transaqua HT2.
Monitoring
Currently there is no discharge and no monitoring. During operations the total volume of hydraulic fluid consumed and discharged is recorded every month.

6.1.2 Physical presence of offshore facilities - impact on marine fauna and seabed

The physical presence of the operational offshore facilities is expected to have a minimal impact on the marine environment. However there are a number of actions / issues that have the potential to result in some impact or change to the marine fauna, these include:

- Erosion/sediment build up around existing infrastructure.
- Placement of subsea infrastructure and the tie-in of Longtom-5.
- Maintenance activities (i.e., lifting of umbilical and installation of sand bags / grout bags / concrete mattresses).

6.1.2.1 Environmental Impacts

The known and potential environmental impacts relating to the presence of the offshore facilities are:

- Seabed infrastructure will act as an artificial habitat for benthic fauna colonization.
- Localised turbidity of the near-seabed water column, resulting in temporary disturbance to benthic habitats and fauna.
- Permanent displacement of a small area of seabed habitat caused during the:
  - Placement of the Longtom subsea facilities.
  - Placement of small structures and sand bags to stabilise equipment.
- The petroleum safety zone around the Longtom-3 and Longtom-4 wells will act as a marine reserve and protect the environment as commercial fishing is excluded.

Benthic fauna colonization

The project's operational infrastructure provides an artificial environment for marine organisms, resulting in an increase in the abundance of benthic fauna. This increase in species diversity and abundance is considered a **positive** impact, given that there are no known sensitive seabed habitats or features in the project area. The wellheads and main structures are all contained within a petroleum safety exclusion zone (gazetted around Longtom-3 and Longtom-

4), which also means that they are protected from commercial fishing (i.e. the area will provide a haven for marine species that are susceptible to impacts from commercial fishing).

Localised turbidity resulting in temporary disturbance to benthic habitats

The project's operational infrastructure, which sits above the sea floor, has the potential to cause localised alterations to the hydrodynamic regime directly around the infrastructure (i.e. localised erosion and the build up of sediment). This impact is not considered significant and from ROV surveys the area appears to stable and to have been recolonised.

Additionally, minor leakage of grout (cement and water) may occur during the filling of grout bags and when the hose is flushed with seawater. While the release of grout may create localised turbidity of the water column, the volume to be released is expected to be very low and the cement is designed to set in the marine environment (i.e. minimal dispersion). Cement chemicals are also of low toxicity and chemically inert. Given the localised extent of effects, the small volumes expected to be released and the non-toxic nature of the grout, the consequence is considered insignificant.

The physical placement of the Longtom assets and the Longtom-5 facilities will displace / damage the benthic fauna that existed in these locations. The seabed in the project area may also be disturbed by the lifting of the umbilical for inspection and the placement of sand bags and mattresses to reduce the freespan of the pipeline.

There are no sensitive benthic habitats in this part of Bass Strait and the area has been and will be rapidly recolonised. Any impacts to epibenthos along the flowline will be both localised and short-lived. Surveys will be conducted following construction campaigns to check that no junk or debris is left on the seafloor.

6.1.2.2 Impact and Risk Assessment

Table 6-5 outlines the risk assessment for impacts on marine fauna and the seabed due to the presence of offshore facilities.

Table 6-5 Marine fauna and seabed disturbance assessment

Hazard duration	Permanent for subsea infrastructure, temporary for intervention and maintenance activities.	
Extent of hazard	Localised to immediate footprint and petroleum safety zones.	
Basis of inherent impact and risk Assessment		
• There are no known sensitive seabed habitats in the project area. • There are no listed shipwrecks in the project area. • Operational infrastructure will act as an artificial habitat for benthic fauna colonisation. • The wellheads and key structures are all contained within petroleum safety exclusion zones thus helping protect the environment from commercial fishing activities. • The impact has already occurred for Longtom 3, 4 and the pipeline.		
Inherent impact risk analysis and ranking		
Consequence	**Likelihood**	**Inherent impact**
Insignificant (1)	N/A	Low

Project specific environmental controls and checks that will take place	Prevention • Engineering design to ensure equipment is stable on the sea floor and the area of disturbance is minimised as far as practicable - effectiveness considered High. • Cement is selected in accordance with the Chemical Selection Process (see Section 6.1.1.2) - effectiveness considered Moderate. Mitigation • An ROV survey will be undertaken following the tie-in of Longtom-5 to conduct an as-built survey and this will also search for and retrieve any construction debris - effectiveness considered Moderate.

Residual risk analysis and ranking		
Consequence	**Likelihood**	**Residual Impact**
Insignificant (1)	N/A	Low

Demonstration of ALARP	
The key preventative controls are the design (particularly the small footprint) of the facilities and the low toxicity of the selected chemicals, the effectiveness of these controls is considered high in preventing environmental impact. The ROV surveys will help ensure that all construction equipment is removed and that any issues are identified further prevent or minimise the impact. Given the low level of inherent impact the controls are considered sufficient, suitably robust, independent and effective to ensure the residual risk is Low and ALARP. The following ALARP analysis confirms that all reasonable risk treatment options have been considered to reduce the environmental impact of the offshore facilities on marine fauna/seabed, and the risk is deemed to be **ALARP**. There are no other feasible risk treatment options. A 'Low' residual risk ranking is **broadly acceptable** according to the SGHE definition of risk. The petroleum safety zones around the Longtom-3 and 4 wellheads will act as a marine reserve as these areas will be protected from commercial fishing activities – this may lead to an actual net benefit to the environment	
Eliminate	Not applicable in terms of the Longtom facilities but damage from commercial fishing activities will be eliminated within the petroleum safety zones.
Substitute	The cement will be subject to a Chemical Selection Process (see Section 6.1.1.2).
Engineering	Engineering design to ensure equipment is stable on the sea floor and the area of disturbance is minimised as far as practicable.
Isolation	Not applicable.
Administrative	Not applicable.
Protective	Not applicable.

Demonstration of Acceptability
The impact of the offshore facilities on marine fauna/seabed, particularly the placement of the Longtom-5 flowline, the lifting of the umbilical for inspection and the placement of small structures to reduce the freespan of the pipeline, is very low and significantly less than the impact from commercial fishing in the area which use scallop dredges and trawls. The potential disturbance to benthic communities and fauna in the water column is considered to be minimal, if any, and highly localised for the operations phase of the project. Benthic communities in Bass Strait are expected to rapidly recolonise any permanently displaced areas and settle on the new infrastructure. The zone affected is small, of low environmental sensitivity and is protected by the Longtom-3 and Longtom-4 petroleum safety exclusion zone. There are numerous other oil and gas developments in Bass Strait (20 production facilities). Longtom being a subsea development poses less of an impact than a conventional platform. Oil and gas infrastructure in the area has been accepted for the last 40 years. There have been no concerns raised during stakeholder consultation regarding the impacts to marine fauna/seabed by the offshore facilities. This risk is considered **acceptable** given the insignificant consequence and as there are no known sensitive seabed habitats in the project area.

Monitoring
No physical seabed sampling or monitoring is necessary based on the absence of sensitive seabed habitats.

6.1.3 Physical presence of offshore facilities - impact on other users

The physical presence of the offshore facilities may have an adverse effect on other users of the area, such as commercial fishing vessels. In order to assess and manage this risk, a consultation process with the relevant stakeholders was undertaken during the original design and construction of the Longtom facilities.

6.1.3.1 Environmental Impacts

The known and potential environmental impacts relating to the presence of the offshore facilities are:

- Damage to fishing equipment (i.e., interference with demersal trawl gear).
- Reduction in fishing grounds by the safety exclusion zone around the Longtom-3 and Longtom-4 subsea wellheads.
- Localised disturbance to habitat for target commercial species.
- Impact on navigation – not considered credible given location within ATBA and the nature of the subsea development.

Damage to fishing equipment and reduction in fishing grounds

Fishing gear such as otter-board or Danish seine trawl nets and anchors have the highest potential for snagging on subsea equipment associated with the project. Squid and pelagic fishing involves no contact of gear with the seabed and therefore these will be largely unaffected.

Based on data supplied by AFMA, the project area is located in an area of low to moderate fishing activity, as defined by DNV Guidelines and Recommended Practices No. 13 (Interference between pipelines and trawl gear, September 1997). The highest level of fishing activity is from trawl and Danish seine fishermen, with otter-board trawl fishing accounting for approximately 10% of the total activity. Consultation with scallop fishermen indicates that the project area is not in an area of frequent scallop recruitment and previous scallop fishing.

To protect the offshore infrastructure from damage, a permanent 500-m safety exclusion zone has been established around Longtom-3 and Longtom 4, as is standard practice in offshore gas fields. This exclusion represents a very small percentage of the total fishing grounds in eastern Bass Strait.

Exclusion zones for fishing around pipelines are generally not practical. They are extremely difficult to enforce, particularly where applied to long, narrow corridors. Furthermore, as offshore production facilities increase in an already developed oil and gas basin, the network of pipelines results in a very complex maze of exclusion corridors if these were to be imposed. For example, there are now over 800 km of subsea pipelines linking production facilities and transferring oil and gas to shore in the offshore Gippsland Basin.

The entire subsea pipeline route is located over sandy seabed, where, over time these sections of pipeline may become partially buried by natural bed sediment transport (sand

movements), especially during storm events. This in itself will decrease the likelihood of interference with gillnet or trawl gear.

The umbilical was trenched between Longtom-3 and Longtom-4, except for short sections adjacent to the tie-ins at each end. The trench has been naturally backfilled. In other areas the umbilical was installed on the sea floor and sections have self buried.

Localised disturbance to habitat

The project is located in an area of low to medium trawl fishing activity. It is not expected that fish species will be exposed to harmful noise levels; however should behavioural changes to fish occur, they will be localised and temporary as the intervention and maintenance activities will be of short duration.

There is a large area of unrestricted fishing ground available to fishermen away from the wellheads that can be used during the short period of intervention and maintenance.

While the establishment of the petroleum safety zones may have had a minor negative impact to fishermen, they are likely to be a positive impact to the fish species themselves through the provision shelter and protection.

Navigation impacts

The construction of the Longtom facilities and the implementation of the Longtom-3 and Longtom-4 safety zones could lead to an impact on merchant vessels navigating through the area. However, the Longtom facilities are largely in the Bass Strait Area to be Avoided (ATBA) that prohibits vessels over 200 tonnes hence there is no real impact on the navigation of merchant shipping.

Most intervention and maintenance activities will occur within the existing exclusion safety zone. Vessels supporting maintenance activities will potentially impact other users of the marine environment such as fishermen however this will only be for a limited period. Stakeholders will be notified prior to maintenance activities commencing and the presence of vessels in the area.

All offshore vessels are equipped with navigation equipment and will display all required navigation lighting to minimise navigation hazards to passing vessels. Given the short duration of the intervention and maintenance activities and the existing ATBA and petroleum safety zones, the risk of significant disruption to other users is minimal.

6.1.3.2 Impact and Risk Assessment

Table 6-6 outlines the risk assessment for impacts on other users due to the presence of offshore facilities.

Table 6-6 Impacts on other users' impact assessment

Hazard duration	Permanent for the petroleum safety exclusion zone, temporary for intervention and maintenance activities.

Extent of hazard	Localised (within the petroleum safety zone and immediate vicinity of the intervention/maintenance activity).

Basis of inherent impact and risk assessment

- The project is located in an area of low to medium trawl fishing activity.
- Intervention and maintenance activities will be of short duration (approximately one week every 1-3 years).
- The pipeline is designed to be over trawlable.
- The Longtom-3 and Longtom-4 safety zones are within the Area to be Avoided – hence they have no significant impact on commercial shipping
- Provision of digital information to fishers and the government on the location of the Longtom wellheads and pipeline. Hydrographic charts have subsequently been updated with Longtom facilities.
- The area associated with the two petroleum safety zones is very small in relation to the rest of the available fishing grounds.

Inherent impact and risk analysis and ranking

Consequence	Likelihood	Inherent impact
Insignificant (1)	N/A	Low
Project specific environmental controls and checks that will take place	Prevention • Longtom-5 design - will be located within the existing Longtom-3 petroleum safety zone – effectiveness considered very High in terms of preventing any additional impact to marine users. • Consultation will be maintained with commercial fishing groups regarding the tie-in of Longtom-5, operations, and intervention and maintenance activities – effectiveness considered Moderate. Mitigation • A survey will be undertaken following intervention and maintenance activities to ensure no junk or debris is left on the seabed – effectiveness considered Moderate.	

Residual risk analysis and ranking

Consequence	Likelihood	Residual Impact
Insignificant (1)	N/A	Low

Demonstration of ALARP

The key preventative controls are the design (particularly that Longtom-5 will be within the existing Longtom-3 petroleum safety zone) and the consultation to date, the effectiveness of these controls is considered very high in preventing community impact. The ROV surveys will help ensure that all construction equipment is removed and that any issues are identified further prevent or minimise the impact. Given the low level of impact the controls are considered sufficient, suitably robust, independent and effective to ensure the residual risk is Low and ALARP.

The following ALARP analysis confirms that all reasonable risk treatment options have been considered to reduce the environmental impact of the offshore facilities on marine fauna/seabed, and the risk is deemed to be **ALARP**. Adopting further risk reduction measures will incur costs that are grossly disproportionate to the benefits gained. A 'Low' residual risk ranking is **broadly acceptable** according to the SGHE definition of risk.

Eliminate	Not applicable.
Substitute	Not applicable.
Engineering	The subsea pipeline has been designed to be over trawled and to withstand impacts of trawl gear.

Isolation	A 500-m permanent petroleum safety exclusion zone has been gazetted around Longtom-3 and Longtom-4, whilst excluding commercial fishing activities in this area this reduces the risk of fishing equipment getting pinned on the Longtom facilities.
Administrative	A survey will also be undertaken following intervention and maintenance activities to ensure no junk is left on the seabed.
Protective	Not applicable.
Demonstration of Acceptability	
The project area is located in an area of low to medium fishing activity. Fisheries consultation undertaken to date shows minimal direct impact on fishermen or access to grounds. The Longtom3 and Longtom-4 safety zones are within the Area to be Avoided hence there is no impact on commercial shipping. There are numerous other oil and gas developments in Bass Strait. Longtom being a subsea development poses less of an impact than a conventional platform. Oil and gas infrastructure in the area has been accepted for the last 40 years. This risk is considered **acceptable** given it will pose no real impact on commercial shipping and the impact to commercial fishing has already been made and any ongoing impact is expected to be insignificant.	
Monitoring	
Consultation with key stakeholders prior to any offshore campaigns identified in the consultation log and complaints (if any) investigated.	

6.2 Non-Routine Impacts

This section describes the project's non-routine operational environmental impacts which can be categorised as follows:

- Loss of containment of hydrocarbons - subsea equipment damage / failure.
- Loss of containment of hydraulic fluid, MEG and methanol - subsea equipment damage / failure.

These non-routine events could only occur if there was some form of major equipment failure. The facilities have been specifically designed to minimise the likelihood of this as not only would it be an environmental risk but it will also pose a safety concern and would lead to major financial implications due to the subsequent loss of production

6.2.1 Loss of containment of hydrocarbons - subsea equipment damage

The Worst Case Credible Spill (WCCS) Scenario from production of the Longtom gas field is an uncontrolled well release (blowout). The only mechanism that has been identified that could lead to a full bore blowout from an operational well is if a large vessel drags its anchor across one of the Longtom trees, ripping it off and the surface controlled subsea safety valve SCSSV fails to close. Given the location of the Longtom wells within the Bass Strait Area to be Avoided and the distance from a shipping lane anchor drag is an extremely unlikely event. The SCSSV has been designed and installed to prevent a full bore release in this instance and is subject to regular testing.

Blowouts generally occur during drilling or workover operations, rather than during production operations. The likelihood of a blowout occurring during production is significantly less likely than the risk of blowout during drilling. Data from SINTEF indicates that less than 5% of blowouts in the North Sea occur during operations and that the frequency of a blowout or release from an operational well (excluding external causes) is 5.5×10^{-6}/yr. External causes such as fishing impact are not a credible cause of failure of the Longtom well due to the designs snag resistance exceeding the capacity of the fishing vessels in the area.

In the event of a blowout, the loss of containment could continue until the well could be killed or a relief well could be drilled to plug the damaged well. Whilst a well kill may be possible from onshore, an offshore relief well could take several months to be completed. The use of a capping stack is not considered credible based on the water depth and that the blowout will be predominantly gas. However this option would be re-assessed in the event of a subsea failure and as capping technology changes.

A pipeline failure or rupture could also lead to a loss of containment, however in this instance the wells would be shut-in and only the contents of the pipeline would be lost. A study into the total liquids inventory in the Longtom-Patricia Baleen pipeline concluded that volume of a spill from the pipeline would be in the range of 485-503 bbls, depending on production rate. The pipeline contents are significantly smaller than the loss that could result from a blowout.

6.2.1.1 Environmental Impacts

A subsea release (Figure 6-1) would form a jet consisting of high velocity fluid confined to a narrow cone. The initial momentum of the jet phase would dissipate rapidly within about 1 m from the release point. By this time distinct droplets and bubbles form and the hydrocarbons start to rise as a plume—a collection of bubbles and droplets act in concert to drag significant volumes of the adjacent seawater upwards in the water column. The plume will reach the surface in a matter of minutes driven by the buoyancy of the oil droplets. The resulting surface slick will spread into a thin film due to the radial outflow of entrained water near the surface. Gas and volatile hydrocarbon components will then be lost to the atmosphere through evaporation.

Cross-flowing currents can complicate the above process in several ways. First, the plume will tend to bend over, resulting in a horizontal offset in the surfaced oil slick. Second, the rising bubbles or droplets can be sieved downstream according to size, with the largest bubbles rising on the upstream side of the plume and the smallest rising on the downstream side. If the cross-flow current is strong enough, the sieving process will disrupt the establishment of the plume, in which case the oil or bubbles will rise individually. Both these effects of cross-currents will influence how long the oil/gas takes to rise to the surface and where it surfaces. The above processes act to reduce concentrations in the water column. The hydrocarbon gasses (mainly methane) may dissolve into the water column to saturation level, however, this would rapidly degrade to carbon dioxide and water through microbial activity.

The potential impacts associated the uncontrolled release of hydrocarbons to the marine environment (sea surface and water column) include physiological impacts to marine fauna

species through smothering, ingestion and inhalation, as well as impacts on marine and coastal habitats.

Oil spill risk assessment modelling was undertaken to assess the impact and risk to environmentally sensitive receptors identified in Section 4.

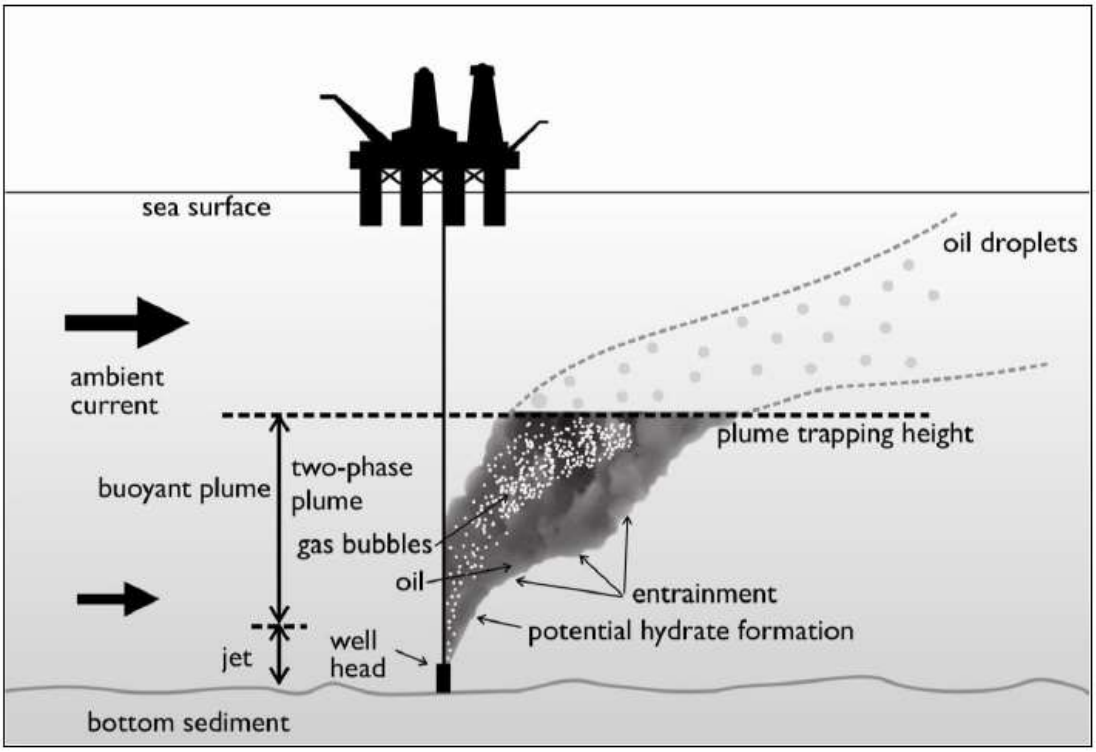


Figure 6-1 Illustration of how oil behaves when spilt to the marine environment

6.2.1.2 Gas Condensate Characteristics

Longtom Condensate was used for the loss of well control scenario. This condensate has an API of 51.2, density of 777.4 kg/m3 (at 15ºC) with low viscosity (1.1 cP) (refer to Table 6-7), classifying it as a Group I oil according to the International Tankers Owners Pollution Federation (ITOPF, 2014) and USEPA/USCG classifications. The Longtom Condensate comprises a significant portion of volatiles and semi to low volatiles (75.8% total) with little residual components (3%) (refer to Table 6-8). This means that the Longtom Condensate will evaporate readily when on the water surface, with limited persistent components to remain on the water surface over time.

Figure 6-2 displays the weathering of the Longtom Condensate simulated under three static wind conditions (5, 10 and 15 knots). Results are based on a 900 bbl subsea release of Longtom Condensate over 24 hours, tracked for 30 days. Rapid evaporation occurs during the first 24 hours of the simulation with approximately 75% of the total volume lost to the atmosphere by end of day-1. The Longtom Condensate is predicted to readily entrain into the water column under wind speeds greater than 10 knots.

Table 6-7 Physical properties of Longtom Condensate

Characteristic	Longtom Condensate
Density (kg/m^3)	777.4
API	51.2
Dynamic viscosity (cP)	1.1
Pour Point (ºC)	-9
Wax Content (%)	
Hydrocarbon property category	Group I
Hydrocarbon property classification	Non-persistent oil

Table 6-8 Boiling point ranges of the Longtom Condensate

Characteristic	Not Persistent			Persistent
	Volatile	Semi-volatile	Low volatility	Residual
Boiling point (ºC)	< 180	180 - 265	265 - 380	>380
Condensate	61.5	14.3	21.2	3.0

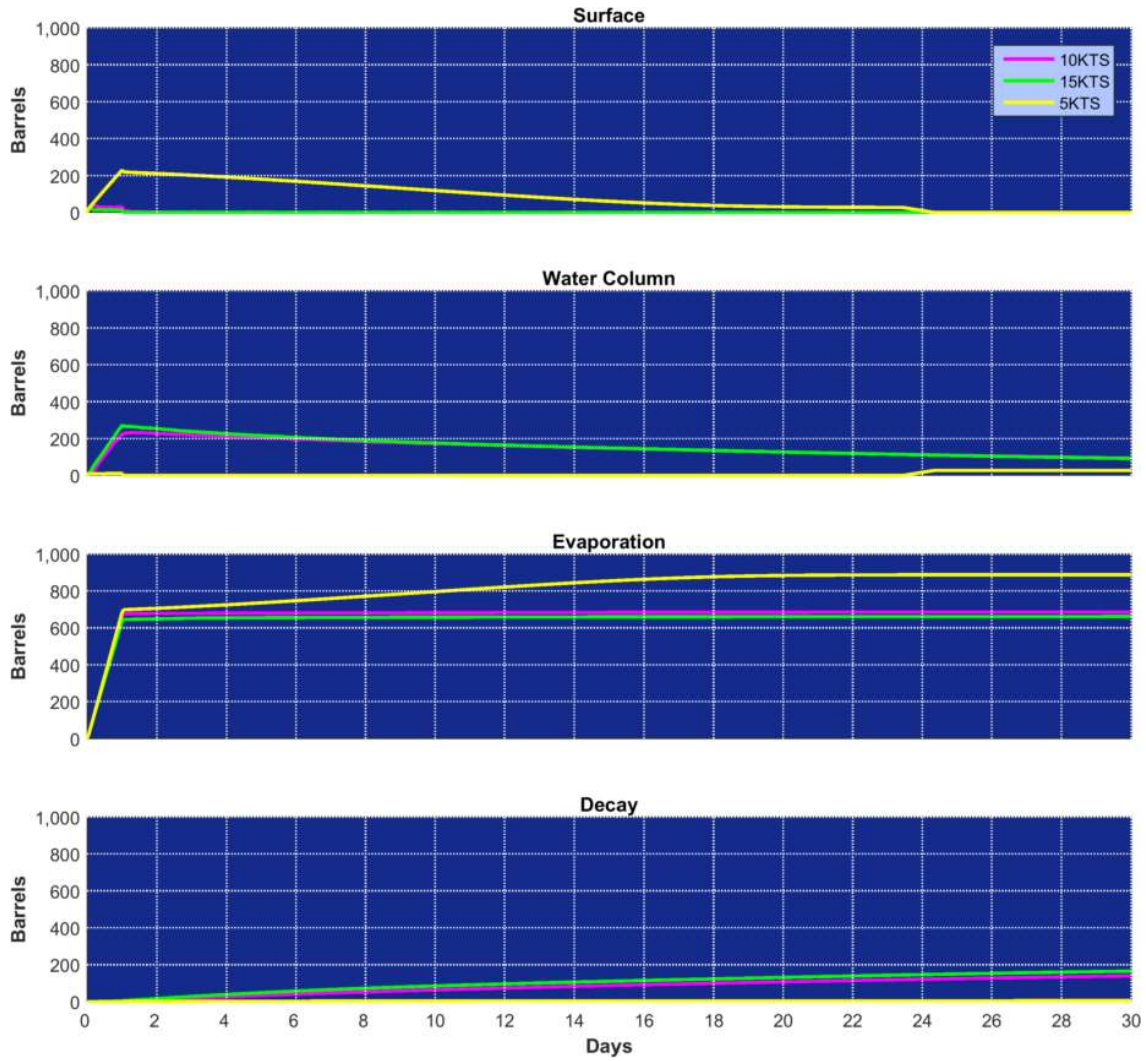


Figure 6-2 Predicted weathering and fates graph for a single spill trajectory

6.2.1.3 Sea surface, Shoreline and In-Water Thresholds

Oil spilt to the marine environment partitions into three distinct phases: surface, entrained and dissolved. Each of these phases behave independently and impact marine biota differently. Concentration thresholds for each phase have been defined (Table 6-9) based on best available scientific literature to assess the impact from each oil phase and to derive the environment that may be affected (EMBA).

Table 6-9: Concentration thresholds used in the modelling and for EMBA

Exposure Zone	Threshold	Justification
Surface		
Low exposure (1 g/m^2–10 g/m^2)	0.5 g/m^2	The 0.5 g/m2 threshold represents the practical limit of observing hydrocarbon sheens in the marine environment and therefore has been used to define the outer boundary of the low exposure zone. This threshold is considered below levels which would cause environmental harm and is more indicative of the areas perceived to be affected due to its visibility on the sea-surface. This exposure zone is not considered

		to be of significant biological impact but may be visible to the human eye. This exposure zone represents the area contacted by the spill and defines the conservative outer boundary of the area of influence from a hydrocarbon spill.
Adverse exposure zone: Moderate exposure (10 g/m^2–25 g/m^2)	10 g/m^2	Ecological impact has been estimated to occur at 10 g/m2 as this level of oiling has been observed to mortally impact birds and other wildlife associated with the water surface (French et al. 1996; French 2000). The 10 g/m2 threshold has been selected to define the moderate exposure zone. Contact within this exposure zone may result in impacts to the marine environment.
Adverse exposure zone: High exposure (> 25 g/m^2)	25 g/m^2	The 25 g/m2 threshold is above the minimum threshold observed to cause ecological impact. Studies have indicated that a concentration of surface oil 25 g/m2 or greater would be harmful for the majority of birds that contact the hydrocarbon at this concentration (Koops et al. 2004; Scholten et al. 1996). Exposure above this threshold is used to define the high exposure zone.
Shoreline accumulated hydrocarbon thresholds		
Low exposure (10 g/m^2–100 g/m^2)	10 g/m^2	A threshold of 10 g/m2 has been defined as the zone of potential 'low' exposure. This exposure zone represents the area visibly contacted by the spill and defines the outer boundary of the area of influence from a hydrocarbon spill.
Adverse exposure zone: Moderate exposure (100 g/m^2– 1,000 g/m^2)	100 g/m^2	French et al. (1996) and French-McCay (2009) have defined an oil exposure threshold of 100 g/m2 for shorebirds and wildlife (furbearing aquatic mammals and marine reptiles) on or along the shore, which is based on studies for sub-lethal and lethal impacts. The 100 g/m2 threshold has been used in previous environmental risk assessment studies (French et al. 2011; French-McCay 2004; French-McCay 2003; French-McCay et al. 2012; National Oceanic and Atmospheric Administration 2013). This threshold is also recommended in AMSA's foreshore assessment guide as the acceptable minimum thickness that does not inhibit the potential for recovery and is best remediated by natural coastal processes alone (AMSA 2015). Thresholds of 100 g/m2 and 1,000 g/m2 will define the zones of potential 'moderate' and 'high' exposure on shorelines, respectively. Contact within these exposure zones may result in impacts to the marine environment.
Adverse exposure zone: High exposure (> 1,000 g/m2)	1,000 g/m2	
Entrained Hydrocarbon Thresholds		
Low exposure (10 parts per billion (ppb)–100 ppb)	10 ppb instantaneous; and 10 ppb averaged over 48 hours .(Note 1)	The 10 ppb threshold represents the lowest concentration and corresponds generally with the lowest trigger levels for chronic exposure for entrained hydrocarbons in the ANZECC & ARMCANZ (2000) water quality guidelines. Due to the requirement for relatively long exposure times (> 24 hours) for these concentrations to be significant, they are likely to be more meaningful for juvenile fish, larvae and planktonic organisms that might be entrained (or otherwise moving) within the entrained plumes, or when entrained hydrocarbons adhere to organisms or when an organism is trapped against a shoreline for periods of several days or more. This exposure zone is not considered to be of significant biological impact. This exposure zone represents the area contacted by the spill and conservatively defines the outer boundary of the area of influence from a hydrocarbon spill.
Adverse exposure zone: Moderate exposure (100 ppb–500 ppb)	100 ppb instantaneous; and 100 ppb averaged over 48 hours .(Note 1)	The 100 ppb threshold is considered conservative in terms of potential for toxic effects leading to mortality for sensitive mature individuals and early life stages of species. This threshold has been defined to indicate a potential zone of acute exposure, which is more meaningful over shorter exposure durations. The 100 ppb threshold has been selected to define the moderate exposure zone. Contact within this exposure zone may result in impacts to the marine environment.
Adverse exposure zone: High exposure (> 500 ppb)	500 ppb instantaneous; and 500 ppb averaged over 48 hours.(see Note 1)	The 500 ppb threshold is considered conservative high exposure level in terms of potential for toxic effects leading to mortality for more tolerant species or habitats. This threshold has been defined to indicate a potential zone of acute exposure, which is more meaningful over shorter exposure durations. The 500 ppb threshold has been selected to define the high exposure zone.

Dissolved Aromatic Hydrocarbon Thresholds		
Low exposure (6 ppb–50 ppb)	6 ppb instantaneous; and 6 ppb averaged over 48 hours[1] (see Note 1)	The threshold value for species toxicity in the water column is based on global data from French et al. (1999) and FrenchMcCay (2003, 2002), which showed that species sensitivity (fish and invertebrates) to dissolved aromatics exposure > 4 days (96-hour LC50) under different environmental conditions varied from 6 ppb–400 ppb, with an average of 50 ppb. This range covered 95% of aquatic organisms tested, which included species during sensitive life stages (eggs and larvae). Based on scientific literature, a minimum threshold of 6 ppb used to define the low exposure zones (Clark 1984; Engelhardt 1983; Geraci and St Aubin 1988; Jenssen 1994; Tsvetnenko 1998). This exposure zone is not considered to be of significant biological impact. This exposure zone represents the area contacted by the spill and conservatively defines the outer boundary of the area of influence from a hydrocarbon spill.
Adverse exposure zone: Moderate exposure (50 ppb–400 ppb)	50 ppb instantaneous; and 50 ppb averaged over 48 hours[1] (see Note 1)	A conservative threshold of 50 ppb was chosen as it is more likely to be indicative of potentially harmful exposure to fixed habitats over short exposure durations (French-McCay 2002). French-McCay (2002) indicates that an average 96-hour LC50 of 50 ppb could serve as an acute lethal threshold to 5% of biota. The 50 ppb threshold has been selected to define the moderate exposure zone. Contact within this exposure zone may result in impacts to the marine environment
Adverse exposure zone: High exposure (> 400 ppb)	400 ppb instantaneous; and 400 ppb averaged over 48 hours[1] (see Note 1)	A conservative threshold of 400 ppb was chosen as it is more likely to be indicative of potentially harmful exposure to fixed habitats over short exposure durations (French-McCay 2002). French-McCay (2002) indicates that an average 96-hour LC50 of 400 ppb could serve as an acute lethal threshold to 50% of biota. The 400 ppb threshold has been selected to define the high exposure zone.

Notes: [1] Exposure times of over 48 hours would provide a better comparison with ecotoxicology tests, which use exposure times of up to 10 days to determine and assess actual impacts rather than instantaneous values.

6.2.1.4 Oil Spill modelling

Overview

SGHE commissioned oil spill modelling for a worst-case credible blowout (RPS-APASA, 2019). A five-year current dataset (2008–2012) that includes the combined influence of three-dimensional ocean and tidal currents was developed. The currents, spatial winds and then detailed hydrocarbon properties were used as inputs in the oil spill model to simulate the drift, spread, weathering and fate of the spilled hydrocarbons.

As spills can occur during any set of wind and current conditions, a total of 100 spill trajectories per hypothetical spill scenario were initiated at random times within a 5-year period (2008–2012) to enable a robust statistical analysis. Each simulation was configured with the same spill information (i.e. spill volume, duration and oil type). This approach ensures that the predicted transport and weathering of an oil slick is subject to a wide range of current and wind conditions. Model parameters used and their justification are summarised in Table 6-10.

During each spill trajectory, the model records the grid cells exposed to hydrocarbons, as well as the time elapsed. Once all the spill trajectories have been run, the model then combines the results from the individual simulations to determine the following:

- Maximum exposure (or load) observed on the sea surface;
- Minimum time before sea surface exposure;

- Probability of contact to any shorelines;
- Probability of contact to individual sections of shorelines;
- Maximum volume of oil that may contact shorelines from a single simulation;
- Maximum load that an individual shoreline may experience;
- Maximum exposure from entrained hydrocarbons observed in the water column; and
- Maximum exposure from dissolved aromatic hydrocarbons observed in the water column.

The stochastic model output does not represent the extent of any one spill trajectory (which would be significantly smaller) but rather provides a summary of all trajectories run for the scenarios.

Table 6-10: Summary of parameters used in blowout modelling

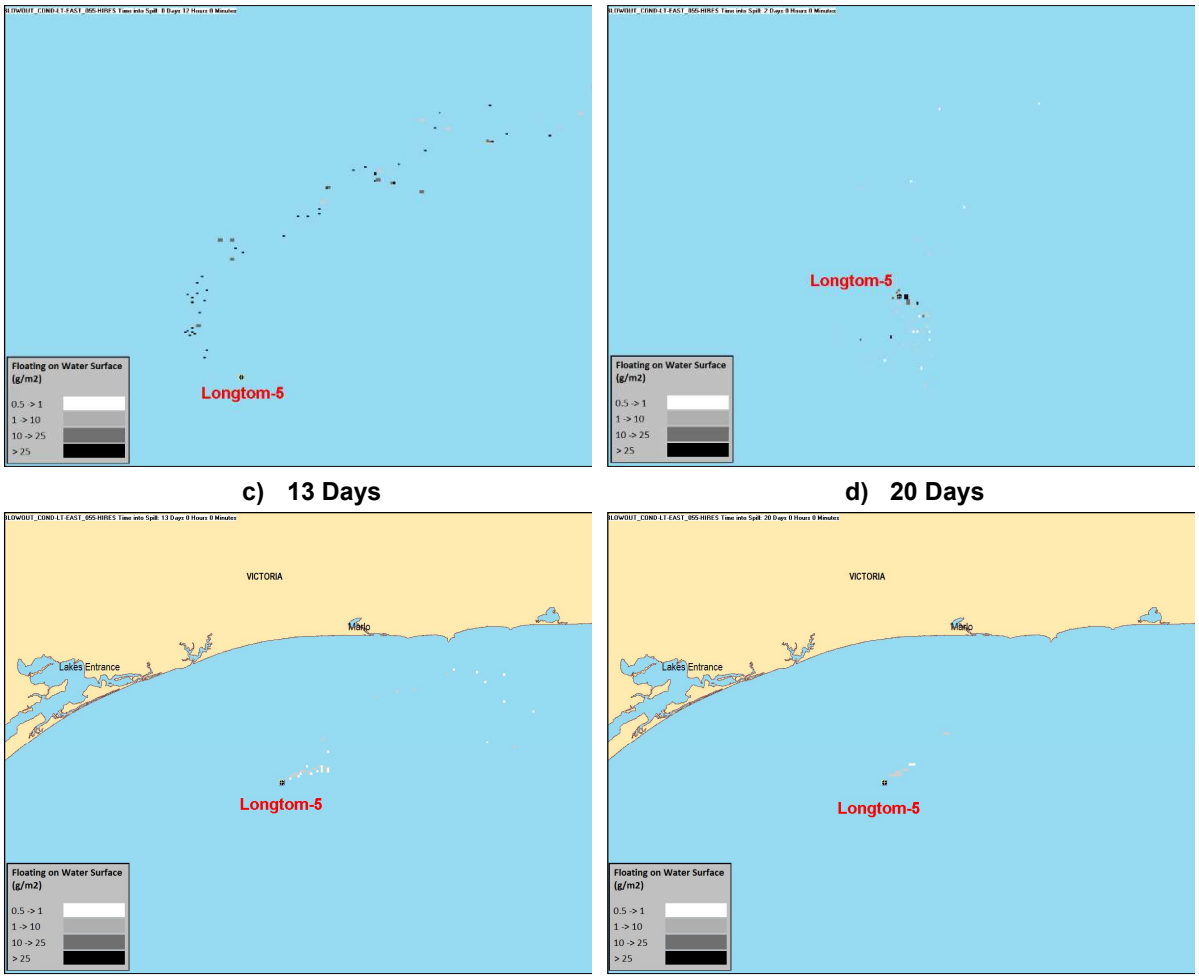
Parameter	Description
Number of spill simulations	100 simulations throughout the year
Hydrocarbon Type	Longtom condensate
Release Type	Subsurface release from one of the Longtom wells
Total spill volume	900 bbl/day (143 m^3/day) for a period of 90 days
Spill volume justification	This scenario was based on a calculated blowout rate of 90 MMscf/day of gas, based on assumed hole size and reservoir pressures, containing 10 bbl of condensate per MMscf of gas, which is the high-side condensate-gas-ratio of the Longtom gas. In the case of ongoing production operations, the Longtom 3 and 4 wells have been progressively depressured and it is expected that their blowout rates would be lower than the worst case drilling scenario that has been modelled and may be unable to continue flowing at this rate for the duration of the blowout.
Release Depth	56 m below the sea surface.
Release Depth justification	Depth of water at field
Blowout release duration	90 days.
Release duration justification	The blowout duration of 90 days that has been used in the oil spill modelling is based on the estimated time it would take to source a rig and kill the well through the use of directional drilling. This assumption has been previously tested by examining the extent of the remaining oil after 90, 70 and 50 days. The plots showed that the extent of the oil spill effectively stabilised as there was little change between the 50 and 70 day blowout stochastic modelling and even less change between the 70 and 90 day case. All models utilised a conservative 3% decay rate for the condensate.
Simulation length	105 days.

Summary of Modelling Results

Deterministic Simulation Results

Figure 6-3 shows snapshots of spatial distribution of the surface oil concentrations from some previous deterministic modelling conducted at Longtom. The deterministic modelling demonstrates that the slick generally covers a small area, ambient currents are high and the area is extremely well flushed. Impact at any single point is intermittent with elevated concentrations lasting a short duration. With this in mind the stochastic simulation must be interpreted with caution.

a) 0.5 Day (12 Hours) **b) 2 Days**



c) 13 Days **d) 20 Days**

Figure 6-3 Deterministic plot of Surface oil from a well blowout

Stochastic

Key results from the stochastic modelling studies for a worst-case loss of well control showed:

- Potential low sea surface exposure zone (Figure 6-4) was predicted to remain within the Gippsland Basin with a low likelihood (<3%) of moderate exposure level predicted for surface waters adjacent to the release location;
- The maximum distance from the release location predicted for low (>0.5 g/m^2) and moderate (>10 g/m^2) exposure was 352 km (northeast) and 1 km (west-southwest) respectively while no exposure at the high threshold (>25 g/m^2) was predicted. Note the 99th percentile maximum distance for low sea surface exposure remained within 147km of the release location;
- The overall probability of shoreline contact was 17% with hydrocarbons predicted to reach the shoreline of Croajingolong (West) a minimum of 6 days after the release.
- The shoreline of Croajingolong (West), Lake Tyers Beach and Lakes Entrance demonstrated up to 10% probability of low contact while the greatest length of shoreline impacted by a single spill trajectory was 18km, and 9km on average;
- The modelling demonstrated no time-averaged dissolved hydrocarbon exposure above 6ppb for any of the receptors assessed, however, instantaneous dissolved hydrocarbon exposure above 6ppb occurred for receptors situated within the Gippsland basin and in waters nearshore of Mallacoota and Eden and up to 10 km south of Tuross Head;
- Low (10ppb) time-averaged exposure zones for entrained hydrocarbons stretched to waters between Flinders Island and the mainland and crossed the NSW border to reach the nearshore waters of Ulladulla.
- Time average exposure to moderate levels (100ppb) was restricted to the immediate vicinity of the release.
- Potential instantaneous low (10ppb) entrained hydrocarbon exposure was predicted for Victorian, Tasmanian and NSW state waters and extending significantly offshore in commonwealth waters.
- Potential instantaneous moderate (100ppb) entrained hydrocarbon exposure was predicted for Victorian and NSW state waters and extended from around Lakes Entrance to Eden.

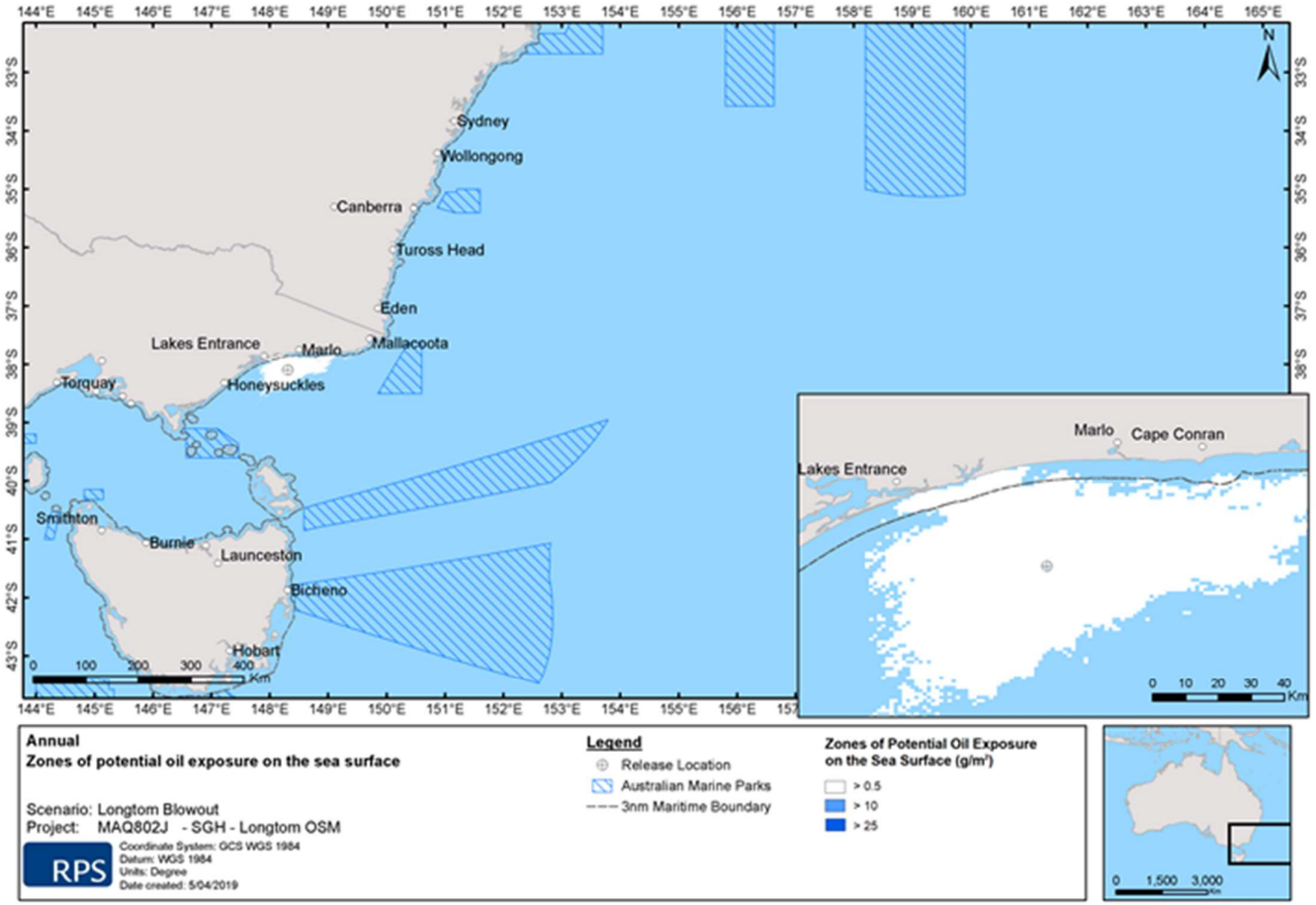


Figure 6-4 Zones of potential oil exposure on the sea surface, for a well blowout.

6.2.1.5 General - Impacts to Biological Species

Seabirds

Seabirds spend a considerable amount of time near the surface of the sea and are therefore at a higher risk of being in contact with a spill.

Seabirds that become coated in oil may suffer from hypothermia, which can result in death, as oil reduces the insulation properties of feathers. Embryo chicks in eggs may be prevented from receiving oxygen if their shells become coated with oil. It has been estimated that as little as four microlitres of petroleum contaminating a fertile egg can cause the embryo to die (AMSA, 2012).

Seabirds may also ingest the oil while feeding or preening, since several species of fish area able to survive beneath floating oil, resulting in toxic effects.

Mammals

Marine mammals are vulnerable to oil spills due to their amphibious habits and their dependence on air. Potential physiological effects of oil on marine mammals may include (AMSA, 2012):

- Hypothermia due to conductance changes in skin, resulting in metabolic shock (expected to be more problematic for non-cetaceans in colder waters).
- Toxic effects and secondary organ dysfunction due to ingestion of oil.
- Congested lungs.
- Damaged airways.
- Interstitial emphysema due to inhalation of oil droplets and vapour.
- Gastrointestinal ulceration and haemorrhaging due to ingestion of oil during grooming and feeding.
- Eye and skin lesions from continuous exposure to oil.
- Decreased body mass due to restricted diet.
- Stress due to oil exposure and behavioural changes.

Individual mammals oiled early in a spill may be exposed to the more toxic components of the oil by direct contact and ingestion and suffer greater toxicity per unit time and volume than those affected by more weathered oil.

By way of reference, aerial monitoring after the Montara oil spill (a light gas condensate) in August 2009 in the Timor Sea indicated there were no confirmed reports of oil-affected cetaceans (though there were 29 oil-affected birds, two oiled sea snakes and one oiled turtle) despite extensive aerial and water-based patrols in the area. There is no available evidence to suggest that the migratory or breeding patterns of any wildlife were affected (SEWPAC, 2012).

Cetaceans

Cetaceans in particular have mostly smooth skins with limited areas of pelage (hair covered skin) or rough surfaces such as barnacled skin. Oil tends to adhere to rough surfaces, hair or calluses of animals, so contact with oil by whales and dolphins may cause only minor oil adherence.

Whales are pelagic (move freely in the oceans) and because of their migratory patterns may only be occasionally affected by oil spills. Several dolphin species are likely to move through the project area. Potential impacts from oil spills to dolphins are similar to that described for whales.

The way a whale consumes its food affects the likelihood of it ingesting oil. Baleen whales (such as humpbacks) skim the surface for krill and are more likely to ingest oil than 'gulp feeders' (toothed whales). Further, oil may stick to the baleen while they 'filter feed' near oil slicks. Sticky, tar-like residues are particularly likely to foul the baleen plates.

It has been stated that pelagic species will avoid oil, mainly because of its noxious odours, but this has not been proven. The strong attraction to specific areas for breeding or feeding

(e.g., Warrnambool calving grounds for southern right whales) may override any tendency for cetaceans to avoid the noxious presence of oil. So weathered or tar-like oil residues can still present a problem by fouling baleen whales feeding systems.

Researchers have also indicated that inhalation of oil droplets, vapours and fumes is a distinct possibility if whales surface in slicks to breathe. Exposure to oil in this way could damage mucous membranes, damage airways or even cause death.

Dolphins

Records indicate that dolphins are able to detect oil spills and avoid them, however there have been instances where this has not been done and the dolphin is exposed to floating oil.

Similar to cetaceans, dolphins are smooth skinned and oil tends not to stick to their skin. Dolphins can, however, inhale oil. This can damage their airways, lungs, ailments, mucous membrane and even cause death. A dolphin's eyesight may also be affected by oil (AMSA, 2012).

Seals

Seals are vulnerable to oil pollution as they spend a lot of their time on or near the surface of water. Seals need to surface every few minutes to breath and regularly haul out on beaches, which puts them at risk of coming in contact with the oil.

Fur seals are the most vulnerable, as the oil may adhere to their fur. Heavy oil coating can result in reduced swimming mobility and even death.

Seal pups are also vulnerable to oil. Their flippers may stick to their bodies, resulting in drowning. They also spend much of their time in rocky shore areas, compared to adults who swim in open water.

Seals may ingest oiled food or inhale oil droplets, which will attack their sensitive tissues causing abrasions and ulcers.

Turtles

When turtles surface in an oil slick to breathe, oil will affect their eyes and damage airways or lungs. Sea turtles will also be affected by oil through contamination of the food supply or by absorption through the skin.

Turtles are very vulnerable at beach nesting sites during the breeding season, note there are no breeding colonies present within the EMBA.

Fish

The eggs, larvae and young fish are the most vulnerable to oil, mainly because larger fish can take avoiding action.

Fish are associated with floating objects, as floating objects can reduce the light intensity (provide shade), provide food and provide shelter from diving birds. This can cause problems for seabirds, who are attracted to fish swimming under an oil slick.

Fish can become tainted if they encounter a spill. The worst tainting problems generally occur in aquaculture facilities.

Impacts of Response Strategies

Consultation with AMOSC and the DoT confirmed the proposed SGHE response strategy of allowing spilled diesel and gas condensate to naturally weather, while monitoring and evaluating the situation as appropriate.

The application of chemical dispersant for the condensate and diesel scenarios is not recommended by either AMOSC or the DoT, and as such is not a preferred response strategy for the defined scenarios. The application of dispersant has the potential to expose pelagic and benthic organisms to toxic components within the entrained mixture of hydrocarbons and dispersant. Avoiding the use of dispersant avoids these impacts. Condensate also rapidly weathers and a large proportion will evaporate from the sea surface.

There is the potential for deflection booms to be used closer to shore in a cleanup operation, however, attempting to collect semi-solid weathered oil residues such as the floating waxy flakes of paraffin residues predicted to develop from the Longtom gas condensate is not likely to be efficient or environmentally beneficial.

The Longtom condensate will rapidly evaporate and within 48 hrs the slick is expected to comprise of paraffin based waxy flakes. Paraffins have a high molecular weight, odourless and insoluble, and their direct toxicity is low. In summary, an intentional ‘hands off’ approach in terms of on-ground response, while monitoring and evaluating the spill primarily through aerial means (with some light foot traffic at some beaches and vessel deployment for water quality monitoring) in the event of a spill will result in little to no environmental impact from response activities.

6.2.1.6 Impacts on Environmental Sensitivities and Biological Values

Environmental sensitivities and biological values that may occur within the EMBA were described in Chapter 4. An assessment of the impact of a condensate spill on these sensitivities and values was undertaken and is summarised in **Table 6-11**.

Table 6-11 Impact of condensate spill on environmental sensitivities

Area of sensitivity	Potential impact of condensate spill	Potential Impact Evaluation
Australian Marine Parks		
Beagle	Spill impact No contact with surface oil > 1g/m^2, instantaneous entrained hydrocarbons > 100 ppb or dissolved hydrocarbons > 6ppb. Priority **LOW**. Open marine environment.	Negligible
East Gippsland	Spill impact No contact with surface oil > 1g/m^2, instantaneous entrained hydrocarbons > 100 ppb or dissolved hydrocarbons > 6ppb. Priority **LOW**. Open marine environment, no shorelines.	Negligible
Flinders	Spill impact No contact with surface oil > 1g/m^2, instantaneous entrained hydrocarbons > 100 ppb or dissolved hydrocarbons > 6ppb. Priority **LOW**. Open marine environment, no shorelines.	Negligible
RAMSAR WETLAND SITES – EASTERN VICTORIAN COAST		
Gippsland Lakes Ramsar Wetland	Spill impact No contact with surface oil > 1g/m^2, instantaneous entrained hydrocarbons > 100 ppb or dissolved hydrocarbons > 6ppb. Low probability of potential exposure to entrained hydrocarbons > 10ppb. Priority **HIGH** (though potential for impact is limited due to only one entry point, Lakes Entrance). Freshwater body, high value tourism.	Negligible
VICTORIAN COASTAL MARINE RESERVES		
Cape Howe Marine National Park and Gabo Island (includes Gabo Island Harbour Special Management Area)	Spill impact No contact with surface oil > 1g/m^2 or dissolved hydrocarbons >50ppb Low probability of dissolved hydrocarbons >6ppb instantaneous. Entrained hydrocarbons >10ppb instantaneous, low probability of >100ppb but no exposure to 100ppb and 48hrs. Priority **HIGH**. Near-pristine sandy beaches backed by dense forest of the Croajingalong National Park.	Low
Mallacoota Inlet Special Management Area /	Spill impact No contact with surface slick or entrained hydrocarbons. Low levels of dissolved aromatics. Priority **MODERATE**.	Negligible
The Skerries Special Management Area	Spill impact No contact with surface slick or entrained hydrocarbons. Low levels of dissolved aromatics. Priority **HIGH**. Major seal-breeding colony.	Negligible
Point Hicks Marine National Park / Beware	Spill impact	Moderate

Area of sensitivity	Potential impact of condensate spill	Potential Impact Evaluation
Reef Marine Sanctuary Croajingalong Biosphere Reserve and National Park	Patches of very light surface oiling with no shoreline loading >10g/m^2. Entrained hydrocarbons >10ppb instantaneous, low probability of >100ppb and low potential exposure to 100ppb for 48hrs. Low probability of dissolved hydrocarbons >6ppb instantaneous. Priority **HIGH**. Near-pristine sandy beaches backed by dense forest of the Croajingolong National Park.	
Gippsland Lakes Coastal Park	Spill impact No contact with surface slick, entrained or dissolved hydrocarbons. Priority **MEDIUM**. A popular tourist destination, but dominated by sandy beaches (with few marine sensitivities) that are easier to remediate compared to other shoreline types.	Negligible
TASMANIAN COASTAL MARINE RESERVES		
Kent Group (Deal, Erith & Dover Islands) National Park (located between Flinders Island and Wilsons Promontory)	Spill impact No contact with surface oiling, or dissolved hydrocarbons. Potential for sparse patches of low instantaneous entrained hydrocarbons > 10ppb. Priority **HIGH**. Mostly rocky, cliff shorelines, isolated small sandy beaches.	Negligible
NSW COASTAL SENSITIVITIES		
Ben Boyd National Park / Nadgee Nature Reserve and Wilderness Area	Spill impact No contact with surface oiling. Low probability of concentrations of dissolved hydrocarbons > 6ppb. Potential for entrained hydrocarbons in water column around Green Cape, the eastern-most point of Ben Boyd National Park >100ppb instantaneous but no exposure to 100ppb for 48hrs. Priority **HIGH**. Near-pristine coastline backing on to National Park.	Low
ECONOMIC AND SOCIAL VALUES		
Commercial and Recreational Fisheries Includes open marine environment, coastal and inshore fish habitat and spawning areas	Spill impact Potential for contact with low levels of surface oil > 0.5 g/m^2 up to 352 kilometres from the well. Moderate surface oiling restricted to within 1km of release. Low likelihood of localised zones of moderate exposure to instantaneous dissolved aromatics along coastline. No exposure to time averaged low thresholds anticipated. Areas of Victorian and NSW waters exposed to instantaneous entrained hydrocarbons >100ppb. Potential for fish within Vic and NSW state waters to be affected by low levels of entrained hydrocarbons. Economic and social impacts associated with disruption to commercial and recreational fishing operations. Priority	Moderate

Area of sensitivity	Potential impact of condensate spill	Potential Impact Evaluation
	HIGH. Valuable spawning and fishing area.	
Tourism and Recreation	Spill impact Earliest shoreline contact: 6 days. Predicted shoreline loading: • Maximum 49 bbl • Average 2 bbl Shoreline load anticipated to be mainly non-toxic waxy flakes between Lakes Entrance and Marlo. Potential for some shoreline loading >100g/m^2. Potential for contact with low levels of surface oil between Lakes Entrance and Marlo. No exposure to moderate surface oiling. Low probability exposure to dissolved hydrocarbons >6ppb instantaneous, Potential for low / moderate levels of entrained hydrocarbons along coastline that could impact primary and secondary recreation. Economic and social impacts of disruption to commercial operators relying on recreation and tourism industry. Priority **HIGH**. Valuable spawning and fishing area.	Low
Cultural assets. Man-made structures e.g. Slipways, boatyards, ports, jetties	Spill impact Earliest shoreline contact: 6 days. Predicted shoreline loading: • Maximum 49 bbl • Average 2 bbl Shoreline load anticipated to be mainly non-toxic waxy flakes between Lakes Entrance and Marlo. Potential for contact with low levels of surface oil between Lakes Entrance and Marlo. Localised zones of exposure to dissolved aromatics and entrained hydrocarbons along coastline. Minimal impact on cultural assets and man-made structures due to limited exposure to hydrocarbons. Limited economic and social impacts associated with disruption to commercial operators relying on boating industry. Priority **LOW**. Potential for damage to man-made structures associated with the predicted exposure is not credible.	Negligible
PARTICULAR BIOLOGICAL VALUES		
Cetaceans	Spill impact Potential exposure to low levels of sea surface oiling, entrained hydrocarbons and dissolved aromatics, or very localised moderate concentrations of dissolved aromatics nearshore. Predicted impact is minimal due to the transitory nature of cetaceans through Bass Strait and their limited ecologically significant activities (such as breeding, foraging and calving) while in the area. Priority **HIGH**. All cetaceans are protected under the EPBC Act 1999 (Cwlth).	Low

Area of sensitivity	Potential impact of condensate spill	Potential Impact Evaluation
Nesting shorebirds and seabirds	Spill impact Potential exposure to low levels of sea surface oiling, entrained hydrocarbons and dissolved aromatics nearshore. Degree of impact depends on whether shorebirds and migratory species are feeding or nesting along shorelines at the time of the spill and in the direct path of low level sea surface oiling (less than fatal) and shoreline loading. Priority **HIGH**. Includes species protected under the EPBC Act 1999 (Cwlth) and/or FFG Act 1988 (Vic).	Low
Little penguins	Spill impact Potential exposure to low levels of sea surface oiling, entrained hydrocarbons and dissolved aromatics. Degree of impact depends on whether little penguins are feeding or nesting along shorelines at the time of the spill and in the direct path of low level sea surface oiling (less than fatal) and shoreline loading. Little penguin colonies could be indirectly affected by impacts on fish populations as their food source. Priority **MEDIUM**. Little penguin is relatively common.	Low
Fur seals	Spill impact Potential exposure to low levels of sea surface oiling, entrained hydrocarbons and dissolved aromatics. Degree of impact depends on whether seals are breeding, feeding or hauling out along shorelines at the time of the spill and in the direct path of low level sea surface oiling (less than fatal) and shoreline loading. Seal colonies could be indirectly affected by impacts on their food source. Priority **HIGH**. Unlike other marine mammals such as cetaceans and sea lions, fur seals depend on their fur rather than blubber for insulation and temperature regulation.	Low
Reptiles – marine turtles	Spill impact Potential exposure to low levels of sea surface oiling, entrained hydrocarbons and dissolved aromatics. Predicted impact is minimal due to the transitory nature of turtles through Bass Strait and their limited ecologically significant activities (such as breeding, foraging and nesting) in the area. Priority **HIGH**. Includes species protected under the EPBC Act 1999 (Cth) and/or FFG Act 1988 (Vic).	Low

This assessment has been used to determine the residual risk ranking given in Table 6-12.

6.2.1.7 Risk Assessment

Table 6-12 outlines the risk assessment for the loss of containment of hydrocarbons due to subsea equipment damage.

Table 6-12 Loss of containment of hydrocarbons risk assessment

Hazard duration	Throughout operations and the life of this EP.	
Extent of hazard	While the area and extent of the EMBA is significant, it should be noted that the predicted impact for a single spill trajectory is relatively narrow and that the EMBA has been based on instantaneous thresholds rather than time averaged ones.	
Basis of inherent impact and risk Assessment		
• The subsea infrastructure has been designed to withstand fishing activities, impact loads, corrosion, and pressures and temperatures from Longtom. • The locations of the wellheads are remote from the shore and sensitive environments. • Wellheads can be shutdown from onshore and are fail safe. • The Longtom gas field development was designed and installed to enable the tie-in on Longtom-5. • The Longtom reservoir is a gas reservoir with relatively small quantities of condensate. The condensate will rapidly evaporate and the residue will be small waxy inert flakes with low environmental impact. • Pipeline marked on navigation charts and Longtom facilities are within the Bass Strait Area to be Avoided. • SGHE is an AMOSC member, giving it access to AMOSC response functions and industry Mutual Aid response capability in the unlikely event of a Tier 2 or 3 spill. • A 500-m petroleum safety exclusion zone exists around Longtom-3 and Longtom 4.		
Inherent impact risk analysis and ranking		
Consequence	**Likelihood**	**Inherent Risk**
Moderate (3)	Unlikely (D)	Moderate
Project specific environmental controls and checks that will take place	<u>Prevention</u> • Compliance with the Longtom Pipeline Safety Case including: - Equipment design and validation of the design. The design ensures that the hydrocarbons are contained and includes; Equipment pressure / temperature rating, Material suitability, Equipment stability under storm and seismic loading, Process controls, alarms and trips – effectiveness considered Very High. - Training, competency and experience of personnel to operate and maintain the facilities appropriately, including 24 hour continuous monitoring of production parameters when in operation – effectiveness considered Moderate. - Procedures for operating and maintenance activities. This will include procedures to pressure and leak testing of the Longtom-5 tie-in prior to the introduction of hydrocarbons - effectiveness considered Moderate. - Maintenance and testing of equipment including shutdown systems - effectiveness considered Moderate.	

	• Compliance with the Well Operations Management Plan (WOMP) including: - Well design including shutdown systems (e.g., SCSSV) – effectiveness considered Very High. - Operating procedures – effectiveness considered Moderate. - Maintenance and testing of equipment including shutdown systems – effectiveness considered Moderate • Maintenance, intervention and tie-in campaigns subject to risk assessment – effectiveness considered Moderate. <u>Mitigation</u> • AMOSC membership and adherence to the following procedures - Effectiveness considered Moderate: - Oil Pollution Emergency Plan (OPEP). - Emergency Response Plan (ERP) • Source control - implementation of a Well Kill Plan and potential Relief well to drill, intersect and kill a blowout – effectiveness considered High.

Residual risk analysis and ranking		
Consequence	**Likelihood**	**Residual Risk**
Moderate (3)	Rare (E)	Low

Demonstration of ALARP	
The risk of a hydrocarbon spill prior to the implementation of the controls (inherent risk) was assessed as 'moderate' based on the possibility of a major consequence occurring without any controls. However, with the above listed controls and the controls listed in the OPEP, WOMP, Longtom Pipeline Safety Case and ERP, the risk has been reduced to low (residual risk). The key preventative controls are the design of the facilities to safely contain the hydrocarbons, the operating and maintenance systems, processes and procedures conducted in line with the safety case and WOMP requirements, the overall effectiveness of these controls is considered very high in preventing environmental impact. Note that the design is critical in ensuring hydrocarbons are contained and is subject to independent validation as part of the safety case that specifically confirms the codes and standards are appropriate and that the safety risks are reduced to ALARP. In the event of a loss of containment these systems will also ensure that the leak is mitigated and minimised (particularly the shutdown systems), the oil spill response will also ensure that spills are monitored and where practicable action is taken to further reduce or prevent the impact. The controls are considered sufficient, suitably robust, independent and effective to ensure the residual risks are Low and ALARP. The following ALARP analysis confirms that all reasonable risk treatment options have been considered to reduce the environmental impact of hydrocarbon spills, and the risk is deemed to be **ALARP**. Adopting further risk reduction measures will incur costs that are grossly disproportionate to the benefits gained. A 'Low' residual risk ranking is **broadly acceptable** according to the SGHE definition of risk.	
Eliminate	Not applicable.
Substitute	Not applicable.
Engineering	The subsea infrastructure has been designed to withstand fishing activities, impact loads, corrosion, and pressures and temperatures from Longtom
Isolation	The pipeline and wells can be isolated from the reservoir.
Administrative	A 500-m petroleum safety zone exists around Longtom-3 and Longtom 4. Training and adherence to the OPEP and the ERP.
Protective	Not applicable.

Demonstration of Acceptability
The operation of the offshore facilities is covered by a Longtom Pipeline Safety Case, WOMP and OPEP. All of these documents have to be reviewed and accepted by NOPSEMA prior to operations commencing, The design of the facilities takes account of pressure, temperature, fluid composition, erosion, external impact and fatigue. These parameters will be monitored by process equipment and actions will be taken if the parameters are outside of acceptable limits. A separate shutdown system, which is fail safe, will also monitor the facilities for abnormal situations. This means that valves can be closed and facilities can be isolated to prevent continued gas and condensate flow. There are numerous other oil and gas developments in Bass Strait (20 production facilities and a large number of pipelines).Oil and gas infrastructure in the area has been accepted for the last 40 years. The locations of the wellheads are remote from the shore. The likelihood of a failure of the subsea equipment or a well blow out is considered remote, therefore this risk is considered **acceptable**.
Monitoring
No ongoing monitoring is required. In the event of a spill monitoring will be undertaken as per the requirements set out in the OPEP and OSMP.

6.2.2 Loss of containment of hydraulic fluid, MEG and methanol - subsea equipment damage

6.2.2.1 Hazards

The umbilical provides hydraulic fluid, MEG, potentially Low Dose Hydrate Inhibitor (LDHI) and methanol offshore. A failure of the umbilical or subsea facilities will result in the accidental discharge of some or all of these and could be of an ongoing minor nature or terminal and result in total shutdown of the Longtom facilities.

The uses of hydraulic fluid, MEG, LDHI and methanol are described below.

Hydraulic fluid

Details of the hydraulic fluid currently used for operations is given in Section 6.1.1.

MEG and LDHI

MEG is pumped offshore via the umbilical and injected at the subsea tree chokes to help prevent hydrate formation and subsequent potential blockage of the pipeline. During the detailed design of the pipeline and the development of the hydrate management plan, the addition of LDHI to the MEG was also considered.

LDHI could be added to the MEG at a concentration of approximately 1.5%, however to date this has not been necessary and is very unlikely to ever be required. The LDHI (Baker Hughes HIW 85574) was assessed by OCNS as having a Silver CHARM ranking, while the MEG is ranked as ‘E’ and is on the PLONOR list.

These chemicals are contained within the pipeline system and pumped from onshore. They would only be released in the event of umbilical or subsea equipment failure.

Methanol

Small amounts of methanol are injected via the control umbilical for start-ups and in the case of relieving hydrate blockage. Methanol is also included on the PLONOR list as a category ‘E’

chemical (CAS Ref: 67-56-1) and is therefore considered to have little or no environmental effect when discharged to the marine environment. Methanol is contained within the enclosed system and returned to shore. It could only be released in the event of umbilical or subsea equipment failure.

6.2.2.2 Description of Environmental Impacts

The known and potential environmental hazards for the loss of hydraulic fluid, MEG and methanol include:

- Localised and temporary decrease in water quality
- Localised impact on marine life.

Operations

In the event of an umbilical failure, the amount of hydraulic fluid, MEG and methanol that would be lost will be limited to approximately two thousand litres before process parameters onshore (i.e., low pressure alarms) would automatically shut down the chemical and hydraulic pumps. There will be no further leakage as the accumulated pressure (hydrostatic pressure) within the umbilical will be vented to sea.

Based on their OCNS rating their impact is considered minor.

Maintenance

The maintenance and repair of an umbilical may be undertaken by lifting the umbilical to the surface (using a vessel crane) and cutting into it to allow a repair to take place. This would result in the release of umbilical fluids however this would be contained on board the vessel. Even if the maximum volumes of fluids were released to the marine environment, the environmental consequence is minor , based on the low volumes, the dilution and dispersion that occur on release, and the low numbers of marine organisms likely to be present at the time of the release.

6.2.2.3 Risk Assessment

Table 6-13 outlines the risk assessment for the loss of containment of hydraulic fluid, MEG and methanol.

Table 6-13 Loss of containment of hydraulic fluid, MEG and methanol risk assessment

Hazard duration	Short term release.	
Extent of hazard	Limited to the area around the release point.	
Basis of inherent impact and risk Assessment		
• The umbilical was appropriately designed and has been pressure tested. • There is no planned discharge of MEG or methanol. • There are no known sensitive environments in the project area. • The selected hydraulic fluid, MEG and methanol are water soluble and have low toxicity.		
Inherent impact risk analysis and ranking		
Consequence	**Likelihood**	**Inherent Risk**
Minor (2)	Unlikely (D)	Low

Project specific environmental controls and checks that will take place	Prevention • Longtom Pipeline Safety Case including: - Equipment design and validation including process controls, alarms and trips – effectiveness considered Very High. - Training and competency of personnel to operate and maintain the facilities appropriately – effectiveness considered Moderate. - Procedures for operating and maintenance activities. This includes procedures to pressure and leak testing of the Longtom-5 tie-in prior to the introduction of hydrocarbons – effectiveness considered Moderate. - Maintenance and Testing of equipment including shutdown systems – effectiveness considered Moderate. • The selected hydraulic fluid - HW525 was a category 'D' OCNS chemical with an assumed low environmental impact – effectiveness was considered High however it was subsequently changed to an A rated chemical. HW525 will therefore be progressively replaced with Transaqua HT2 which is a category 'D' OCNS chemical – see risk of loss of hydraulic fluid for more detail. • The MEG and methanol are category 'E' OCNS chemicals with low environmental impact – effectiveness considered High. Mitigation • Shut down of chemical and hydraulic pumps at the gas plant – effectiveness considered High.

Residual risk analysis and ranking		
Consequence	**Likelihood**	**Residual Risk**
Minor (2)	Rare (E)	Low

Demonstration of ALARP	
The key preventative controls are the design of the facilities, the operating and maintenance systems, processes and procedures conducted in line with the safety case and WOMP requirements, the overall effectiveness of these controls is considered very high in preventing environmental impact. In the event of a loss of containment these systems will also ensure that the leak is mitigated and minimised (particularly the shutdown systems) and the low toxicity of the chemicals also ensures that any consequence is minor. The controls are considered sufficient, suitably robust, independent and effective to ensure the residual risks are Low and ALARP. The following ALARP analysis confirms that all reasonable risk treatment options have been considered to reduce the environmental impact of hydraulic fluid, MEG and methanol discharges, and the risk is deemed to be **ALARP**. There are no other feasible risk treatment options. A 'Low' residual risk ranking is **broadly acceptable** according to the SGHE definition of risk.	
Eliminate	Not applicable. Hydraulic fluid, MEG and methanol cannot be eliminated.
Substitute	The selected hydraulic fluid (HW525) will be progressively replaced with Transaqua HT2 which is a category 'D' OCNS chemical, and the MEG and Methanol are category 'E' OCNS chemicals with low environmental impact.
Engineering	The subsea facilities have been installed and there is no practical way to re-engineer the system. The design has been checked and the system pressure tested.
Isolation	Shut down of chemical and hydraulic pumps at the gas plant.
Administrative	A 500-m petroleum safety exclusion zone exists around Longtom-3 and Longtom 4 to help prevent interference.
Protective	Not applicable.

Demonstration of Acceptability
The loss of containment of hydraulic fluid, MEG and methanol would not lead to a significant risk due to the localised nature of release and the rapid dilution of chemicals. The chemicals are category 'D' or 'E' OCNS chemicals, which are considered to have a low environmental impact. Hydraulic fluid, MEG and methanol are standard chemicals used in the control of subsea facilities and to control hydrates. It is common practice to inject them into subsea facilities and other operators in Bass Strait use similar products in this same manner.HW525 will be progressively replaced with Transaqua HT2. There have been no concerns raised regarding the discharge of hydraulic fluid, MEG or methanol during stakeholder consultation. The volumes of fluids used are not expected to cause any significant environmental issues, and given the 'minor' consequences, this risk is considered **acceptable**.
Monitoring
The total volume of MEG and methanol used is monitored at the gas plant.

6.3 Impacts from Maintenance, Intervention and Tie-in of Longtom-5

This section describes the environmental impacts resulting from maintenance, intervention and tie in activities utilising offshore vessels and ROV operations. Note that maintenance, intervention and tie-in activities are infrequent short term activities. The potential hazards or impacts that have been assessed include:

- Vessel collisions with marine fauna.
- Noise emissions.
- Light emissions.
- Atmospheric emissions.
- Discharge of sewage and grey water.
- Discharge of putrescible waste.
- Discharge of contaminated deck/bilge water.
- Discharge of non-hazardous waste.
- Discharge of hazardous waste.
- Discharge of cooling water.
- Discharge of desalination brine water.
- Introduction of invasive marine species.
- Diesel (MDO) spill.
- ROV discharges.
- Longtom -5 commissioning and installation chemicals.

6.3.1 Vessel collisions with marine fauna

Vessel related activities have the potential to cause physical interference with marine fauna. Noise impacts are addressed separately in Section 6.3.2.

The vessel-related activities required to support ongoing operations are conservatively expected to be approximately one week every 1-3 years. The vessel-related activities associated with the tie-in of Longtom-5 are predicted to require only a few weeks of vessel time in the field. During either of these activities there is a potential for the vessels to impact or strike marine fauna however given that whilst conducting petroleum activities the vessels will be operating at low speeds (2 knots) the risk is not considered credible.

6.3.1.1 Description of Environmental Impacts

Marine fauna travelling through the area are at less risk from displacement or vessel strike than those species that are resting and feeding. A vessel strike may lead to behavioural changes or wounding and/or mortality. Vessel strikes generally occur when there is high vessel traffic operating at fast speeds. Speed appears to be a key issue affecting the frequency of incidents, with 89% of ship strikes examined involving vessels travelling in excess of 14 knots (Laist et al, 2001).

When the vessels are engaged in petroleum activities they will be operating at low speed and typically on DP. Their noise should alert marine fauna to their presence and the marine fauna will have time to react and avoid a collision.

No impacts to marine fauna from vessel collisions have occurred to date during Longtom activities. Vessels involved in intervention, maintenance and Longtom-5 tie-in activities will only be required for a short duration and will adhere to the Australian National Guidelines for Whale and Dolphin Watching (DEH, 2005) where practicable.

6.3.1.2 Risk Assessment

Table 6-14 outlines the inherent impact and risk assessment for vessel collisions with marine fauna.

Project specific environmental controls have not been provided or are considered appropriate given the nature and scale of the activity and that the risk was deemed to have no credible impact. This was based on the SGHE risk assessment team's judgement that no new negative impacts are plausible.

Table 6-14 Vessel collisions with marine fauna inherent impact risk assessment

Hazard duration	Intermittent for short durations during maintenance activities and the tie-in of Longtom-5.
Extent of hazard	Localised (the immediate area around the vessel, only while moving).
Basis of Inherent impact and risk Assessment	
• There are no known critical feeding, breeding or migration habitats for whales in the project area. • Intervention and maintenance activities will be of short duration (approximately one week every 1-3 years). • Tie-in activities are likely to only last for a few weeks. • Whilst engaged in petroleum activities (i.e. within the 500m zone) vessels will be operating at low speed / on DP.	

• Vessels will comply with the Australian National Guidelines for Whale and Dolphin Watching (2005).
Inherent impact risk analysis and ranking
Consequence deemed to have no credible impact given the nature and scale of the activity. No further assessment is required.

6.3.2 Noise emissions

The following activities have the potential to create underwater noise:

- Vessel thrusters
- ROV operations.
- Helicopter movements (infrequent).

6.3.2.1 Known and Potential Environmental Impacts

The known and potential impacts of the above-mentioned hazards are:

- Attraction into the area.
- Increased stress levels.
- Disruption to underwater acoustic cues.
- Behavioural changes.
- Localised avoidance.
- Potential hearing impairment.
- Secondary ecological effects, by alteration of a predator-prey relationship.

6.3.2.2 Description of Environmental Impacts

Marine mammals utilise acoustics to monitor the marine environment and noise generated from offshore works has the potential to interfere with their acoustic perception. Excessive noise above a tolerable threshold for marine animals may result in damage to the auditory system, behavioural change, avoidance, temporary shift in hearing thresholds and interference with acoustic signals (McCauley et al., 2003; McCauley, 1998). For marine fauna that are reliant on auditory sense, 120 dB re 1μPa is the currently accepted noise threshold above which avoidance and or behavioural changes commence (McCauley in APPEA, 2005).

The short duration of the intervention, maintenance and tie-in activities provides a temporary and localised impact to marine animals.

Vessel noise

The potential noise to be produced during intervention, maintenance and tie-in activities, is expected to be similar to the already existing noise in Bass Strait associated with vessels servicing existing petroleum facilities as well as from commercial fishing and shipping operations.

This noise has existed for the past thirty years since the first development of offshore petroleum production facilities in the Gippsland Basin.

Whales may be present in the project area, although the area is not a significant one for whale migration, feeding or calving. Indirect effects to whales from noise associated with intervention and maintenance vessels could be caused by the disturbance or dissipation of krill aggregations, which provide the main food supply for blue whales. However, blue whales are not frequently observed in waters of this depth and it is generally considered that crustacea (including their planktonic larvae) are not adversely affected by noise. Other cetacean species such as southern right or humpback whales are not likely to be significantly impacted by the presence of these in a specified work area due to low level of noise providing opportunities for whales to avoid the project area if necessary.

The potential impacts of underwater noise on marine mammals is expected to be localised, short term in nature and minimal in impact.

Helicopter noise

The main noise source from helicopters is the impulsive noise from the main rotor consisting of blade-vortex interaction (BVI) in descent or level flights at low to medium speeds and high speed impulsive (HSI) noise related to transonic effects of the advancing blade. The fundamental frequency of the rotating blades is typically less than 100 Hz.

Sound pressure in the water directly below a helicopter is greatest at the surface and diminishes with increasing receiver depth, while the opposite can occur when the helicopter is not directly overhead (i.e., sound increases with increasing receiver depth) with the duration of audibility increasing with increasing altitude.

Effects of overflights on whales appear transient and are not known to have long-term impacts on them (NMFS, 2001). When flying below 150 m, whales may react to helicopter noise by diving, but resume normal feeding activity within minutes.

6.3.2.3 Risk Assessment

Table 6-15 outlines the inherent impact risk assessment for underwater noise.

Project specific environmental controls have not been provided as the risk was deemed to have no credible impact. This was based on the SGHE (formerly Nexus) risk assessment team's judgement that:

- Vessels and helicopters involved in intervention, maintenance and tie-in activities will only be required for a short duration and will adhere to cetacean avoidance procedures.
- The additional noise expected to be generated from intervention, maintenance and tie-in activities is low compared with other activities that are occurring in the area. Bass Strait currently has over 20 oil and gas production platforms with associated support vessels and helicopter activity and there have been numerous offshore campaigns. Commercial fishing activities also take place within the area and shipping lanes exist further offshore.
- There have been no indications to date of any significant impact on cetaceans. Whilst cetaceans occur within the area, it is not a known feeding or breeding location hence any

temporary displacement of cetaceans will have no long term impact. In addition, some marine fauna exhibit avoidance behaviour and are able to remove themselves from the area of impact.

- No new negative impacts are plausible.

Table 6-15 Underwater noise inherent impact risk assessment

Hazard duration	Intermittent for short durations during intervention, maintenance and tie-in activities.
Extent of hazard	Localised (vicinity of the vessels/ROV/helicopters).
Basis of inherent impact and risk assessment	
• There are no known critical feeding, breeding or migration habitats for whales in the project area. • Intervention and maintenance activities will be of short duration (approximately one week in every year). • Tie-in activities are likely to only last for a few weeks. • Vessels will be stationary or slow-moving while undertaking petroleum activities. • Vessels will comply with the Australian National Guidelines for Whale and Dolphin Watching (2005).	
Inherent impact risk analysis and ranking	
Consequence deemed to have no credible impact given the nature and scale of the activity. No further assessment is required.	

6.3.3 Light emissions

Deck floodlights and maritime navigational lighting, kept on 24 hours a day for maritime safety purposes (Part 30 (Prevention of Collisions) of the Marine Orders made under the *Navigation Act* 2012) will result in some light emission during maintenance, intervention and tie-in activities.

6.3.3.1 Description of Environmental Impacts

Seabirds may be attracted to vessels at night due to the light glow. Bright lighting can disorientate birds, thereby increasing the likelihood of seabird injury or mortality through collision with infrastructure, or mortality from starvation due to disrupted foraging at sea (Wiese et al. 2001 in SEWPAC, 2011g). Nesting birds may be disorientated where lighting is adjacent to rookeries. This is evident in young fledglings leaving breeding colonies for the first time, in particular wedge-tailed shearwaters. Light pollution is a particular issue for wedge-tailed shearwaters due to their nocturnal habits. Bright lights can also impact on migrating birds.

Other marine life may also be attracted to the vessels as a result of an attraction to light sources by prey items (e.g., worms, squid, plankton) that can aggregate directly under downward facing lights.

There is no evidence to suggest that artificial light sources adversely affect the migratory, feeding or breeding behaviours of cetaceans. Cetaceans predominantly utilise acoustic senses to monitor their environment rather than visual sources (Simmonds et al., 2004) so light is not considered to be a significant factor in cetacean behaviour or survival.

6.3.3.2 Risk Assessment

Table 6-16 outlines the inherent impact risk assessment for lighting.

Project specific environmental controls have not been provided as the risk was deemed to have no credible impact. This was based on the SGHE (formerly Nexus) risk assessment team's judgement that no new negative impacts are plausible.

Table 6-16 Lighting inherent impact risk assessment

Hazard duration	During intervention, maintenance and tie-in activities (short-term).
Extent of hazard	Localised (significant light glow not visible beyond several kilometres).
Basis of Inherent impact risk Assessment	
• The project area is not located near any sensitive seabird nesting grounds. • There are no turtle rookeries in Bass Strait. • Intervention and maintenance activities will be of short duration (approximately one week in every year). • Tie-in activities are likely to only last for a few weeks.	
Inherent impact risk Analysis	
Consequence deemed to have no credible impact given the nature and scale of the activity. No further assessment is required.	

6.3.4 Atmospheric Emissions

The combustion of fossil fuels in vessel engines and onboard power generators will contribute to exhaust emissions including the generation of greenhouse gas (CO_2).

6.3.4.1 Description of Environmental Impacts

The use of fuel (specifically marine diesel) to power vessels and generators will result in gaseous 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 (SOx) and nitrous oxides (NOx).

The emissions generated from vessels add to the GHG load in the atmosphere, which adds to the global warming potential. The emission of non-GHG gases, such as NOx and SOx, can lead to a reduction in local air quality.

The combustion of fuels in such a remote locality will not impact on the nearest coastal settlements, and is not out of the ordinary with other industrial combustion processes occurring at the oil and gas platforms of Bass Strait and their onshore processing facilities (e.g., the Patricia Baleen Gas Plant and Longford Oil and Gas processing facility) or from commercial fishing and shipping activities. Offshore winds will disperse and dilute any gaseous emissions.

6.3.4.2 Risk Assessment

Table 6-17 outlines the inherent impact risk assessment for atmospheric emissions.

Project specific environmental controls have not been provided as the risk was deemed to have no credible impact. This was based on the SGHE (formerly Nexus) risk assessment team's judgement that no new negative impacts are plausible.

Table 6-17 Atmospheric emissions inherent impact risk assessment

Hazard duration	During intervention, maintenance and tie-in activities (short-term).
Extent of hazard	Localised (local air shed).
Basis of Inherent impact risk Assessment	
• Use of marine grade diesel, which has a low sulphur content, hence minimising the generation of SOx. • Engines are maintained in accordance with the planned maintenance system (PMS) to ensure their operating at maximum efficiency. • Vessels hold current international air pollution certificates.	
Inherent impact risk Analysis and ranking	
Consequence deemed to have no credible impact given the nature and scale of the activity. No further assessment is required.	

6.3.5 Discharge of sewage and grey water

Vessel activities will result in the discharge of sewage and grey water from the ablution and laundry facilities.

6.3.5.1 Description of Environmental Impacts

Sewage can contain hazardous pathogens and if released untreated to the marine environment, may cause contamination to the food chain. Similarly, grey water can contain a wide variety of pollutant substances at different strengths.

All intervention and maintenance vessels will come equipped with MARPOL-compliant sewage treatment systems and holding tanks, which will be confirmed during contract negotiations and pre mobilisation audits. For vessels without sewage treatment systems, they must have holding tanks that are capable of discharging their waste via port facilities.

The discharge of treated sewage will temporarily add to the nutrient load (particularly nitrogen and phosphorus) of the surrounding waters immediately around the vessels, though the discharge stream will be rapidly diluted and dispersed by currents.

The biological oxygen demand (BOD) of the treated effluent is unlikely to lead to oxygen depletion of the receiving waters (Black et al., 1994), as it will be treated prior to release. Surface currents will also assist with oxygenation of the discharge once it is released. Given this high dilution and dispersal, low volumes and short discharge period, the risk of sewage and grey water having a significant impact on the marine environment is low.

6.3.5.2 Risk Assessment

Table 6-18 outlines the risk assessment for sewage and grey water discharges.

Table 6-18 Sewage and grey water risk assessment

Hazard duration	During intervention, maintenance and tie-in activities (short-term).	
Extent of hazard	Expected to be largely localised (50 m radius from the vessel, top 10 m of water column).	
Basis of inherent impact and risk Assessment		
• MARPOL-approved sewage treatment plant (STP) fitted to vessels. • The Longtom facilities are located in approximately 57 m of water and 40 km offshore in a relatively high energy environment (current and waves) – sewage and grey water will be rapidly dispersed. • There are no known sensitive environments in the project area. • Intervention and maintenance activities will be of short duration (approximately one week every 1-3 years). • Tie-in activities are likely to only last for a few weeks. • There will be no discharge of sewage within 12 nm of any coastline.		
Inherent impact and risk analysis and ranking		
Consequence	**Likelihood**	**Inherent impact**
Insignificant (1)	N/A	Low
Project specific environmental controls and checks that will take place	Prevention • Not applicable Mitigation • Vessels will be required to comply with MARPOL Annex IV and have in place a valid International Sewage Pollution Prevention Certificate – effectiveness considered moderate.	
Residual risk analysis and ranking		
Consequence	**Likelihood**	**Residual Impact**
Insignificant (1)	N/A	Low
Demonstration of ALARP		
The key control is compliance with MARPOL Annex IV requirements and this will ensure that any sewage discharge is managed and treated to minimise environmental impact. Given the nature and scale of the activity and the low inherent consequence and risk this control is considered sufficiently effective to ensure the residual risk is Low and ALARP. The following ALARP analysis confirms that all reasonable risk treatment options have been considered to reduce the environmental impact of sewage and grey water, and the risk is deemed to be **ALARP**.A 'Low' residual risk ranking is **broadly acceptable** according to the SGHE definition of risk.		
Eliminate	The generation of sewage and grey water by personnel on the vessel cannot be eliminated. This discharge is permitted under MARPOL Annex IV and is consistent with industry codes and standards.	
Substitute	Not applicable	
Engineering	STPs will be installed on the vessels. Bacteria in the waste stream will be killed in the treatment process, reducing the risk of sewage discharge overboard to ALARP.	
Isolation	The alternative to the treatment and discharge of sewage offshore would require the storage and transfer of sewage to shore for disposal. Typical	

	offshore vessels are not designed to store sewage and grey water for extended durations and to do so would introduce a health and safety hazard to crew. Transfer to shore for treatment is not viable given the health and safety hazards associated with storage, transfer and disposal. This would involve undue logistics effort and costs given the minor impact of its offshore discharge. On this basis, the only viable option is to treat the sewage and discharge offshore.
Administrative	Not applicable.
Protective	Not applicable.
Demonstration of Acceptability	
In order to ensure marine pollution is kept to acceptable levels, offshore petroleum operations are required to comply with MARPOL. The ocean currents and depth of the operations will cause any increases in nutrient loading to be dispersed quickly through the water column. There are numerous other oil and gas developments in Bass Strait (20 production facilities) which generate sewage and grey water. Commercial fishing activities and merchant vessels also discharge sewage and grey water. There have been no indications to date of any significant impact on the environment from such activities in Bass Strait. There have been no concerns raised during any consultation regarding sewage and grey water discharges. Given that the project is located some 40 km offshore in a high energy environment, and that vessel operations are of a short duration, this risk is considered **acceptable**.	
Monitoring	
The availability of the Sewage Treatment Plant will be checked daily during offshore campaigns, included as a line item on the daily report and will be recorded and included in the annual EP Compliance Report.	

6.3.6 Discharge of Putrescible Waste

The generation of food waste from the galley during the maintenance and Longtom-5 tie-in activities is likely to result in the discharge of putrescible waste to the ocean:

6.3.6.1 Description of Environmental Impacts

Food scraps generated in the galleys of the vessels will be macerated and discharged overboard. The overboard discharge of macerated food wastes results in a localised and temporary increase in the nutrient load of the surface waters. This may in turn act as a food source for scavenging marine fauna or seabirds, whose numbers will temporarily increase as a result. However, the rapid consumption of this food waste by scavenging fauna, and physical and microbial breakdown, ensures that the impacts of putrescible waste discharges are insignificant. In accordance with industry best practice, no food wasted of any type, ground or unground will be discharged from vessels within 12 nautical miles of land.

There are no nearby sensitive environments or biological communities that are at risk from the discharge of putrescibles wastes.

6.3.6.2 Risk Assessment

Table 6-19 outlines the risk assessment for putrescible waste discharges.

Table 6-19 Putrescible waste discharge risk assessment

Hazard duration	During intervention, maintenance and tie-in activities (short-term).
Extent of hazard	Localised (50 m radius from the vessel, top 10 m of water column).

Basis of Inherent impact risk Assessment

- The Longtom facilities are located in approximately 57 m of water and 40 km offshore in a relatively high energy environment (current and waves). This will lead to rapid dispersion.
- There are no known sensitive environments or biological communities in the project area.
- Intervention and maintenance activities will be of short duration (approximately one week in every year).
- Tie-in activities are likely to only last for a few weeks.

Inherent impact risk analysis and ranking

Consequence	Likelihood	Inherent impact
Insignificant (1)	N/A	Low
Project specific environmental controls and checks that will take place	Prevention • Vessels will comply with MARPOL Annex IV and V. • Macerated food waste will not be discharged overboard within 12 nm of any coastline. • Cooking oils and greases will be collected in containers and transported back to shore for disposal. • All non-food galley wastes (e.g., packaging) will be transported back to shore for recycling or disposal. Mitigation The galley macerator will macerate food scraps to a diameter of less than 25 mm before being disposed of overboard, in compliance with MARPOL Annexes IV and V. If the macerator fails, all food waste will be bagged and sent ashore for disposal.	

Residual risk analysis and ranking

Consequence	Likelihood	Residual Risk
Insignificant (1)	Rare (E)	Low

Demonstration of ALARP

The key control is compliance with MARPOL Annex IV and V requirements and this will ensure that any putrescibles wastes are managed and treated to minimise environmental impact. Given the low inherent consequence and risk this control is considered sufficiently effective to ensure the residual risk is Low and ALARP.

The following ALARP analysis confirms that all reasonable risk treatment options have been considered to reduce the environmental impact of putrescible waste, and the risk is deemed to be **ALARP**.A 'Low' residual risk ranking is **broadly acceptable** according to the SGHE definition of risk.

Eliminate	The generation of putrescible waste by personnel cannot be eliminated. This discharge is permitted under MARPOL Annex V.
Substitute	The substitute to discharging putrescible waste at location is to bag it and back-load for onshore disposal. This presents unacceptable health and hygiene for crews and onshore disposers due to rapid decomposition of organic matter in hot environments. This would also introduce a potential requirement for additional supply vessels to visit the offshore location, to back load the waste for disposal, thus introducing additional environmental risks during the campaign.
Engineering	A MARPOL Annex V-compliant macerator is or will be installed on the vessels.
Isolation	The project area is located > 12 nm from shore.
Administrative	Not applicable.

Protective	Regardless of the distance from shore, all food waste will be macerated prior to discharge. The macerators will be maintained in accordance with the PMS. In the event of macerator failure, all food waste will be bagged and shipped to shore for disposal.
Demonstration of Acceptability	
In order to ensure marine pollution is kept to acceptable levels, offshore petroleum operations are required to comply with MARPOL. The vessel will be required to have a macerator certified to MARPOL requirements. The ocean currents and depth of the operations will cause any increases in nutrient loading to be dispersed quickly through the water column. There are numerous other oil and gas developments in Bass Strait (20 production facilities) which generate putrescibles waste. Commercial fishing activities and merchant vessels also discharge putrescibles waste. The risk of food/galley wastes having a significant negative impact on the marine environment is low. Given that the project is located some 40 km offshore in a relatively high energy environment, and that vessel operations are of a short duration, this risk is considered **acceptable**.	
Monitoring	
The availability of the macerator will be checked daily during offshore campaigns, included as a line item on the daily report and will be recorded and included in the annual EP Compliance Report.	

6.3.7 Discharge of contaminated deck/bilge water

The following activities have the potential to result in the discharge of contaminated deck or bilge water to the ocean:

- Deck washing, ocean spray (green water) and rain water that captures minor contaminants such as oil, grease and detergents on the deck prior to draining overboard.
- Malfunction of the oily water separator.

6.3.7.1 Description of Environmental Impacts

Chemicals discharged to the marine environment have the potential to temporarily reduce water quality and cause physiological damage to marine fauna that may ingest these chemicals or absorb them through their skin. The greatest risk at the project location will be to plankton and pelagic fish, given the absence of other habitat types in the project area. Given the very small volumes of such chemicals or hydrocarbons (oil, grease) that may be accidentally discharged overboard and the temporary presence of the vessels, it is not expected that marine fauna will be exposed to chemicals or hydrocarbons in quantities that would induce acute or chronic toxicity impacts.

Generally, drainage on most vessels is handled in the following manner:

- **Uncontaminated deck rainwater:** Directed overboard via open drains.
- **Main deck and hull machinery space:** Drains routed to waste water tank, then pumped to waste oil settling tank. Oil and water are separated, with the skimmer collecting oily residue, directed to a waste oil tank and sent ashore for disposal. Cleaned water is discharged overboard and continuously monitored by an oily-water monitor, ensuring no discharge over 15 ppm. Spills are mopped up.

- **Fuel transfer point:** Bunded area, drains blocked with scupper plugs, spills cleaned using absorbent materials. Note there will be no offshore refuelling and hence this source is not applicable to this EP.

6.3.7.2 Risk Assessment

Table 6-20 outlines the risk assessment for contaminated deck/bilge water.

Table 6-20 Contaminated deck/bilge water risk assessment

Hazard duration	During intervention, maintenance and tie-in activities (short-term).	
Extent of hazard	Localised.	
Basis of Inherent impact risk Assessment		
• The Longtom facilities are located in approximately 57 m of water and 40 km offshore in a relatively high energy environment (current and waves). This will lead to rapid dispersion. • There are no sensitive environments or biological communities in the project area. • Intervention and maintenance activities will be of short duration (approximately one week in every year). • Tie-in activities are likely to only last for a few weeks. • Vessels will comply with MARPOL Annex I and have an International Oil Pollution Prevention Certificates and accepted SOPEP.		
Inherent impact risk analysis and ranking		
Consequence	**Likelihood**	**Inherent Risk**
Insignificant (1)	Moderate (C)	Low
Project specific environmental controls and checks that will take place	Prevention • Vessels will comply with MARPOL Annex I and have an International Oil Pollution Prevention Certificates and accepted SOPEP – effectiveness considered High. • Hydrocarbon and chemical storage areas are bunded and chemicals are stored in chemical storage lockers – effectiveness considered moderate. • Areas where spills could occur are drained to a bilge tank and discharged via an oily water separator. Discharges are monitored via an oil in water meter and no discharge of >15 ppm oil in water is allowed. • Fixed and mobile equipment is maintained in accordance with the PMS – effectiveness considered moderate. Mitigation • SOPEP including. - Vessel crew regularly undertake spill response training drills. - Spills to deck will be cleaned up immediately using SOPEP kits. - SOPEP kits will be stored in various locations around the vessel and will be maintained fully stocked. - Scupper plugs will be readily available for use in the event of a deck spill to prevent contaminants draining directly overboard. Effectiveness considered moderate	
Residual risk analysis and ranking		
Consequence	**Likelihood**	**Residual Risk**

Insignificant (1)	Unlikely (D)	Low

Demonstration of ALARP	
The key preventative controls are vessel in compliance with MARPOL Annex I, vessel to have, an International Oil Pollution Prevention Certificates and an accepted SOPEP. These controls, checked as part of the pre-mobilisation audit will ensure that the vessel is designed, managed and operated to minimise environmental impact. In addition the SOPEP and associated equipment and procedures will ensure that in the event of any spill it will be treated and captured to minimise the impact. Given the low inherent consequence and risk these controls are considered sufficiently effective to ensure the residual risk is Low and ALARP. The following ALARP analysis confirms that all reasonable risk treatment options have been considered to reduce the environmental impact of contaminated deck/bilge water, and the risk is deemed to be **ALARP**. No further reasonable mitigation measures exist. A 'Low' residual risk ranking is **broadly acceptable** according to the SGHE definition of risk.	
Eliminate	The elimination of chemicals, oils, fuels and lubricants etc is not possible due the need to maintain safe operations. However, the chemicals and volumes stored on board should be managed and are expected to be relatively minor.
Substitute	Not applicable
Engineering	Engineering control in place such as the installation of a MARPOL-compliant oily water system on the vessels.
Isolation	Spills on decks are isolated through the use scupper plugs and SOPEP materials, such as absorbent 'sausages' and 'kitty litter'. Spills from fixed equipment, such as engines and generators, are enclosed and spills captured via bilges that drain via the oily water separator. Mobile equipment or chemicals will be stored and handled within temporary bunding.
Administrative	The vessels will have current and valid International Oil Pollution Prevention Certificates. Spill drills will be regularly undertaken by the vessel crew.
Protective	Fixed and mobile equipment is maintained in accordance with the PMS.

Demonstration of Acceptability
In order to ensure marine pollution is kept to acceptable levels, vessels must meet their international and class requirements. Bass Strait currently has over 20 oil and gas production platforms and these have associated support vessels that also generate deck bilge discharges. There have been no indications to date of any significant impact on the environment from such activities. No significant environmental impacts are expected from the occasional release of contaminated deck/blidge water given the low level of contamination, low volumes and large dilution effects when entering the marine environment. This risk is therefore considered **acceptable**.
Monitoring
The availability of the oily water analyser will be checked daily during offshore campaigns, included as a line item on the daily report and will be recorded and included in the annual EP Compliance Report.

6.3.8 Discharge of non-hazardous waste

The following non-hazardous wastes have the potential to be deposited overboard or disposed of inappropriately:

- Paper and cardboard.
- Wooden pallets.
- Scrap steel, metal, aluminium and cans.
- Bottles and glass.
- Plastics.
- Rope.

Domestic sewage and food waste are addressed separately (discussed in Sections 6.3.5 and 6.3.6 respectively).

6.3.8.1 Description of Environmental Impacts

If accidentally discharged overboard (i.e., dropped object, storm that results in goods rolling off the deck, wind that blows rubbish overboard), solid wastes can injure or kill fish or marine birds through ingestion or contact (e.g., high-order fish mistaking plastics for jellyfish, rope getting caught around the necks of turtles and seabirds). It could also wash ashore contributing to shoreline litter.

6.3.8.2 Risk Assessment

Table 6-21 outlines the risk assessment for non-hazardous wastes.

Table 6-21 Non-hazardous waste discharge risk assessment

Hazard duration	Short to medium (litter may be present for many months).	
Extent of hazard	Localised (seabed near vessel) to far-reaching (ocean current-driven waste or windblown litter).	
Basis of Inherent impact risk Assessment		
• No waste (other than sewage and putrescibles wastes) is planned to be discharged offshore. • The Longtom facilities are located in approximately 57 m of water and 40 km offshore in a relatively high energy environment (current and waves). This will lead to rapid dispersion. • There are no sensitive environments or biological communities in the project area. • Intervention and maintenance activities will be of short duration (approximately one week in every year). • Tie-in activities are likely to only last for a few weeks.		
Inherent impact risk analysis and ranking		
Consequence	**Likelihood**	**Inherent Risk**
Insignificant (1)	Moderate (C)	Low
Project specific environmental controls and	Prevention	

checks that will take place	• Vessels will be required to comply with MARPOL Annex V and hold an International Convention for the Prevention of Pollution from Ships Certificate – effectiveness considered High. • The vessel will implement a Waste Management Plan, which at a minimum will specify: - The responsibilities of the Vessel Master, Offshore Manager, Waste Coordinator and crew with regard to waste management. - Waste will be segregated according to recyclability (e.g. timber, plastic, glass, cardboard, steel, batteries, fluorescent tubes). - Waste segregation units (bins, drums, sacks or skips) must be used, and must be fully secured, watertight, undamaged and rust-free, stored in a vertical position, and clearly labelled. Lids must be kept on at all times to prevent wind-blown debris from escaping, and liquid waste must be stored in drip trays. - Waste must be disposed of via a supply vessel only. - Waste Transfer Notes must be maintained. - A Garbage Record Book must be maintained (by the vessel). Effectiveness considered High. <u>Mitigation</u> An ROV survey of the seabed will check for (and retrieve) dropped objects following a construction campaign – effectiveness considered moderate.

Residual risk analysis and ranking		
Consequence	**Likelihood**	**Residual Risk**
Insignificant (1)	Unlikely (D)	Low

Demonstration of ALARP	
The key preventative controls are vessel in compliance with MARPOL Annex V, vessel to have an International Convention for the Prevention of Pollution from Ships Certificate and a Waste Management Plan. These will ensure that wastes are managed and treated to minimise environmental impact. In addition the ROV survey will ensure that any waste ending up on the sea bed is identified and where practicable removed to minimise the impact. Given the low inherent consequence and risk this control is considered sufficiently effective to ensure the residual risk is Low and ALARP. The following ALARP analysis confirms that all reasonable risk treatment options have been considered to reduce the environmental impact of non-hazardous waste, and the risk is deemed to be **ALARP**. No further reasonable mitigation measures exist. A 'Low' residual risk ranking is **broadly acceptable** according to the SGHE definition of risk.	
Eliminate	The elimination of consumable products onboard the vessel is not possible – waste will be generated. Any unused project consumables will be returned to suppliers or store for future use.
Substitute	Not applicable.
Engineering	Not applicable.
Isolation	Waste will be stored in suitable receptacles to minimise the potential for accidental loss overboard.
Administrative	Waste management and housekeeping.
Protective	Not applicable

Demonstration of Acceptability
Vessels must meet the requirements of MARPOL and their waste management plan. Non-hazardous wastes will not be discharged overboard. All waste will be transferred onshore. Oil and Gas supply vessels, merchant shipping and commercial fishing activities take place in Bass Strait and these could all discharge waste, their activities are all currently accepted by the community with no concerns raised to SGHE regarding inappropriate waste disposal during the consultation process. The risk to the environment from non-hazardous waste is low and considered to be **acceptable**, given the high energy environment, water depth and short duration of the activities.
Monitoring
Weight/volume of the various waste streams is measured, recorded and reported by the Logistics Coordinator in the waste manifest and daily logs.

6.3.9 Discharge of hazardous waste

The following hazardous wastes may be generated through the use of consumable products on board the vessels and could be accidentally discharged overboard or disposed of inappropriately:

- Chemicals (e.g., biocides, corrosion inhibitors and hydrocarbon-based materials (e.g., pipe dope, lubricating oils)).
- Hydrocarbon-contaminated materials (e.g., oily rags, oil filters).
- Batteries, empty paint cans, aerosol cans, fluorescent tubes, printer cartridges.
- Acids and solvents.

6.3.9.1 Description of Environmental Impacts

Hazardous wastes accidentally released to the ocean causes pollution and contamination, with either direct or indirect effects on marine organisms. For example, chemical spills can impact on pelagic fish communities, causing physical damage through ingestion or absorption through the skin. These impacts would be temporary and small in scale if a chemical discharge was to occur.

Other solid items of wastes, such as paint cans containing paint residue, batteries and so forth, will settle on the seabed and over time, will result in the leaching of hazardous materials to the seabed, which is likely to result in a small area of substrate becoming toxic and unsuitable for colonisation by benthic fauna.

6.3.9.2 Risk Assessment

Table 6-22 outlines the risk assessment for hazardous wastes.

Table 6-22 Hazardous waste discharge risk assessment

Hazard duration	Short to medium (litter may be present for many months).
Extent of hazard	Localised (seabed near the vessel) to far-reaching (ocean current-driven waste or windblown litter).
Basis of Inherent impact risk Assessment	
• No waste (other than sewage and putrescibles wastes) is planned to be discharged offshore.	

- The Longtom facilities are located in approximately 57 m of water and 40 km offshore in a relatively high energy environment (current and waves). This will lead to rapid dispersion.
- There are no sensitive environments or biological communities in the project area.
- Intervention and maintenance activities will be of short duration (approximately one week in every year).
- Tie-in activities are likely to only last for a few weeks.

Inherent impact risk analysis and ranking		
Consequence	**Likelihood**	**Inherent Risk**
Insignificant (1)	Moderate (C)	Low
Project specific environmental controls and checks that will take place	Prevention • Vessels will be required to comply with MARPOL Annex V and hold an International Convention for the Prevention of Pollution from Ships Certificate – effectiveness considered High. • Chemical drums and dry bagged chemicals will be stored in bunded areas– effectiveness considered Moderate. • The vessel will implement a Waste Management Plan – effectiveness considered Moderate, which at a minimum will specify: - The responsibilities of the Vessel Master, Offshore Manager, Waste Coordinator and crew with regard to waste management. - Waste will be segregated according to recyclability (e.g., batteries, used oil filters, fluorescent tubes). - Waste segregation units (bins, drums, sacks or skips) must be used, and must be fully secured, watertight, undamaged and rust-free, stored in a vertical position, and clearly labelled. Lids must be kept on at all times to prevent wind-blown debris from escaping, and liquid waste must be stored in drip trays. - Waste Transfer Notes must be maintained. - A Garbage Record Book must be maintained (by the vessel). Mitigation • SOPEP response kits are located throughout the vessel in appropriate locations (e.g., sack room, main deck, refuelling station) and well stocked – effectiveness considered Moderate. • An ROV survey of the seabed will check for (and retrieve) dropped objects – effectiveness considered Moderate.	

Residual risk analysis and ranking		
Consequence	**Likelihood**	**Residual Risk**
Insignificant (1)	Unlikely (D)	Low

Demonstration of ALARP

The key preventative controls are vessel in compliance with MARPOL Annex V, vessel to have an International Convention for the Prevention of Pollution from Ships Certificate and a Waste Management Plan. These will ensure that wastes are managed and treated to minimise environmental impact. In addition the SOPEP and ROV survey will ensure that any waste is contained, identified and where practicable removed to minimise the impact. Given the low inherent consequence and risk these controls are considered sufficiently effective, robust and independent to ensure the residual risk is Low and ALARP.

The following ALARP analysis confirms that all reasonable risk treatment options have been considered to reduce the environmental impact of hazardous waste, and the risk is deemed to be **ALARP**. No further reasonable mitigation measures exist. A 'Low' residual risk ranking is **broadly acceptable** according to the SGHE definition of risk.

Eliminate	The elimination of consumable products onboard the vessel is not possible – waste will be generated. Any unused project consumables will be returned to suppliers or store for future use.
Substitute	Some substances only become hazardous when inappropriately disposed of (such as batteries, fluorescent light tubes), and the use of these items cannot be substituted (e.g. light fittings throughout the vessel would need to be switched to alternative lighting methods, which is not commensurate with the low risk of these use of these materials).
Engineering	Not applicable.
Isolation	Waste will be stored in suitable receptacles to minimise the potential for accidental loss overboard.
Administrative	Waste management and housekeeping.
Protective	Not applicable
Demonstration of Acceptability	
In order to ensure marine pollution is kept to acceptable levels, vessels must meet the requirements of their waste management plan. Hazardous wastes will not be discharged overboard. All waste will be transferred onshore. Oil and Gas supply vessels, merchant shipping and commercial fishing activities take place in Bass Strait and these could all discharge waste, their activities are all currently accepted by the community with no concerns raised to SGHE regarding inappropriate waste disposal during the consultation process. The risk to the environment from hazardous waste is low and considered to be **acceptable**, given the nature and scale of the activities.	
Monitoring	
Weight/volume of the various waste streams is measured, recorded and reported by the Logistics Coordinator in the waste manifest and daily logs.	

6.3.10 Discharge of cooling water

Seawater is used as a heat exchange medium for cooling machinery engines and vessel activities will result in a discharge of warm sea water to the environment.

6.3.10.1 Description of Environmental Impacts

It is anticipated that a small volume of cooling water will be discharged directly overboard during intervention, maintenance and Longtom-5 tie-in activities, and will have an exit temperature several degrees higher than that of the receiving waters.

Modelling undertaken for the BHP Petroleum Pyrenees FPSO Development in the Exmouth Basin (BHP, 2005) shows that based on a discharge of 100,000 m3/day at a water temperature of 25°C above that of the surrounding ocean, there is a 50% probability of the temperature of surface water within 25 to 50 m of the discharge point exceeding the ambient temperature by more than 2°C decreases to 1% within about 60 to 85 m of the discharge point, depending on seasonal variations in the water current.

Modelling of continuous waste water discharges undertaken by Woodside for its Torosa South-1 drilling campaign in the Browse Basin found that discharge water temperature decreases quickly as it mixes with the receiving waters, with the discharge water temperature being less than 1°C

above background levels within 100 m (horizontally) of the discharge point, and will be within background levels within 10 m vertically (Woodside, 2008).

6.3.10.2 Risk Assessment

Table 6-23 outlines the inherent impact risk assessment for cooling water discharges.

Project specific environmental controls have not been provided as the risk is was deemed to have no credible impact. This was based on the SGHE risk assessment team's judgement that no negative impacts are plausible.

Table 6-23 Cooling water discharge inherent impact risk assessment

Hazard duration	During intervention, maintenance and tie-in activities (short-term).
Extent of hazard	Localised (100 m radius from the vessel, top 10 m of water column).
Basis of Inherent impact risk Assessment	
• There are no known sensitive environments or biological communities in the project area. • The discharged warm water is expected to rapidly mix and disperse and no lasting or significant environmental impact is anticipated.	
Inherent impact risk Analysis	
Consequence is deemed to have no credible impact based on the nature and scale of the activity. No further assessment is required.	

6.3.11 Discharge of desalination brine water

Brine water (hypersaline water) is created through the vessel's desalination process that creates fresh water for drinking, showers, cooking and so forth. This is achieved through reverse osmosis (RO) or distillation resulting in the discharge of seawater with a slighted elevated salinity (~10% higher than seawater). The freshwater produced is then stored on board and then discharged along with the sewage and grey water back to the environment.

6.3.11.1 Description of Environmental Impacts

It is estimated that the temperature of discharge waters is only several degrees Celsius (1°C - 6°C) above background water temperature with a salinity of about 40,000 ppm (normal seawater is 35,000 ppm).

Woodside undertook wastewater discharge modelling (vertical, horizontal and temperature) for their Torosa South-6 appraisal well drilled near Scott Reef (Woodside, 2008). Vertical modelling indicates that most of the discharged volume remains in the upper water column (in the upper 10 metres) due to the neutral buoyancy of the discharge, but a small portion penetrates below the water surface, where it rapidly dissipates through the water column due to strong tides (Woodside, 2008). For the horizontal modelling, results indicate that there are only small differences in movement for each of the four seasons. Results show that a concentration of a component within the discharge stream is reduced to 1/100th of its original concentration at no less than 50 m from the discharge point under any condition (Woodside, 2008).

Temperature dispersion modelling shows that discharge water temperature will decrease quickly as it mixes with the receiving waters, with discharge waters being less than 1°C above background levels within less than 100 m (horizontally) of the discharge point. Vertically, the discharge will be within background levels within 10 m (Woodside, 2008).

Most marine species are able to tolerate short-term fluctuations in water salinity in the order of 20-30%, and it is expected that most pelagic species passing through a denser saline plume would not suffer adverse impacts (Walker and McComb, 1990).

The Woodside water discharge dispersion modelling found that in general, in a sensitive environment such as Scott Reef, routine discharges would not have an impact on sensitive receptors, regardless of season. It can therefore be concluded that there will be negligible impacts due to the discharge of brine water, particularly as there are no sensitive environmental receptors present.

6.3.11.2 Risk Assessment

Table 6-24 outlines the inherent impact risk assessment for desalination brine water discharges.

Project specific environmental controls have not been provided as the risk was deemed to have no credible impact. This was based on the SGHE risk assessment team's judgement that no negative impacts are plausible.

Table 6-24 Desalination brine discharge inherent impact risk assessment

Hazard duration	During intervention, maintenance and tie-in activities (short-term).
Extent of hazard	Localised (100 m radius from the vessel, top 10 m of water column).
Basis of Inherent impact risk Assessment	
• There are no known sensitive environments or biological communities in the project area. • The discharged brine water is expected to rapidly mix and disperse and no lasting or significant environmental impact is anticipated.	
Inherent impact risk Analysis	
Consequence is deemed to have no credible impact based on the nature and scale of the activity. No further assessment is required.	

6.3.12 Introduction of Invasive Marine Species

Vessel activities have the potential to result in the introduction of invasive marine species to the project area, through ballast water discharge containing foreign species and vessel hull and equipment biofouling.

6.3.12.1 Description of Environmental Impacts

Ballast Water

Vessels are not expected to take on, nor discharge, ballast water while working on Longtom infrastructure. Any ballast water exchange will comply with the Australian Ballast Water

Management Requirements and if required, it will only be undertaken more than 12 nautical miles from land, given the Longtom location.

Any risk of introducing invasive marine species will likely be from attachment to vessel hulls and biofouling.

Biofouling

Biofouling is the accumulation of aquatic micro-organisms, algae, plants and animals on vessel hulls and submerged surfaces. Regular anti-fouling of the hull is required to prevent this build up. The main chemical used in the anti-fouling agent, tributylin (TBT), persists in the environment by attaching itself to muds (accumulating in sediments) and in high concentrations can have toxic effects on marine organisms through bioaccumulation. The impact of TBT leaching off a single vessel in open waters has been found not to be detrimental to marine life (Fabris et al., 1995) and remains under the ANZECC Guidelines for Fresh and Marine Water Quality (2000) TBT trigger value of 0.0004 µgL-1 for the protection of 99% of species in marine waters.

Standard procedures for minimising the introduction or translocation of invasive marine species into the waters of eastern Bass Strait include the treatment of vessels with anti-fouling paints and compliance with AQIS and Victorian EPA requirements.

Invasive Marine Species Invasion

Successful invasive marine species invasion requires the following three steps (AQIS, 2011):

1. Colonisation and establishment of the marine pest on a vector (e.g., vessel hull) in a donor region (e.g. home port).
2. Survival of the settled marine species on the vector during the voyage from the donor to the recipient region (e.g. project area).
3. Colonisation (e.g. dislodgement or reproduction) of the marine species in the recipient region, followed by successful establishment of a viable new local population.

Invasive marine species are likely to have little or no natural competition or predation, thus outcompeting native species for food or space, preying on native species or changing the nature of the environment. It is estimated that Australia has over 250 established marine pests, and it is estimated that approximately one in six introduced marine species becomes pests (AMSA, n.d.).

Marine pest species can also deplete fishing grounds and aquaculture stock, with between 10% and 40% of Australia's fishing industry being potentially vulnerable to marine pest incursion (AMSA, n.d). For example, the introduction of the North Pacific Seastar in Victorian and Tasmanian waters was linked to a decline in scallop fisheries. Marine pests can also damage marine and industrial infrastructure, such as encrusting jetties and marinas or blocking industrial water intake pipes. The accumulation on vessel hulls can slow the vessels down and increase fuel consumption.

Successful invasive marine species invasion during project activities is highly unlikely to occur as:

1. **Colonisation and establishment of the marine pest on the vessel hull or in ballast water in a donor region:** SGHE will ensure that vessel hulls have been recently cleaned, with anti-fouling paint applied and has a valid Statement of Compliance issued under the *International Convention on the Control of Harmful Anti-Fouling Systems on Ships*. Where

the vessel has relocated to Bass Strait, the vessel will be required to comply with the Australian Ballast Water Management Requirements. SGHE will ensure the vessel posses a Low level of IMS risk by assessing the risk using their IMS risk assessment process and implementing additional controls as necessary prior to mobilisation.

2. **Survival of the settled marine species on/in the vessel during the voyage from the donor to the recipient region:** This is unlikely to occur as all contracted vessels undergo regular anti-fouling of the hull to prevent the build up of barnacles and other organisms that increase the drag of the vessel, leading to increased fuel consumption.
3. **Colonisation of the marine species in the recipient region, followed by successful establishment of a viable new local population:** This is unlikely to occur due to the presence of anti-fouling paint (preventing colonisation of the hull).

6.3.12.2 Risk Assessment

Table 6-25 outlines the risk assessment for invasive marine species.

Table 6-25 Invasive marine species risk assessment

Hazard duration	Long-term (in the event of IMS introduction and establishment).	
Extent of hazard	Localised (seabed near vessel) to far-reaching (driven by ocean currents and reproductive techniques).	
Basis of Inherent impact risk Assessment		
• Ballast water discharge is not expected, however if required it will occur within 12 nautical miles from land and will comply with the Australian Ballast Water Management Requirements. • Intervention and maintenance activities will be of short duration (approximately one week in every 1-3 years). • Tie-in activities are likely to only last for a few weeks.		
Inherent impact risk analysis and ranking		
Consequence	**Likelihood**	**Inherent Risk**
Moderate (3)	Unlikely (D)	Moderate
Project specific environmental controls and checks that will take place	Prevention SGHE will ensure vessels pose a low IMS risk by assessing the IMS risk and implementing controls as necessary in line with their IMS RA procedure. For example vessels will be required to have a valid International Anti-fouling System Certificate in place. – effectiveness considered High. Mitigation Not applicable.	
Residual risk analysis and ranking		
Consequence	**Likelihood**	**Residual Risk**
Moderate (3)	Rare (E)	Low
Demonstration of ALARP		
The key preventative controls are vessels will be assessed for IMS risk in accordance with the SGH IMS RA procedure. Application of this procedure and only using vessels that pose a low risk is considered sufficiently effective, to ensure the residual risk is Low and ALARP. The following ALARP analysis confirms that all reasonable risk treatment options have been considered to reduce the environmental impact of invasive marine species, and the risk is deemed		

to be **ALARP**. No further reasonable mitigation measures exist. A 'Low' residual risk ranking is **broadly acceptable** according to the SGHE definition of risk.	
Eliminate	The use of a vessel that remains permanently or near-permanently partly submerged in water is unavoidable, and thus hull fouling and the uptake of marine organisms in ballast water cannot be eliminated.
Substitute	Use of a purpose built Longtom specific vessel is not practicable.
Engineering	Not applicable.
Isolation	No ballast water exchange will occur within 12 nautical miles of land and any ballast water exchange will comply with the Australian Ballast Water Management Requirements.
Administrative	SGHE will ensure that vessels selected have current International Anti-fouling System Certificates to verify that they comply with the International Convention on the Control of Harmful Anti-fouling Systems on Ships. Vessels to comply with AQIS and National Biofouling Management requirements. A premobilisation audit will be undertaken to confirm vessel acceptability.
Protective	Not applicable.
Demonstration of Acceptability	
Ballast water discharge is not expected, however should it be required, it will comply with the Australian Ballast Water Management Requirements and no discharge of ballast water at Longtom will be planned. Bass Strait currently has over 20 oil and gas production platforms with associated maintenance vessels, in addition to shipping traffic and commercial fishing all of which also pose a risk of invasive marine species. These are all currently accepted activities within Bass Strait. The risk of the introduction or spread of invasive marine species to Bass Strait is low and considered to be **acceptable**.	
Monitoring	
Vessel ballast uptakes and discharges (if any) while in Australian waters will be recorded in the daily logs.	

6.3.13 Vessel diesel spill

Vessel activity has the potential to result in a spill of marine diesel oil (MDO) only if there is a major equipment failure or accident offshore. No refuelling will take place during maintenance, intervention or tie-in activities.

6.3.13.1 Description of Environmental Impacts

General Impacts

The following information regarding the impacts of an MDO spill on the marine environment is sourced from APASA.

In many circumstances a spill of a similar quantity of MDO can be of greater environmental consequence than a spill of a similar quantity of light condensates.

MDOs usually have a very narrow boiling point range unless doctored with heavy fuel oil which in the trade is called ‘dirty diesel’. Most commercial MDOs supplied to offshore vessels are a kept within a tight technical specification and most operators refrain from using dirty diesel in the offshore industry.

Diesel fuel oils are dominated by n-alkane hydrocarbons that give diesel its unique compression ignition characteristics and usually consist of carbon chain C11-C28 but may vary depending upon specifications (e.g., winter vs. summer grades). Many MDOs can contain approximately 3-7% by volume of hydrocarbons that are classified as ‘persistent’ under IOPC Fund definition (i.e., greater than 5% boiling above 370°C). It is common for the residues of diesel spills after weathering to contain n-alkanes, iso-alkanes and naphthenic hydrocarbons. Minor quantities of PAHs will be present.

When spilt at sea, MDOs will spread and thin out quickly and more than half of the oil volume can be lost by evaporation within 12 hours depending upon sea temperature and winds. MDOs also have low viscosities and can result in hydrocarbons becoming physically dispersed as fine droplets into the water column when winds exceed 10 knots. Droplets of diesel oil that are naturally or chemically dispersed will be sub-surface and will behave quite differently to surface oil. Diesel droplets will now move 100% with the currents under water but on the surface are affected by both wind and currents. Natural dispersion of MDOs will reduce the hydrocarbons available to evaporate into the air.

Although evaporation reduces the level of hydrocarbons on the water surface, it increases the level of hydrocarbons able to be inhaled. This increased hydrocarbon vapour exposure can affect any air breathing animal including whales, dolphins, seals and turtles.

The different MDO product compositions, together with different environmental conditions during marine spills (sea temperature, wind and sea states) can vary the quantities of hydrocarbons lost to the atmosphere due to evaporation (but generally ranges between 40-65%). Dispersion into the sea by the action of wind and waves can result in 25 to 50% of the loss of hydrocarbons from surface slicks and dissolution (solubility of hydrocarbons) can account for 1-10% loss from the surface.

The environmental effects of MDOs spills are not as visually obvious as those of heavier fuel oils or crude oils. MDOs are considered to have a higher aquatic toxicity in comparison to many other crude oils and condensates due to the types of hydrocarbons present and that dispersed droplets of diesel can be more bio-available to marine organisms. MDOs have a high potential to bio-accumulate in organisms and have high water solubility along with a higher potential to naturally entrain into the water column than HFOs.

Due to their higher solubility and ease of entrainment/dispersion into the water column, MDO spills can have a greater ecological impact in comparison to other floating oil slicks. MDOs are also known to taint seafood. According to the International Maritime Organisation (IMO) (ESPH 16/6/1 September 2010), diesel oil has a GESAMP (Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection) rating of 3 for acute toxicity (damage to living organisms) and 4 for bioaccumulation/tainting (4 = high potential to bioaccumulate, 5 is the highest).

Diesel oil in the water column can adhere to fine-grained suspended sediments that can settle out and result in oiled sediments being deposited on the seabed. MDO spills that reach shorelines are usually still mobile residues and will penetrate shoreline sediments due to the low viscosity of the oil and have direct consequences on in-faunal organisms.

The impacts of hydrocarbons on marine mammals and other marine species are discussed in Section 6.2.1.1.

Diesel Spill Modelling

SGHE commissioned APASA to conduct hydrocarbon spill modelling for the following scenario:

Vessel collision incident – a release of 80 m3 of MDO (80,000 litres/503 barrels) over 6 hours and tracked until it reaches a minimum oil thickness threshold of 0.0001 mm) and 0.01 mm.

- It is unlikely that more than one tank would be ruptured in a vessel collision given the typical safety features of the vessels (e.g., double hulls) and the fact that the vessels will be within the Bass Strait “Area to be Avoided” and the Longtom-3 and 4 safety zones when conducting the majority of the petroleum activity.
- SGHE has investigated the typical storage volumes and tank configurations of various supply vessel companies (e.g., Farstad, Go Marine, Swire) (see Table 6-26) and concluded that 80 m3 would represent the contents of a typical fuel tank. In reality this volume of diesel is unlikely to be lost as the tanks can be managed and product pumped from one to another. In addition in the event of a tank failure, water will tend to flow in while diesel will flow out until an equilibrium is achieved (i.e., if the hole is half way up the tank then only half the contents would likely be lost).
- AMOSC has stated that a spill of 80 m3 of MDO is highly unlikely, and that spills are more likely going to be related to refuelling rather than collisions. A loss of containment during refuelling is considered to be less than 8 m3, see below.

Table 6-26 Typical AHTS vessel storage capacities

Company	Vessel	Total fuel storage volume (m^3)	Number of Tanks	Range of tank volumes (m^3)
Swire	Pacific Battler	878	12	30 – 118
	Pacific Blade	878	12	30 – 118
	Pacific Champion	900	10	23 - 180
Farstad	Lady Sandra	820	10	26 - 154
	Lady Gerda	929	15	24 - 103
	Lady Valisia	1078	12	26 - 117
Go Marine	Go Altair	536	10	31 - 119
	Deep Sea	1242	15	23-212

Other scenarios considered, but discounted from diesel modelling, included:

- Refuelling incident – no offshore refuelling will take place at Longtom.
- Catastrophic vessel collision incident – a large release of about 1,000 m^3 of MDO (1 million litres/6,289 barrels). This was not considered credible based on;
  - The location of the Longtom wells within the Bass Strait "Area to be Avoided"
  - The design and configuration of typical AHTS vessels.
  - AMOSC advice to SGHE (formerly Nexus) that spills of this size should not be considered credible given the low speed and nature of the work undertaken by the vessels.

Table 6-27: Summary of parameter used in vessel diesel spill modelling

Parameter	Description
Number of spill simulations	100 simulations throughout the year
Hydrocarbon Type	MDO
Release Type	Surface release
Total spill volume	80 m3 of MDO over 6 hours
Release Depth	Surface
Release duration	6 hours
Simulation length	30 days

MDO Characteristics

The MDO is a light-persistent fuel oil used in the maritime industry. It has a density of 829.1 kg/m3 (API of 37.6) and a low pour point (-14 oC). The low viscosity (4 cP) indicates that this oil will spread quickly when released and will form a thin to low thickness film on the sea surface, increasing the rate of evaporation. Approximately, 5% (by mass) of the oil is categorised as a group II oil (light-persistent) based on categorisation and classification derived from AMSA (2015)

guidelines. The classification is based on the specific gravity of hydrocarbons in combination with relevant boiling point ranges.

Table 6-28 details the physical properties of MDO, while Table 6-29 presents the boiling point ranges of the MDO used in this study. Figure 6-5 shows weathering graphs for an 80 m3 release of MDO over 6 hours (tracked for 30 days) during three static wind conditions.

The prevailing weather conditions will influence the weathering and fate of the MDO. Under lower wind-speeds (5 knots), the MDO will remain on the surface longer, spread quicker, and in turn increase the evaporative process. Conversely, sustained stronger winds (>15 knots) will generate breaking waves at the surface, causing a higher amount of MDO to be entrained into the water column and reducing the amount available to evaporate.

Table 6-28 Physical properties of the Marine Diesel Oil

Characteristic	Marine Diesel Oil
Density (kg/m^3)	829.1
API	37.6
Dynamic viscosity (cP)	4.0
Pour Point (ºC)	-14
Wax Content (%)	1
Hydrocarbon property category	Group II
Hydrocarbon property classification	Light – Persistent

Table 6-29 Boiling point ranges of the Marine Diesel Oil

Characteristic	Not Persistent			Persistent
	Volatile	Semi-volatile	Low volatility	Residual
Boiling point (ºC)	< 180	180 - 265	265 - 380	>380
Marine Diesel Oil	6.0	34.6	54.4	5.0

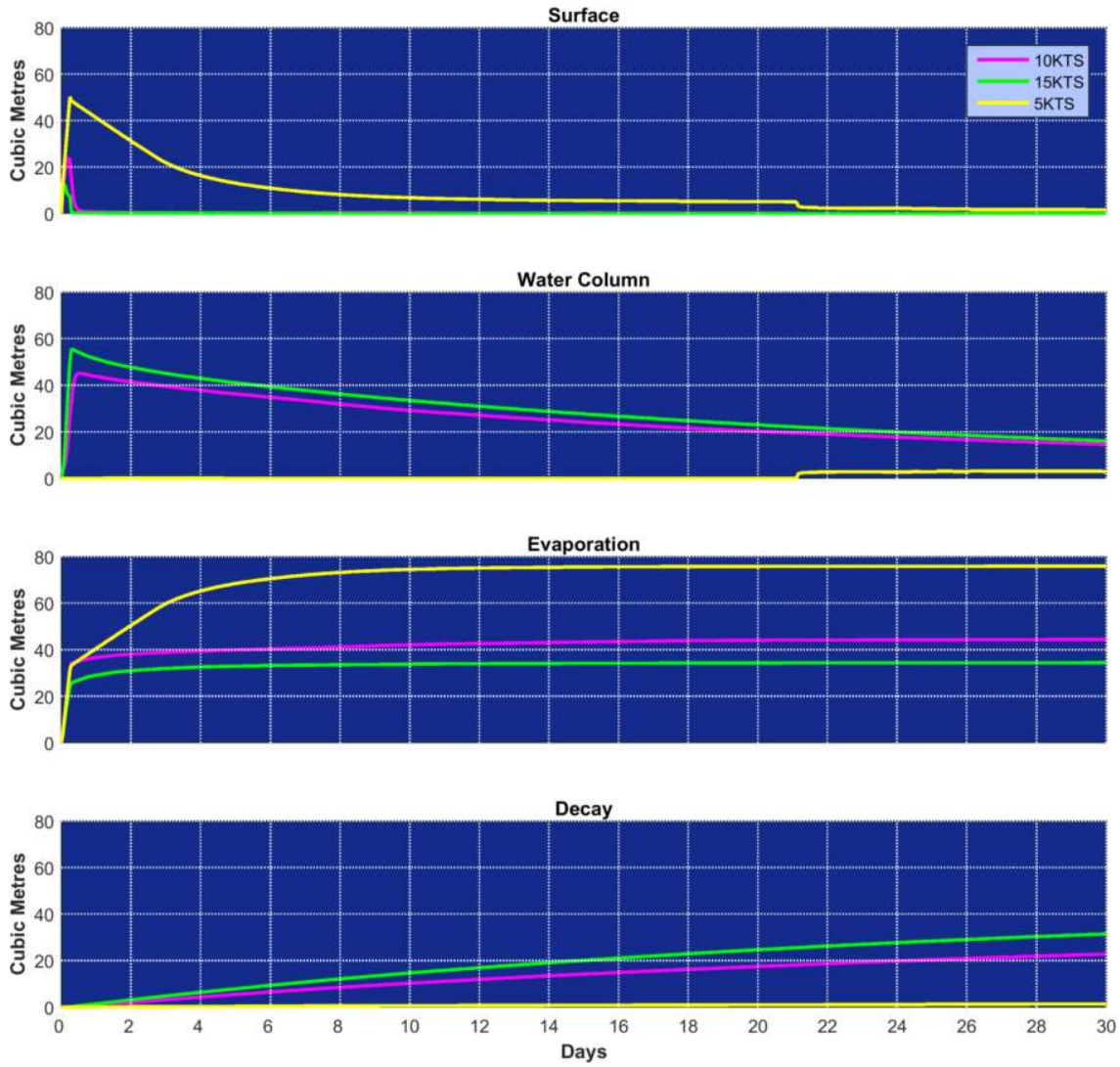


Figure 6-5 Predicted weathering and fates graph for Marine Diesel Oil

Model results

Key results from the stochastic modelling are:

- No shoreline contact was predicted for the scenario;
- The maximum distance from the release location predicted for low (> 0.5 g/m^2) and moderate surface (> 10 g/m^2) exposure was 52 km (east-northeast) and 6 km (east) respectively while no exposure at the high (>25 g/m^2) threshold was observed (Figure 6-6);
- Zones of low and moderate potential surface exposure were shown to extend predominantly south-southwest and east-northeast of the release location;
- The Upwelling East of Eden KEF had the greatest predicted probability to experience surface oil at, or above, the low exposure threshold;
- The modelling demonstrated no time-averaged dissolved hydrocarbon exposure above 6ppb for any of the receptors assessed;

- Instantaneous dissolved hydrocarbon exposure was predicted to remain in offshore waters and the Key Ecological Feature – Upwelling East of Eden was the only sensitive receptor exposed to low dissolved hydrocarbon level. Note, the release location is situated within the boundaries of this receptor.
- Potential time-averaged entrained hydrocarbon exposure was indicated at low level except for the KEF – Upwelling East of Eden which demonstrated a 1% chance of moderate exposure and recorded the highest time-average and instantaneous exposure. The second highest record was predicted for Croajingolong (West) and East Gippsland for time-averaged exposure and New Zealand Star Bank and Point Hicks MNP for instantaneous exposure.
- Potential instantaneous entrained hydrocarbon exposure was predicted at low, moderate and high levels. While the extent of instantaneous exposure zones is significantly larger than time-averaged exposure zones, these results are provided to define a spatial boundary for the environment that may be exposed to oil contamination as per the requirements outlined in NOPSEMA (2019) and may not be representative of any adverse effect to the aquatic environment.

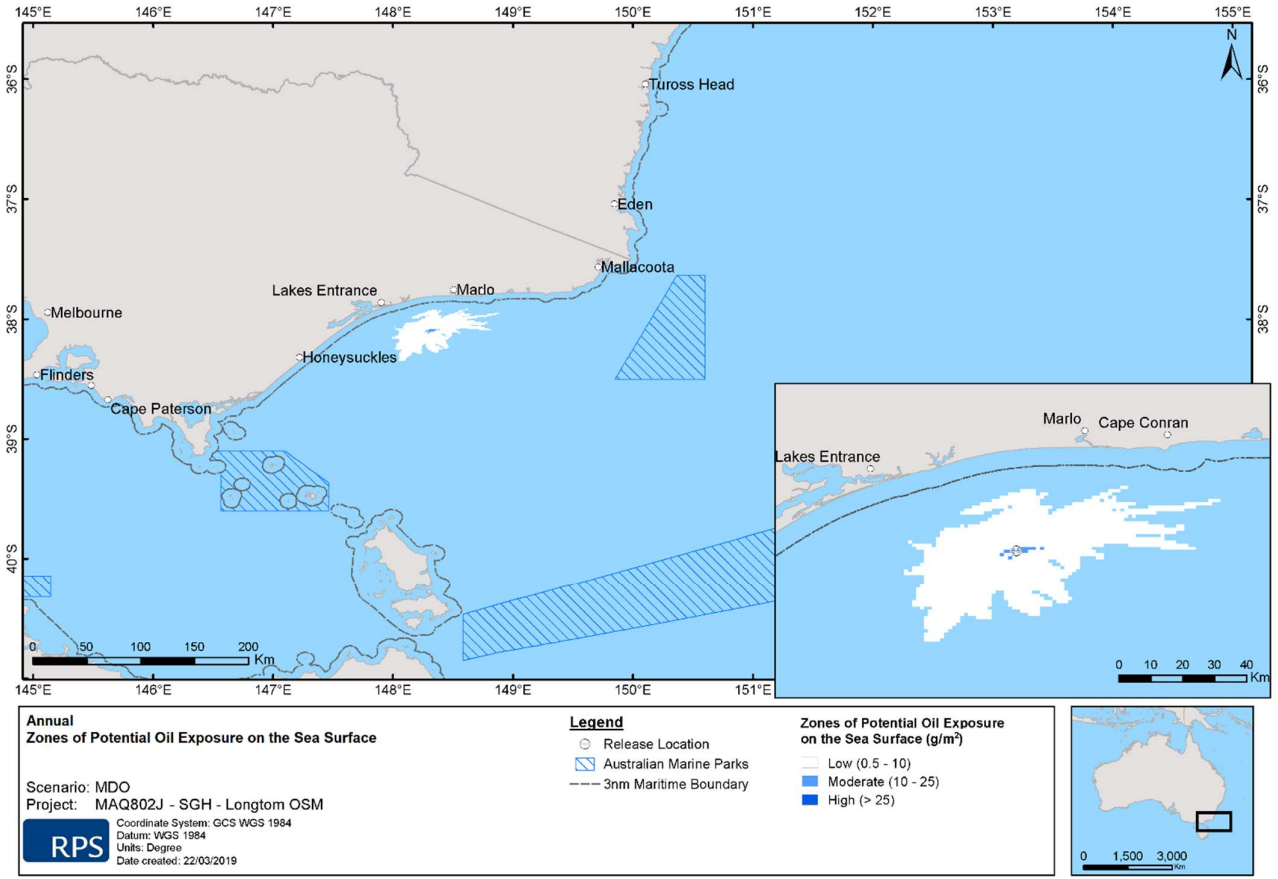


Figure 6-6 Zones of potential MDO exposure on the sea surface.

6.3.13.2 Risk Assessment

Table 6-30 outlines the risk assessment for MDO spills.

Table 6-30 MDO Spill risk assessment

Hazard duration	Temporary (duration of intervention, maintenance and Longtom-5 tie-in activities).	
Extent of hazard	EMBA is relatively widespread, however it should be noted that the predicted impact for a single spill trajectory will be far smaller.	
Basis of Inherent impact risk Assessment		
• The subsea facilities are located within the Bass Strait shipping 'Area to be Avoided' and are not close to any shipping lane thus minimising interactions with third-party vessels. • A 500-m petroleum safety exclusion zone exists around Longtom-3 and Longtom 4. • The Longtom facilities are located in approximately 57 m of water and 40 km offshore – hence running aground is not credible during Longtom activities. • Intervention and maintenance activities will be of short duration (approximately one week in every 1-3 years). • Longtom-5 tie-in activities are likely to only last for a few weeks. • Class certification and maintenance of fuel tanks. • Vessels will maintain navigation watch 24hrs per day, bridge will be manned and petroleum activities only take place during appropriate weather windows.		
Inherent impact risk analysis and ranking		
Consequence	**Likelihood**	**Inherent risk**
Moderate (3)	Unlikely (D)	Moderate
Project specific environmental controls and checks that will take place	Prevention • Vessel design, class, certification and maintenance which will be confirmed for appropriateness during pre-mobilisation audit – effectiveness considered Very High. • Vessel manned by competent, trained and experienced marine crew with appropriate qualifications, which will be confirmed during pre-mobilisation audit – effectiveness considered High. • No refuelling at Longtom – effectiveness considered High. Mitigation • SOPEP material is available on board and personnel are trained in its use – effectiveness considered Moderate. • Utilisation of the SOPEP, OPEP and ERP in the event of a spill to sea – effectiveness considered Moderate. • Source control e.g. pumping between tanks, ballasting and other vessel measures effectiveness considered moderate.	
Residual risk analysis and ranking		
Consequence	**Likelihood**	**Residual Risk**
Minor (2)	Rare (E)	Low
Demonstration of ALARP		
The key preventative control is that all vessels will be subject to a pre-mobilisation audit to confirm vessel acceptability, this will check vessel class, certification, that the systems and processes are in place and in use to prevent a diesel spill and the marine crew. In addition there will be no offshore refuelling. Mitigative controls include the vessel having a SOPEP with crew trained in its use and the SGHE Oil Pollution Emergency Plan. These controls are considered sufficiently effective, robust and independent to ensure the residual risk is Low and ALARP.		

The following ALARP analysis also confirms that all reasonable risk treatment options have been considered to reduce the environmental impact of invasive marine species, and the risk is deemed to be **ALARP**. No further reasonable mitigation measures exist. A 'Low' residual risk ranking is **broadly acceptable** according to the SGHE definition of risk.	
Eliminate	Not applicable – offshore vessels are required.
Substitute	Not applicable – offshore vessels must be powered, electric powered or wind powered vessels are not credible.
Engineering	Vessels are equipped with sophisticated navigation aids and competent marine crew, allowing them to avoid collisions with other vessels. Fuel tanks are designed to contain fuel and minimise the risk of loss of containment Fuel can also be transferred between tanks in the event of a spill from one tank.
Isolation	Tanks can be isolated from each other.
Administrative	The Longtom wells are located within safety exclusion zones and most of the Longtom facilities are within the Bass Strait Area to be Avoided. These both limit the risk of other vessels being in the vicinity.
Protective	Not applicable.
Demonstration of Acceptability	
The subsea facilities are located within the Bass Strait shipping 'Area to be Avoided' and within a 500-m petroleum safety exclusion zone, thus minimising interactions with third-party vessels. Fishing, merchant vessel traffic and other oil and gas operations currently take place in Bass Strait that could also result in a diesel leak and these are all currently accepted by the community. The oil spill modelling has indicated that there is a low likelihood of the diesel reaching shore. Given that any intervention, maintenance or tie-in vessels will be located approximately 40 km offshore, a small refuelling diesel spill or shipping accident is considered unlikely to pose a significant threat to the near-shore or coastal environment. Hydrocarbons lost in the unlikely event of a spill would consist of light hydrocarbons (diesel) that are highly evaporative. Potential impacts are likely to be short-lived, therefore this risk is considered **acceptable**.	
Monitoring	
• The availability of the vessels navigation systems will be checked daily during offshore campaigns, included as a line item on the daily report and will be recorded and included in the annual EP Compliance Report. • Monitoring of the actual spill is discussed in the OPEP.	

6.3.14 ROV discharges

There is the potential for a release of hydraulic fluid into the marine environment in the event of equipment failure or a hose rupture supplying the ROV. A limited amount of hydraulic fluid (approximately 10-20 litres) could be lost to the marine environment.

6.3.14.1 Description of Environmental Impacts

Small volumes, typically around 10-20 litres, of hydraulic fluid could be lost in the event of major equipment failure or hose damage. This could result in toxic impacts to marine fauna that are exposed to the hydraulic fluid or feed on contaminated food.

6.3.14.2 Risk Assessment

Table 6-31 outlines the risk assessment for the loss of hydraulic fluid supplying the ROV.

Table 6-31 Loss of hydraulic fluid supplying the ROV risk assessment

Hazard duration	During intervention, maintenance and tie-in activities (short-term).	
Extent of hazard	A few hundred metres down-wind/current of the ROV.	
Basis of Inherent impact risk Assessment		
ROVs are typically designed to prevent hydraulic fluid leaks, with the hoses and fittings all rated for the operating pressures to ensure their availability. The ROV hydraulic supply system would typically have a low pressure shutdown that would operate in the event of a major loss of containment shutting down the supply and limiting the volume of hydraulic fluid lost to the environment.		
Inherent impact risk analysis and ranking		
Consequence	**Likelihood**	**Inherent Risk**
Insignificant (1)	Moderate (C)	Low
Project specific environmental controls and checks that will take place	Prevention • Design including, pressure rating of hoses, hydraulic fluid is stored and supply systems / maintenance areas located within bunded areas on board the vessel – effectiveness considered High. • Pre-installation and pre-dive checks conducted – effectiveness considered Moderate. • The ROV is maintained and tested in accordance with the PMS - effectiveness considered High. Mitigation • ROV fluid to be selected / approved for use by SGHE- effectiveness considered Moderate. • Design via isolation of feed supplies in the event of a major hydraulic leak - effectiveness considered High. • SOPEP material is available on board and personnel are trained in its use – effectiveness considered Moderate.	
Residual risk analysis and ranking		
Consequence	**Likelihood**	**Residual Risk**
Insignificant (1)	Unlikely (D)	Low
Demonstration of ALARP		
The key preventative control is the design, operation and maintenance of the ROV system, these items will all be checked as part of the pre-mobilisation audit to confirm ROV acceptability. Mitigative controls include the SGHE chemical selection process, the design of the ROV system to isolate the hydraulic tanks and the vessel having a SOPEP. These controls are considered sufficiently effective, robust and independent to ensure the residual risk is Low and ALARP. The following ALARP analysis confirms that all reasonable risk treatment options have been considered to reduce the environmental impact of invasive marine species, and the risk is deemed to be **ALARP**. No further reasonable mitigation measures exist. A 'Low' residual risk ranking is **broadly acceptable** according to the SGHE definition of risk.		
Eliminate	The use of ROVs is standard practice and essential to ensure safe operations. Hydraulic fluid is required for their operation.	
Substitute	Substitution of the hydraulic fluids with a more environmentally sensitive fluid may be possible and will be examined once the ROV operator has been identified. However this may not be possible without extensive testing to ensure the ROV materials are compatible with the hydraulic fluid and hence may not be practicable.	
Engineering	The ROV system is designed to prevent hydraulic fluid leaks. The hoses and fittings are all rated for the operating pressures.	

Isolation	In the event of major equipment or hose failure, isolations will prevent continued loss of hydraulic fluid being fed from the pumps and supply system.
Administrative	The ROV will be subject to pre-dive checks to determine the status and readiness of commencing the dive, this will check for leaks. The ROV is subject to regular maintenance and inspections in accordance with the PMS.
Protective	Not applicable.
Demonstration of Acceptability	
The ROV will be inspected and maintained routinely to ensure no discharges of hydraulic fluids. The relatively small amount of hydraulic fluid that would be lost in the event of hose or equipment damage will have a minimal impact to the marine environment. ROV campaigns are regularly conducted in Bass Strait and to SGHE's understanding there have been no community concerns regarding their operation to date. Once the ROV operator has been identified, it is proposed that the ROV fluid is reviewed and approved in accordance with the SGHE' Chemical Selection Process (see Section 6.1.1.2). This risk is considered **acceptable** given that the use of ROVs is standard practice, only small volumes would be lost before isolation, and the expected low toxicity of the ROV fluid.	
Monitoring	
The operations of the ROV and its fluid levels will be checked daily during offshore campaigns, included as a line item on the daily report and will be recorded and included in the annual EP Compliance Report.	

6.3.15 Discharges during Installation of Longtom-5

6.3.15.1 Hazards

The tie-in of Longtom-5 will require an extension of the existing umbilical, through Hydraulic Flying Leads (HFLs) and the installation of pipe spools and / or a flexible pipe between the Longtom-5 wellhead and the Longtom pipeline.

The umbilical provides hydraulic fluid, MEG and methanol offshore and the Longtom-5 HFL will provide these from the existing umbilical to the new well to allow well control and chemical injection. During the tie-in some flushing may be required to ensure no ingress of sea water and during pressure testing a small amount could also be lost in the event of a leak and subsequent rectification activities. The design and installation process including valving arrangements and tie-in procedures will minimise this as far as practical.

Details of the hydraulic fluid currently used for operations is given in Section 6.1.1 and details of the MEG in Section 6.2.2.

The Longtom-5 production spools and / or the flexible flowline will be installed with either a MEG water mix or treated water. The preferred option will be to use a MEG mixture as this would then be processed via the gas plant and only minor discharges would occur during the tie-ins and in the event of leaks during testing. The design of Longtom-5 is currently underway and the installation contractor is yet to be confirmed, and whilst a MEG mixture is preferred, alternative commissioning philosophies may be required that use treated water.

If treated water is used to fill and test the Longtom-5 tie-in it is likely to be fresh water dosed with a number of chemicals to prevent corrosion, biological growth and in the event of a leak a dye to enable the leak location to be identified. If hydrotest water is used it may have to be displaced with nitrogen and discharged offshore to prevent plant upsets. The quantity of

hydrotest water that could be discharged if it was all to be flushed offshore is about $3m^3$. The following table present the chemicals, their OCNS ranking and their typical concentrations that are currently being considered. Any changes will be subject to the SGHE Chemical selection process.

Table 6-32 Longtom-5 Chemicals

	Chemical	OCNS ranking (Jan 2014)	Concentration
MEG	Nalco	E	40%
Oxygen scavenger	Champion OS2	E	200 ppm
	Nalco 7408	E	200 ppm
Biocide	Champion Bactron 1710	Gold	400 ppm
Corrosion Inhibitor	Baker CRW83133	Gold	1000 ppm
Dye	Champion Flourescein dye	Gold	Upto 1000 ppm

6.3.15.2 Known and Potential Environmental Impacts

The known and potential environmental hazards for the loss of umbilical fluids, MEG or hydrotest water from Longtom tie-in activities include:

- Highly localised and very short term temporary decrease in water quality
- Highly localised and very short term temporary impact on marine life.

6.3.15.3 Description of Environmental Impacts

Umbilical / HFLs

In the event of a Longtom-5 umbilical leak during commissioning, the amount of hydraulic fluid, MEG and methanol that would be lost would be limited to a litres before installation monitoring would identify the leak and action would be taken to stop the pumps. The risk is considered insignificant.

MEG and Hydrotest Water

Small amounts of MEG or hydrotest fluid would be lost during the installation process and these are also not expected to cause any significant environmental impact.

The worst case planned scenario is considered to be the use of hydrotest water and that this then displaced with nitrogen. In this scenario approximately $3m^3$ will be discharged offshore, probably near the sea bed. The following section examines the potential impact from the hydrotest chemicals

The oxygen scavenger is dosed to ensure the removal of oxygen from the hydrotest water and help prevent biological activity and as such it is overdosed. There will therefore still be some active oxygen scavenger during the discharge. The active ingredient, Ammonium bisulphite is on the PLONOR list (CAS Ref Number: 10192-30-0), which defines substances that are considered to pose no or little risk to the environment. Even if all the oxygen scavenger remained active at the expected dose less than 100ml would be discharged.

Ammonium bisulphite is water soluble and rapidly reacts with the dissolved oxygen in the water to provide an oxygen free environment. The ammonium is weakly bioaccumulated, but only at high concentrations. The substance does not biomagnify and exhibits very low toxicity. The reaction product of ammonium bisulphite and oxygen is ammonium sulphate, ions which are commonly present in all surface waters. Any excess or unreacted oxygen scavenger will immediately react with dissolved oxygen in the open seawaters upon release. Given the large volume of water in Bass Strait and the current conditions this is expected to have no impact.

The dye will be dosed at a low rate, Gold CHARM rating, short duration and one off nature of the activity, it is considered that the release of fluorescent dye will not have a deleterious environmental effect on the marine environment.

The biocide acts with the oxygen scavenger to control biological activity within the Longtom-5 tie-in. While it is therefore a threat to marine environment it is also consumed in a similar way to the oxygen scavenger. Small active volumes again around 100ml would be discharged if hydrotest water was used. Given the OCNS ranking, the short duration and one-off nature of hydrotest water disposal, the fact that the biocide dose is planned so that it is mostly consumed during its time of residence within the tie-in, and that the discharge will be rapidly dispersed, it is considered very unlikely that the biocide dose when released to the marine environment will cause any deleterious environmental effects.

The corrosion inhibitor is also expected to have no significant environmental impact, it is an OCNS gold rated chemical and will be consumed, break down and rapidly disperse on discharge.

The worst case unplanned scenario is one where a MEG water mix is used and a failure occurs during a pressure test. In this case around $3m^3$ of the MEG water mix would be discharged to the marine environment. The concentration of the MEG is likely to be around 40%, hence about 1.2 m^3 of MEG would actually be discharged. MEG is E rated, the likelihood of a major pressure test failure, resulting in this type of release is highly unlikely and the fact that the MEG will rapidly disperse means that there is unlikely to be any significant impact.

6.3.15.4 Risk Assessment

Table 6-33 outlines the risk assessment for the discharge of fluids during the tie-in of the Longtom-5 well.

Table 6-33 Discharges during Longtom-5 tie-in risk assessment

Hazard duration	Once off / Short term release.	
Extent of hazard	Limited to the immediate area around the release point.	
Basis of Inherent impact risk Assessment		
• The umbilical and Longtom-5 HFLs are appropriately designed and pressure tested prior to deployment offshore. • There are no known sensitive environments in the project area. • Volumes will be small, even if the entire contents of the tie-in piping are discharged this is only around 3m^3.		
Inherent impact risk analysis and ranking		
Consequence	**Likelihood**	**Inherent Risk**
Insignificant (1)	Unlikely (D)	Low

Project specific environmental controls and checks that will take place	Prevention
	• Installation engineering and procedures effectiveness considered High, this will include;
	  • Design of HFL and tie-ins to limit leaks during connection and installation
	  • Design of spools / flexible to minimise the loss during installation and to minimise the risk of a loss of containment during pressure testing
	• MEG is a category 'E' OCNS chemicals with low environmental impact effectiveness considered Moderate
	• The hydrotest chemicals are Gold and E rated chemicals and if these change will be subject to the SGHE chemical selection process effectiveness considered Moderate.
	Mitigation
	Shut down of chemical and hydraulic pumps at the gas plant and or on the installation vessel effectiveness considered Moderate.	

Residual risk analysis and ranking		
Consequence	**Likelihood**	**Residual Risk**
Insignificant (1)	Rare (E)	Low
Demonstration of ALARP		
The following ALARP analysis confirms that all reasonable risk treatment options have been considered to reduce the environmental impact of discharges during Longtom-5 installation and commissioning. The risk is deemed to be **ALARP**. There are no other feasible risk treatment options. A 'Low' residual risk ranking is **broadly acceptable** according to the SGHE definition of risk.		
Eliminate	Not applicable. Hydraulic fluid, MEG and methanol within the umbilical cannot be eliminated they are essential to operate the Longtom-5 well and the HFL has to be connected to tie-in Longtom-5. The tie-in piping has to be filled with some fluid to limit the ingress of untreated seawater. Seawater could pose a corrosion risk and could also lead to problems within the gas plant. Installation procedures and techniques will be selected where practical to eliminate the need for offshore discharges. Use of a MEG fill for the tie-in is preferred as this can be processed via the gas plant.	
Substitute	Substituting the hydraulic fluid (HW525) specifically for the tie-in is not practicable, however operationally swapping it with a higher OCNS rated chemical is currently being examined and is further addressed in section 6.1.1. The MEG and Methanol are category 'E' OCNS chemicals with low environmental impact no other chemicals are suitable.	

	The hydrotest water chemicals are category 'E' or 'Gold' chemicals with low environmental impact. Note the preferred option will be to use a MEG water mixture.
Engineering	The subsea facilities and installation will be designed and engineered to prevent loss of containment and to pass the pressure test. Engineering to determine whether to use a MEG water mixture or treated water fill and how this will be processed are underway.
Isolation	Shut down of chemical and hydraulic pumps at the gas plant and on the installation vessel. Valving arrangements will be available to isolate the Longtom-5 HFL from the rest of the Longtom facilities.
Administrative	Installation will be subject to installation procedures and these will detail chemicals, dose rates, pressure testing requirements and actions to be taken in the event of a leak and how (if necessary) the fluids are discharged.
Protective	Not applicable.
Demonstration of Acceptability	
The loss of containment of hydraulic fluid, MEG and methanol will not lead to a risk due to the very small quantities, localised nature of release and the rapid dilution of chemicals. The chemicals with the exception of HW 525 are category 'D', 'E' or 'Gold' OCNS chemicals, which are considered to have a low environmental impact. Hydraulic fluid, MEG and methanol are standard chemicals used in the control of subsea facilities and it is essential that the Longtom-5 facilities are commissioned to ensure their integrity and functionality. There have been no concerns raised regarding the discharge of hydraulic fluid, MEG or methanol during stakeholder consultation. Similar hydrotest chemicals were utilised during the initial installation of the Longtom facilities and during that campaign over 1,300m^3 were discharged when the Longtom pipeline was dewatered. This was discussed with the state regulator at the time and presented within the installation environment plan that was accepted. The volumes of fluids used are not expected to cause any environmental issues, and given the 'insignificant' consequences, this risk is considered **acceptable**.	
Monitoring	
Chemical use and discharges shall be monitored during the installation campaign.	

7 Environmental Performance Objectives, Standards and Measurement Criteria

This section presents the environmental performance objectives, environmental performance standards and measurement criteria required to manage the hazards identified for the Longtom Gas Project (operations, intervention and maintenance and tie-in of Longtom-5 phases). These terms are defined below:

- *Environmental Performance Objective* – a statement of the objectives or goals for protecting the environment relevant to the given hazard.
- *Environmental 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 the environmental risk of a given hazard.
- *Measurement Criteria* – defines how performance will be measured to determine whether the environmental performance objectives and environmental performance standards have been met.

Table 7-1 details the performance objectives, standards and measurement criteria for Longtom operations, which ensure environmental risks are managed to ALARP.

Table 7-2 details the leading performance objectives, standards and measurement criteria for SGHE preferred oil spill response strategies. In the unlikely event of a hydrocarbon or diesel spill, the detailed environmental performance objectives, standards and measurement criteria provided in the OPEP) will be used. To avoid repetition, these objectives, standards and measurement criteria have not been repeated herein.

Table 7-1 Environmental performance objectives, standards and measurement criteria

Risk Number	Hazard	Performance Objective	Performance Standard	Measurement Criteria
General				
All	Impacts to the environment from pipeline operations	The subsea facilities shall be designed and operated to prevent loss of containment and hence protect the environment.	• The subsea facilities have been, and any future modifications will be designed in line with standards and criteria contained in detail within the Longtom Pipeline Safety Case[1] and validated in accordance with the NOPSEMA scope of validation requirements. • PB Operations and maintenance shall be conducted in line with the Safety Case and APA EHS Management System including. 1. Use of company HSE standards 2. PB Personnel trained in line with the APA Training and Competency standard. 3. Compliance with procedures and work processes 4. Maintenance and testing conducted in line the Operation Integrity Standard EHSMS11 including the Asset Integrity Management System and the Integrity Management Plan. • Operations personnel are aware of the Environment Plan and its requirements	• Design Validation certificate issued by a third party and safety case accepted • Annual audit to confirm: 1. Compliance with company EHS Management system standards 2. Training records demonstrate personnel directly associated with operations and maintenance are trained, certified and experienced 3. Operations carried out in accordance with approved processes and procedures. Maintenance activities carried out under a PTW system and subject to environmental assessment. 4. Records show that pipeline integrity inspections have been undertaken and equipment maintained and tested in line with the maintenance program and CFT schedule. • Log available of audit actions, verifying the status and close out of each.

Risk Number	Hazard	Performance Objective	Performance Standard	Measurement Criteria
General				
All	Impacts to the environment from maintenance, intervention and tie-in campaigns	All offshore campaigns to be reviewed to prevent impacts to the environment.	Environmental risk assessment conducted and no risks identified greater than described within this EP	Pre campaign environmental risk assessment report.
Routine Impacts				
1	Discharge and use of chemicals (hydraulic fluid)	Lowest toxicity chemicals shall be selected for Longtom operations and maintenance purposes to prevent environmental impact.	• Chemicals will have a minimum ranking of OCNS 'D', silver or better. • The use of a chemicals not specifically described within this EP will be subject to the SGHE chemical selection process (see section 6.1.1.2) and approved by the SGHE HSEC Manager.	• Annual EP audit to confirm use in compliance; 1. An approved list of chemicals is maintained. 2. Chemicals selection sheet are used and approved (if chemicals are not specifically approved in the EP). 3. All chemicals used are covered by either 1 or 2. • All documentation associated with use and discharge of chemicals, including audits and checklists, are retained for reference.
		The volume of the hydraulic fluid used shall be monitored, to prevent unexpected losses damaging the environment.	• The number of subsea valve operations is monitored and recorded across each month and the volume of hydraulic fluid discharged is calculated. • The volume of hydraulic fluid leaking from the solenoid valve in the Longtom-4 SCM is estimated, monitored and recorded across each month to confirm the status of the leak, and actions taken when necessary to reduce the risk to an acceptable level.	• Measurements of hydraulic fluid consumption and discharges are recorded and kept in the Longtom Operations Discharge Log on at least a monthly basis during operations. • Significant unexpected loss of hydraulic fluid is reported to SGHE management and NOPSEMA as required. • Annual EP audit to check Operations Discharge Log and LT4 SCM records to ensure that they have been appropriately reported and responded to.

Risk Number	Hazard	Performance Objective	Performance Standard	Measurement Criteria
General				
2	Physical presence of offshore facilities – impact on marine fauna and seabed	Impacts to marine fauna and the seabed as a result of maintenance shall be minimised.	• Routine inspections of the subsea facilities will be undertaken to identify and rectify possible areas of impact, e.g. potential erosion/scouring. • Inspections will take place during maintenance activities to ensure no unplanned disturbance occurs during conduct of maintenance.	• Pipeline inspection report to provide details of any significant areas of erosion/scouring. • Daily reports and End of Campaign report show that no unplanned disturbance occurred.
		Unplanned disturbance to marine fauna and the seabed from Longtom activities shall be prevented through engineering design and inspection.	• The Longtom-5 flowline will be designed to be stable and the area of disturbance is minimised as far as practicable. • An ROV survey will be undertaken following the installation of the Longtom-5 flowline to ensure the flowline is built as per the engineering design and to retrieve any construction debris.	• Design validation certificate by a third party. • ROV survey report, including video footage, is available. • Records show that dropped objects have been retrieved, or their retrieval has been judged not practical and the environmental risk has been assessed as acceptable.
		Lowest toxicity chemicals shall be selected for Longtom operations and maintenance purposes to prevent environmental impact.	Refer to Routine Impact Risk #1 chemical selection	Refer to Routine Impact Risk #1 chemical selection

Risk Number	Hazard	Performance Objective	Performance Standard	Measurement Criteria
General				
3	Physical presence of offshore facilities – impact on other users	Impacts to other users shall be prevented through infrastructure layout, design and inspection.	• Longtom-5 related facilities shall be located within the existing Longtom-3 petroleum safety zone. • A survey will be undertaken following intervention and maintenance activities to retrieve any construction debris.	• As built layouts. • End of Campaign report includes final survey and records show that dropped objects have been retrieved, or their retrieval has been judged not practical and the environmental risk has been assessed as acceptable.
		Impacts to other users shall be prevented through adequate consultation.	• Consultation has taken place, as described in this EP. • Ongoing consultation will be carried out in accordance with Regulation 11(A) (Schedule 2, Division 2.2A) of the OPGGS (E) Regulations 2009 and consultation log. • All stakeholders as identified in the consultation log will be notified prior to the commencement of intervention, maintenance or tie-in activities.	• Ongoing consultation records (including records of notifications). • Consultation report issued to NOPSEMA in accordance with Regulation 16 (B) of the OPGGS (E) Regulations 2009.
		Impacts to other users shall be prevented through vessel navigation.	• Vessel navigation and communication equipment is functional and maintained in accordance with the planned maintenance system (or vessel operator's equivalent).	• Pre Mobilisation audit to confirm Navigational equipment is functional and that Vessel maintenance schedule is up to date and maintenance records are available. • Daily report includes check of navigation equipment.
Non-Routine Impacts				
4	Loss of containment of hydrocarbons – subsea	The subsea facilities shall be designed and operated to prevent the loss of containment and	• Adherence to the WOMP, including well design, shutdown systems and operating procedures.	Annual EP audit to confirm compliance with the WOMP to include: 1. Personnel trained and competent

Risk Number	Hazard	Performance Objective	Performance Standard	Measurement Criteria
General				
	equipment damage	hence protect the environment.	• Regular maintenance and inspection of the subsea facilities in accordance with the pipeline safety case and WOMP.	2. Operations carried out in accordance with approved processes and procedures, and Maintenance activities carried out under a PTW system including an environmental assessment. 3. Records show that equipment maintained and tested in line with the maintenance program and CFT schedule.
		Implement a response to a hydrocarbon spill to minimise the impacts to the marine environment.	• In the event of a hydrocarbon spill, the procedures in the OPEP[2] are followed, including: immediate actions, notifications, response actions and scientific monitoring as required. • Adherence to the ERP.	• The OPEP and ERP are readily available and their contents have been communicated to all relevant personnel. • Training records indicate personnel have appropriate competencies and training. Minimum expectations are that the Leader has IMO level 3 oil spill response training and the Planning and/or operations lead has IMO level 2 oil spill response training. This is checked quarterly. • Spills, immediate actions, response actions and post-spill monitoring are recorded and reported. The close out of a spill is verified by the SGHE Development Manager and the designated authority. • An ERP/OPEP exercise is undertaken annually.
		For a loss of well control event, the source of release is controlled as soon as possible to limit the impact to the environment.	In the event of a blowout, the well is killed or a relief well is drilled to control the source in accordance with the regulatory requirements, and as described in Section 2.1.1 of the OPEP[2] .	• Source controlled within 90 days • All key documentation regarding well containment activities are retained in company records.

Risk Number	Hazard	Performance Objective	Performance Standard	Measurement Criteria
General				
5	Loss of containment of hydraulic fluid, MEG and methanol – subsea equipment damage	Lowest toxicity chemicals shall be selected for Longtom operations and maintenance purposes to prevent environmental impact.	Refer to Routine Impact Risk #1 chemical selection	Refer to Routine Impact Risk #1 Chemical Selection.
Impacts from Vessels/ROV Operations				
All	Impacts to the environment from maintenance, intervention and tie-in campaigns	All offshore campaigns will be conducted in a manner that does not cause damage to the environment.	• Environmental risk assessment conducted and no risks identified greater than described within this EP. • Identified hazards are managed in accordance with specific standards and criteria described below. • Any spill to the environment is managed in accordance with the OPEP. • Vessel and project personnel are aware of the Environment Plan and its requirements.	• Pre campaign environmental risk assessment conducted and available. • Project induction includes information on the Environment Plan and records show all personnel have undergone the training. • All key records and documentation regarding specific hazards are retained for compliance and reference, as per further details in remainder of table 7.1.
		Vessels are selected to prevent impact to the environment.	• Pre-mobilisation audit conducted to confirm vessel acceptability and compliance with the requirements of this EP. • Pre-mobilisation audit conducted to confirm vessel manned by competent and trained marine crew (Vessel Master, First Mate and	• Pre-mobilisation audit complete and available. No significant non compliances with the EP identified.

Risk Number	Hazard	Performance Objective	Performance Standard	Measurement Criteria
General				
			Second Mate have a valid STCW qualification)	
6	Vessel collisions with marine fauna	Risk assessed to have no credible impact. Refer to further details of assessment in section 6.3.1. No performance objectives, standards or measurement criteria are required.		
7	Noise emissions	Risk assessed to have no credible impact. Refer to further details of assessment in section 6.3.2. No performance objectives, standards or measurement criteria are required.		
8	Light emissions	Risk assessed to have no credible impact. Refer to further details of assessment in section 6.3.3. No performance objectives, standards or measurement criteria are required.		
9	Atmospheric emissions	Risk assessed to have no credible impact. Refer to further details of assessment in section 6.3.4. No performance objectives, standards or measurement criteria are required.		
10	Discharge of sewage and grey water	Project vessels will manage sewage and grey water to prevent impact to the environment.	• Vessels to comply with MARPOL 73/78 Annex IV and have a valid International Sewage Pollution Prevention certificate in place. • No untreated sewage or grey water discharged overboard. • The sewage treatment plant will be maintained in accordance with the vessel's planned maintenance system.	• The International Sewage Pollution Prevention certificate is readily available, current and is checked during the pre-mobilisation audit. • Vessel's waste management practices, including the adequacy of the sewage treatment plant - checked during the pre-mobilisation audit. • Maintenance records confirm equipment is maintained in accordance with manufacturer's specifications and is checked during the pre-mobilisation audit.

Risk Number	Hazard	Performance Objective	Performance Standard	Measurement Criteria
General				
				• Daily report includes check of sewage treatment plant availability. • Pre-mobilisation audit and daily reports are retained in hardcopy and electronic files for reference.
11	Discharge of putrescible waste	There will be no discharges of unmacerated food waste during project activities to prevent impact to the environment.	• Vessels will comply with MARPOL 73/78 Annexes IV and V. • A galley macerator will be installed which shall macerate good scraps to a diameter of 25 mm prior to disposal overboard, in accordance with MARPOL standards. • Cooking oils and greases will be collected and transported back to shore for disposal. • All non-food galley waste will be transported back to shore for recycling/disposal. • The galley macerator will be maintained in accordance with the vessel's planned maintenance system.	• The vessel's compliance with MARPOL 73/78 Annexes IV and V, the waste management practices, including the adequacy of the macerator all checked during the pre-mobilisation audit. • Garbage records are available describing the type of waste disposed/collected, location and quantity. • Daily Report summarises waste transfers. • Maintenance records confirm equipment is maintained in accordance with manufacturer's specifications - confirmed during the pre-mobilisation audit. • Audit documentation and daily reports are retained in hardcopy and electronic files for reference.
12	Discharge of contaminated deck/bilge water	There will be no discharge of untreated bilge water to prevent impact to the environment.	• Vessels will comply with MARPOL 73/78 Annex I. Oil or oily mixtures will be retained on board or disposed of if in accordance with MARPOL standards (i.e., if it is less than 15 parts per million oil-in-water).	• Vessel compliance with MARPOL 73/78 Annex I is checked during the pre-mobilisation audit. • The International Oil Pollution Prevention certificate is readily available, current and valid and is checked during the pre-mobilisation audit.

Risk Number	Hazard	Performance Objective	Performance Standard	Measurement Criteria
General				
			• Fixed and mobile equipment will be maintained in accordance with the vessel's planned maintenance system.	• Maintenance records confirm equipment is maintained in accordance with manufacturer's specifications. • Daily report includes check of oily water storage / disposal system. • Audit documentation and daily reports are retained in hardcopy and electronic files for reference.
		Project vessels will have a SOPEP in place to address chemical and hydrocarbon spills on deck and avoid overboard discharges to prevent impact to the environment.	• Vessels will have an approved SOPEP in place. Scupper plugs will be readily available, and any spills will be cleaned up immediately. • Vessel crew trained in SOPEP and SOPEP exercises conducted • Hydrocarbon and chemical storage areas will be bunded and chemicals will be stored in chemical storage lockers.	• The SOPEP, vessel's waste management practices, including the availability of SOPEP kits/scupper plugs and the adequacy of the bunded areas will be checked during the pre-mobilisation audit. • Training records confirm crew have appropriate competencies and training and SOPEP exercise records will be checked during the pre-mobilisation audit. • Audit documentation and daily reports are retained in hardcopy and electronic files for reference.
13 & 14	Discharge of non-hazardous waste	Project vessels will not discharge solid waste to sea to prevent impact to the environment.	• Vessels to comply with MARPOL 73/78 Annex V and have a valid International Convention for the Prevention of Pollution from Ships Certificate. • Vessels to implement a Waste Management Plan. • An ROV survey undertaken to check for, and retrieve, dropped objects following a construction campaign.	• The International Convention for the Prevention of Pollution from Ships certificate is readily available, current and valid and checked during the pre-mobilisation audit. • The Waste Management Plan is readily available and its contents have been communicated to crew, confirmed during the pre-mobilisation audit. • Garbage records are available verifying that there are no discharges of waste to sea (other than food wastes). The records also detail the types and volumes of waste taken ashore.

Risk Number	Hazard	Performance Objective	Performance Standard	Measurement Criteria
General				
				• Daily Report summarises waste transfers. • The end of campaign report to include results of the ROV survey. Records show that dropped objects have been retrieved, where practical. • Audit documentation, waste management plan and associated records and daily reports are retained for reference.
15	Discharge of cooling water	Risk assessed to have no credible impact. Refer to further details of assessment in section 6.3.10. No performance objectives, standards or measurement criteria are required.		
16	Discharge of desalination brine water	Risk assessed to have no credible impact. Refer to further details of assessment in section 6.3.11. No performance objectives, standards or measurement criteria are required.		
17	Introduction of invasive marine species	Project vessels will comply with ballast and biofouling requirements to reduce the risk of invasive marine species introduction causing damage to the environment.	• Vessels to have been assessed using the SGH IMS RA procedure and the risk is Low.	• IMS RA available and demonstrates that the vessel presents a Low level of risk
18	Vessel diesel spill	Vessel and vessel equipment is operated and maintained to a standard that prevents	• Vessel navigation and communication equipment is functional and maintained in accordance with the planned maintenance system (or vessel operator's equivalent).	• A pre-mobilisation vessel audit to confirm compliance, specifically the vessel's anti collision protocols and whether SOPEP kits are available and adequate.

Risk Number	Hazard	Performance Objective	Performance Standard	Measurement Criteria
General				
		spill causing a damage to the environment.	• Vessel storage tanks functional and maintained in accordance with the planned maintenance system (or vessel operator's equivalent) • Maintenance, intervention and tie-in campaigns will be subject to risk assessment and controls will be implemented to manage the identified risks.	• Vessel maintenance schedule and up to date maintenance records are available and is checked during the pre-mobilisation audit. • Daily Report includes diesel volumes. • Audit documentation, logs and daily reports are retained for reference.
		For a loss of diesel, the source of release is controlled as soon as possible to minimise the scale of the spill and the impact on the environment	• In the event of a diesel spill the vessels ERP/SOPEP is implemented • Where possible diesel is transferred between tanks to minimise spill and the vessels ballast is also adjusted to minimise / control the source of the spill.	• Source controlled within 24 hours • All key documentation regarding spill response activities are retained in company records.
		Implement a response to a diesel spill to minimise the impacts to the marine environment.	• In the event of a diesel spill, the procedures in the SOPEP and OPEP[2] are followed, including: immediate actions, notifications, response actions and scientific monitoring as required. • Adherence to the ERP.	• The vessel SOPEP, OPEP and an ERP are readily available and their contents have been communicated to crew. • Pre-mobilisation audit to confirm crew have appropriate competencies and training. • Project specific training provided and confirmed via training records. • A campaign specific ERP/OPEP exercise is undertaken. • Audit documentation, ERP/OPEP exercise records and daily reports are retained for reference.

Risk Number	Hazard	Performance Objective	Performance Standard	Measurement Criteria
General				
19	ROV discharges	ROV activities to not discharge hydraulic fluid into the marine environment.	• The ROV is designed to prevent hydraulic fluid leaks, with the hoses and fittings all rated for the operating pressures. • Compliance with maintenance and operating procedures, as they relate to ROV equipment, hose management and isolation/shutdown systems. • ROV maintenance area, Hydraulic fluid and supply systems are arranged to prevent leaks to the environment, i.e. bunded.	• Records/certificates show that ROV has been appropriately designed and is confirmed as part of pre-mobilisation audit. • Maintenance records indicate ROV and hoses are maintained in accordance with their planned maintenance system and is confirmed as part of pre-mobilisation audit • Adequacy of ROV maintenance area, Hydraulic fluid and supply systems, confirmed as part of pre-mobilisation audit. • Training records confirm crew have appropriate competencies and training, confirmed as part of pre-mobilisation audit • Pre-dive checklists completed and confirmed as part of pre-mobilisation audit. • Audit documentation and associated records are retained for reference.
		Lowest toxicity chemicals shall be selected for Longtom maintenance purposes to prevent environmental impact.	Refer to Routine Impact Risk #1 chemical selection	Refer to Routine Impact Risk #1 chemical selection

Notes:

1. The Longtom Pipeline Safety Case must demonstrate that the safety risks are managed to ALARP and must include performance standards. A large number of these safety performance standards, particularly those for preventative controls also provide control against potential environmental risks. For example, the controls in place to prevent a vessel collision or pipeline failure will protect personnel and will also protect the environment. In addition, the Safety Case requires a third party validation of safety related items. Listing all these individual controls separately in the table is not considered appropriate.
2. The OPEP and the NEBA provide additional performance objectives, standards and measurement criteria in the event of a spill to ensure that the risk to the environment is managed to ALARP.

Table 7-2 Leading environmental performance objectives, standards and measurement criteria for the OPEP preferred response strategies

Response Strategy	Objective	Standards	Measurement Criteria
Monitoring	Operational and scientific monitoring program (OSMP) specific to the Longtom Gas Project available.	Longtom Gas Project OSMP is consistent with: • NOPSEMA IP1073 - Information paper - Operational Scientific Monitoring Programs- Revision 2 - March 2016 • AMSA Oil Spill Monitoring Handbook 2016.	• Annual EP Audit includes check of OSMP and availability of service providers
Aerial surveillance	Aerial surveillance is deployed to monitor a spill and facilitate effective operational response to protect sensitive environments.	• Current contact details for AMOSC (for trained aerial observers) and local aviation service providers are included in Longtom Production Operations ERP Contacts directory. • Aerial surveillance is deployed within the next daylight shift after a spill greater than 10m^3 is detected.	• At least an annual review of Longtom Production Operations ERP Contacts directory and check that AMOSC have trained aerial observers. • Records of aerial surveillance demonstrate that aerial surveillance was commenced with the next daylight shift after the spill was detected and information regarding slick movement is available to OSRT.
Satellite monitoring	Satellite tracking buoys are deployed for significant spills within an appropriate timeframe to facilitate effective operational response to protect sensitive environments.	• Satellite buoys are available for deployment. • Satellite buoys are deployed within 24 hours for spills greater than 10m^3.	• Annual review of AMOSC equipment includes check of satellite buoys to support spill response for SGHE. • Records demonstrate that satellite buoys were deployed within 24 hours of the initial detection of a spill and information regarding slick/plume movement is available to OSRT.
Oil spill trajectory prediction	Trajectory of slick estimated via modelling to guide the selection of appropriate spill response strategies for minimising the impact	• Key project personnel are familiar with spill trajectory estimation techniques.	• Annual OPEP exercise includes requirement to estimate spill trajectory.

Response Strategy	Objective	Standards	Measurement Criteria
	on the environment and protection of sensitive areas.	• Arrangements are in place for initiating spill trajectory modelling. • Trajectory modelling is produced within 12 hours of a spill greater than 10m^3.	• SGHE membership of AMOSC which provides for access to APASA for oil spill trajectory modelling. • Contract between AMOSC and APASA is checked as part of the annual review of AMOSC capabilities. • Production of trajectory model and information regarding slick/plume movement is available to OSRT and is documented as part of oil spill response, with records maintained.
Deflection and recovery	Booms are available for deployment to protect sensitive environments such as inlets and estuaries identified in the OPEP.	• 500 m of suitable deflection booms are available for deployment in the event of a spill. • Equipment can be relocated and available for deployment in East Gippsland within 24 hours.	• Annual review of AMOSC equipment, resources and timing for deployment to East Gippsland, with documentation of this confirmation to be maintained.
	Deflection booms and recovery equipment are relocated and deployed in East Gippsland within an appropriate timeframe to facilitate effective operational response to protect sensitive environments.	• Deflection booms and recovery equipment are deployed within 24 hours where defendable estuaries or shorelines are threatened by slick movement.	• Threatened defendable estuaries or shorelines are protected within 24 hours of request initiated. • Records of communications and logistics regarding boom deployment is retained as part of the oil spill response documentation.

8 Implementation Strategy

8.1 Aim

This section describes the implementation strategy for the EP, specifically detailing the measures required to ensure the environmental performance objectives and environmental performance standards are met. The broad environmental objectives of the Longtom Gas Project are to:

- Achieve and demonstrate best practice environmental management of any aspect of the operations that may have an impact on the environment.
- Minimise and manage the damage where an impact is unavoidable.

The SGHE' HSEC Policy serves as the key environmental management document for the project (Attachment 3). This policy guides the development and implementation of all other management system components. SGHE retains full and ultimate responsibility as the titleholder.

The following table presents a summary of the implementation strategy against the typical the "Plan, Do, Check, Review and Improve" requirements of a successful plan.

Table 8-1 Plan, Do, Check and Review Requirements

Stage	What we do	Who	Where described
Plan	Maintain an accepted EP	SGHE Development Manager or above	This document
	Maintain an OPEP and ERP	SGHE Development Manager or above	EP Section 8.9 and refer to OPEP
	Develop Project Execution Plans, conduct HAZIDs and Risk Assessments	SGHE Project Manager	SGHE Hazard and Risk Assessment Protocol CORP-HSE-027, and activity specific PEP's and RA's etc are filed in company records.
Do	Execute our Operations in line with our EP and Longtom safety case	SGHE Development Manager and all personnel working on Longtom.	This document and Longtom Pipeline Safety Case – Operations 05-HSEQ-GEN-PL-13
	Conduct Training in the EP	SGHE HSEC Manager	EP Section 8.4. Training records (incl attendance sheets) maintained in company records.
	Conduct ERP and OPEP training, drills / exercises	SGHE HSEC Manager	EP Section 7 Table 7.1, Section 8.9, and refer to OPEP. Training records (incl attendance sheets) maintained in company records.

Stage	What we do	Who	Where described
	Review acceptability of vessels and contractors	SGHE HSEC Manager	HSEC Category Assessments for Contracts CORP-HSE-021, and EP Section 7 Table 7.1.
	Conduct induction training for projects	SGHE HSEC Manager	EP Section 7 Table 7.1, and training records (incl attendance sheets) maintained in company records.
	Report reportable and recordable incidents.	SGHE Development Manager or above	EP Table 8.2
	Monitor discharges and other items as identified within the risk assessments.	SGHE HSEC Manager	EP Section 8.7
	Report to Regulator annually on the performance of the EP. Report reportable and recordable incidents.	SGHE Development Manager or above	EP Table 8.2
	Consult with identified stakeholders prior to major activities	SGHE HSEC Manager	EP Section 4, 8.10 and Attachment 4.
Check	Routine monitoring and reporting of compliance with Performance Objectives, standards and criteria	SGHE HSEC Manager	EP section 8.6
	Review changes to procedures, equipment and chemicals	SGHE Development Manager or above	EP Section 8.5, SGHE HSEC Management Standard 6 for Management of Change (MOC), SGHE MOC procedure and APA/Cooper MOC where relevant.
	Vessel inspections and checks during campaigns	SGHE Offshore Representative	EP Section 7 Table 7.1 and 8.7
	Daily reports during campaigns	SGHE Offshore Representative	EP Section 7 Table 7.1 and 8.7
	Quarterly check of ERP / OPEP contacts and phone numbers	SGHE HSEC Manager	EP Section 8.9
Review and Improve	Review EP Risk and ALARP Assessment annually	SGHE HSEC Manager	EP Section 8.8
	Lesson Learnt workshop conducted for Offshore campaigns	SGHE Projects Manager	EP Section 8.8
	Conduct annual EP compliance audits	SGHE HSEC Manager	EP Section 8.8

Stage	What we do	Who	Where described
	Conduct annual ERP / OPEP Exercise	SGHE HSEC Manager	EP Section 8.9 and OPEP
	Reporting and investigation of incidents and non conformances	SGHE HSEC Manager	SGHE Incident Management Procedure CORP-HSE-003

8.2 SGHE HSEC Management System

SGHE has a set of HSEC Management Standards that provide a systematic and consistent approach for the management of project and operational activities. This approach aims to achieve the following outcomes:

- Planned, systematic, verifiable and continually improving approach to achieving HSEC policies, plans, objectives and targets.
- Hazards are identified and controlled.
- Assets owned or managed by SGHE are designed and operated to accepted internal and external HSEC standards.

Each manager is responsible for ensuring full compliance within their area of responsibility and control and will be held accountable for the successful implementation of these standards. During operations a self-assessment against the HSEC Management Standards is undertaken each year by the SGHE HSEC Manager.

The SGHE HSEC Management Standards consist of 15 standards, each of which is supported by several procedures or protocols:

1. Policy, Leadership and Commitment.
2. Organisation, Responsibility and Resources.
3. Planning, Objectives and Targets.
4. Regulatory Requirements and Document Control.
5. Competence, Training and Behaviours.
6. Risk and Change Management.
7. Projects, Facility Design, Construction and Commissioning.
8. Operations and Maintenance.
9. Incident Management.
10. Contractors, Suppliers and Partners.
11. Performance Measurement, Reporting and Communication.

12. Crisis and Emergency Management.
13. Health and Fitness for Work.
14. Audits, Inspections and Reviews.
15. Community.

The HSEC Management Standards are the means by which the SGHE HSEC Policy is implemented. The hierarchy of the HSEC Management System is presented in Figure 8-1.

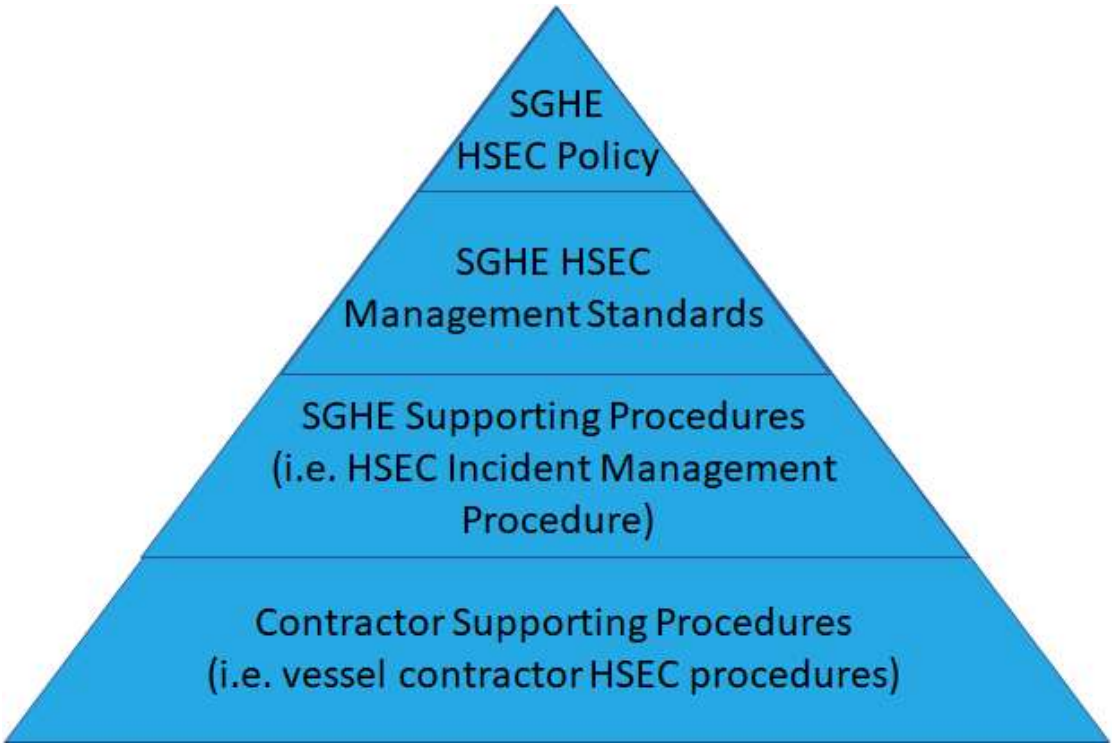


Figure 8-1 SGHE HSEC Management Hierarchy

APA as the operators of the PB gas plant also have an EHS management system, this is described in detail within the Longtom Safety Case.

8.3 Roles and Responsibilities

All SGHE and contractor personnel are required to comply with the Environment Plan and all relevant conditions of approval. Key environmental roles and responsibilities, and therefore chain-of-command, are identified in Table 8-2.

SGHE is responsible for ensuring that the project is managed in an environmentally responsible manner and in accordance with all regulatory requirements.

Table 8-2 Environmental Roles and Responsibilities

Role	Responsibilities
SGHE Development Manager	• Responsible for overall operation of the field. • Responsible for reporting to authorities (e.g., NOPSEMA). • Responsible for meeting regulatory requirements, including the Environment Plan. • Ensures compliance with the Nexus HSEC Policy. • Ensures all required plans, audits and reviews are undertaken in accordance with the regulatory requirements and as required by this EP.
SGHE Project Manager	• Responsible for the management of offshore campaigns including Longtom-5. • Responsible for ensuring offshore campaigns meet the regulatory requirements, including the Environment Plan. • Ensures campaigns comply with the SGHE HSEC Policy. • Ensures all campaign required plans, audits and reviews are undertaken in accordance with the regulatory requirements and as required by this EP.
SGHE HSEC Manager	• Coordinates the preparation of the environmental approvals documentation. • Ensures all personnel are inducted and are aware if their environmental responsibilities. Ensures overall compliance with the EP. • Responsible for coordinating emergency response preparedness. • Ensures maintenance, intervention and tie-in campaigns are subject to risk assessment and controls will be implemented to manage the identified risks. • Conducts (or delegates) a pre-mobilisation audit and annual EP compliance audits. • Reports environmental incidents to the SGHE Development Manager. • Ensures environmental incidents are reported to statutory authorities (see Section 8.6). • Ensures changes are assessed and approved by SGHE, in accordance with Section 8.5. • Ensures incident investigations are conducted. • Ensures corrective actions from environmental audits and incidents are completed. • Prepares and submits monthly reports to NOPSEMA.
SGHE Offshore Representative (when applicable)	• Responsible offshore for day to day conduct of the project. • Responsible for checking that the contractor implements all relevant environmental requirements (including inductions and training). • Responsible for reporting results of environmental matters to the SGHE HSEC Manager and Project Manager.

Role	Responsibilities
	• Responsible for monitoring the performance/compliance of the Offshore Longtom-5 Installation Contractor with regards to the requirements of the EP and all conditions of approval. • Conducts HSE inductions for crew arriving on the vessels. • Attends daily meetings, reviews JSAs and ensures general adherence to vessel specific procedures and project specific procedures, including the WOMP, OPEP, ERP and Safety Case. Undertakes periodic HSE inspections to check for compliance with EP commitments. • Reports on vessel performance to the SGHE HSEC • Collates whale sightings and forwards on to the Nexus HSEC Manager • Liaises closely with the SGHE HSEC Manager on performance and incidents. • Ensures training requirements are fully implemented.
Vessel Masters and/or Plant Superintendent	• Responsible for the safe operation of the vessel / site. • Overall responsibility for HSE management. • Implements and ensures adherence to all relevant environmental legislative requirements, commitments, conditions and procedures on-board the vessel. • In the event that the Offshore Representative or SGHE HSEC Manager is not available, reports reportable incidents to NOPSEMA within 2 hours of an incident occurring. • Communicates hazards and risks to the workforce and the importance or following good work practices. • Maintains the site / vessel in a state of preparedness for emergency response. • Reports environmental incidents within the 500-m radius safety zone to the SGHE Offshore Representative. • Reports environmental incidents to the SGHE Offshore Representative and the SGHE HSEC Manager when they occur outside the 500-m safety radius safety zone but within the SGHE permit area. • Applies appropriate enforcement mechanisms to prevent breaches of the EP.
SGHE CEO	• Ensures sufficient resources are available to implement the SGHE HSEC Policy and environmental commitments. • Ensures all incidents are investigated and reported in line with the SGHE HSEC Policy.
All vessel personnel	• Adhere to this EP. • Follow good housekeeping procedures and work practices. • Encourage improvement wherever possible. • Report incidents to the SGHE Offshore Representative and Vessel Masters.

8.4 Competence, Training and Awareness

The SGHE HSEC Management Standard No. 5 (Competence, Training and Behaviours) defines the training and competency expectations for SGHE staff and contractors. APA as

the operators of the PB gas plant also have an EHS management standard for training and competency (EHSMS06). This defines the training and competency requirements and supporting management system to ensure employees, contractors and visitors to the gas plant have the necessary knowledge and skills to enable them to conduct their activities:

- safely
- in an environmentally responsible manner; and
- without damaging plant and equipment.

Following acceptance of the EP in 2014, Nexus worked with Santos to include a specific requirement for all PB gas plant operators to attend an EP induction training session. This session highlighted the specific requirements of the EP on PB operations, defined what constituted an incident and the subsequent actions to be taken in the event of an incident. Prior to restart this training will be re-provided to PB operations personnel and other parties involves in managing any Longtom production.

In the event of an offshore campaign SGHE ensures compliance with the EP requirements by way of pre-mobilisation audits, induction training, regular HSE meetings and checks and by having SGHE representation offshore. This will ensure each crew member is aware of their responsibilities and have the necessary skills to complete the required tasks and meet project objectives and targets.

Each contracting party involved with the project is required to have its own matrix that defines required skills, competencies and organisational compliance levels.

The vessel pre-mobilisation induction training aims to ensure personnel are aware of their roles and responsibilities in ensuring compliance with the EP and minimal impact to the environment during project activities. The information presented at the induction will include:

- An overview of the EP and its key commitments.
- Regulatory and procedural requirements.
- The SGHE and vessel environmental policies.
- Environmental sensitivities of the area.
- Environmental management procedures (e.g., waste management).
- Emergency and oil spill response procedures.
- Observation and notification procedures in the event of detrimental effects to marine flora or fauna.
- Recording and reporting of information to SGHE and the regulators.

All personnel are required to sign an attendance sheet to confirm their participation in, and understanding of, the pre-mobilisation induction.

8.5 Management of Change

The SGHE HSEC Management Standard No. 6 (Risk and Change Management) defines how SGHE manage change. The SGH MOC procedure (CORP-PM-PR-0001) and associated forms (CORP-PM-FO-0001) provide further guidance on how change is managed. The standard and procedure ensures that when changes are made to the project, to control systems, to an organisational structure or to personnel, the HSE risks and other impacts of such changes are identified and appropriately managed.

A risk assessment is undertaken which considers the impact of the proposed change on the project's environmental risks and on the environmental performance objectives (Section 7).

In the event that the proposed change introduces a significant new environmental impact or risk or results in a significant increase to an existing risk, this EP will be revised for resubmission.

Where the proposed change can be managed such that environmental performance objectives are met, this will be documented without the requirement for a formal revision to this EP. In the event that the proposed change results in non-compliance with a performance objective, this EP will be revised for resubmission.

All changes to the onshore facilities and their operation should also be controlled and managed under the Onshore Gas Plants MOC system. The SGHE audit / inspections of the gas plant operator will confirm that change is appropriately managed.

8.6 Incident Recording and Reporting

SGHE has an Incident Management Procedure (CORP-HSE-003) that details the actions to be undertaken in the event of a safety or environmental incident, with all incidents reported to the SGHE Development Manager.

During an offshore campaign all environmental incidents will be reported in the first instance to the SGHE Offshore Representative, who will then report to the SGHE HSEC Manager and the SGHE Development Manager.

The SGHE Development Manager and the SGHE HSEC Manager will determine whether the incident is a reportable or recordable incident and notify NOPSEMA accordingly. If these personnel are unavailable the SGHE Offshore Representative will notify NOPSEMA. If the reporting requirement is in doubt the SGHE recommendation is to report the incident.

On the vessels, the Vessel Master is responsible for maintaining an onsite copy of internal records and reports, which are filed using standard office protocols.

8.6.1 Management of EP Non-conformance

All breaches of this EP will be treated as non-compliances. Breaches may be identified during an audit or as a consequence of an incident.

All non-compliance issues must be communicated immediately to the Offshore Representative during an offshore campaign and to the SGHE Development Manager and SGHE HSEC Manager. This expectation is reinforced at inductions and regularly throughout the project. All non-compliance incidents will be investigated as per the SGHE HSEC Management Standard No. 9 (Incident Management). Following an investigation, remedial actions are developed to prevent recurrence and tracked to completion.

Significant non-compliances are communicated to the offshore crew during standard forums such as daily tool-box talks, pre-tour meetings, and weekly safety meetings on board the respective vessels. Non-conformances will be reported as per Section 8.6.2.

8.6.2 Incident Recording and Reporting

The processes for recording and reporting recordable and reportable environmental incidents to external authorities in line with the OPGGS (E) Regulations 2009 are described in Table 8-3. Figure 8-2 provides an illustration of reporting requirements.

Table 8-3 Routine and incident reporting requirements

Requirements	Timing
Routine Reporting	
Submit an EP Compliance Report to NOPSEMA annually during the life of the project. The EP Compliance Report will include the results of performance reviews, audits, any incidents, and details of any intervention and maintenance activities.	Submit an annual report by April 15th to NOPSEMA for the previous calendar year during the life of the project.
Recordable Incident Reporting	
Legislative Definition: *"for an operator of an activity, means an incident arising from the activity that:* *(a) breaches a performance objective or standard in the Environment Plan that applies to the activity; and* *(b) is not a reportable incident."*	Submit NOPSEMA Recordable Environmental Incident Monthly Report to NOPSEMA by 15th of every month if there has been an incident in that month. A nil incident report will not be submitted.
Reportable Incident Notification	
Legislative Definition: *'for an operator of an activity, means an incident relating to an activity that has caused, or has the potential to cause, moderate to significant environmental damage.'*	Report verbally (or by email if phone contact is not possible) to NOPSEMA within 2 hours or as soon as practicable. Include summary in a monthly report to NOPSEMA by 15th of following month. Ph: (08)6461 7090 Email: submissions@nopsema.gov.au
Incidents classified as reportable using the equivalent SGHE risk assessment process (i.e., having a potential consequence rating of 'moderate (3)', 'major (4)' or 'catastrophic (5)') are: • A well blowout. • The introduction of invasive marine species. • A vessel diesel spill. • Hydraulic fluid release of 500 litres / day or greater than 50000 litres in a month	

Requirements	Timing
The verbal notification must include the following information: • The incident and all material facts and circumstances concerning the incident that is known at the time. • Any actions taken to avoid or mitigate any adverse environmental impacts. • Any corrective actions that have been taken, or may be taken, to prevent a repeat of similar incidents occurring. • In addition, oil spills must be reported immediately to AMSA. • Any spills that could impact State waters should be reported to the Victorian DEDJTR State Duty Officer.	**Oil spill only (within 1 hr)** to **AMSA**: Ph: 1800 641 792 Email: mdo@amsa.gov.au Any emergency notifications to also go to the DEDJTR SDO with contact details as 0409 858 715 and sccvic.sdo.dedjtr@scc.vic.gov.au Any incident notifications including POLREPS and SITREPS should also go to the semdincidentroom@ecodev.vic.gov.au
Reportable Incident Reporting	
The initial notification to NOPSEMA must be followed up by a written report. As a minimum, the written incident report will include: • The incident and all material facts and circumstances concerning the incident. • Root cause analysis. • Actions taken to avoid or mitigate any adverse environmental impacts. • Any corrective actions that have been taken, or may be taken, to prevent a recurrence of the incident. • Completion date. The written incident report must also be provided to NOPSEMA, the National Offshore Petroleum Titles Authority (NOPTA) and the Victorian DEDJTR State Duty Officer. If the initial notification of the reportable incident was only verbal, any information that was not included in the verbal notification must be included in the written report.	As soon as practicable, and not later than 3 days following the incident Email (NOPSEMA): submissions@nopsema.gov.au Email (NOPTA): info@nopta.gov.au

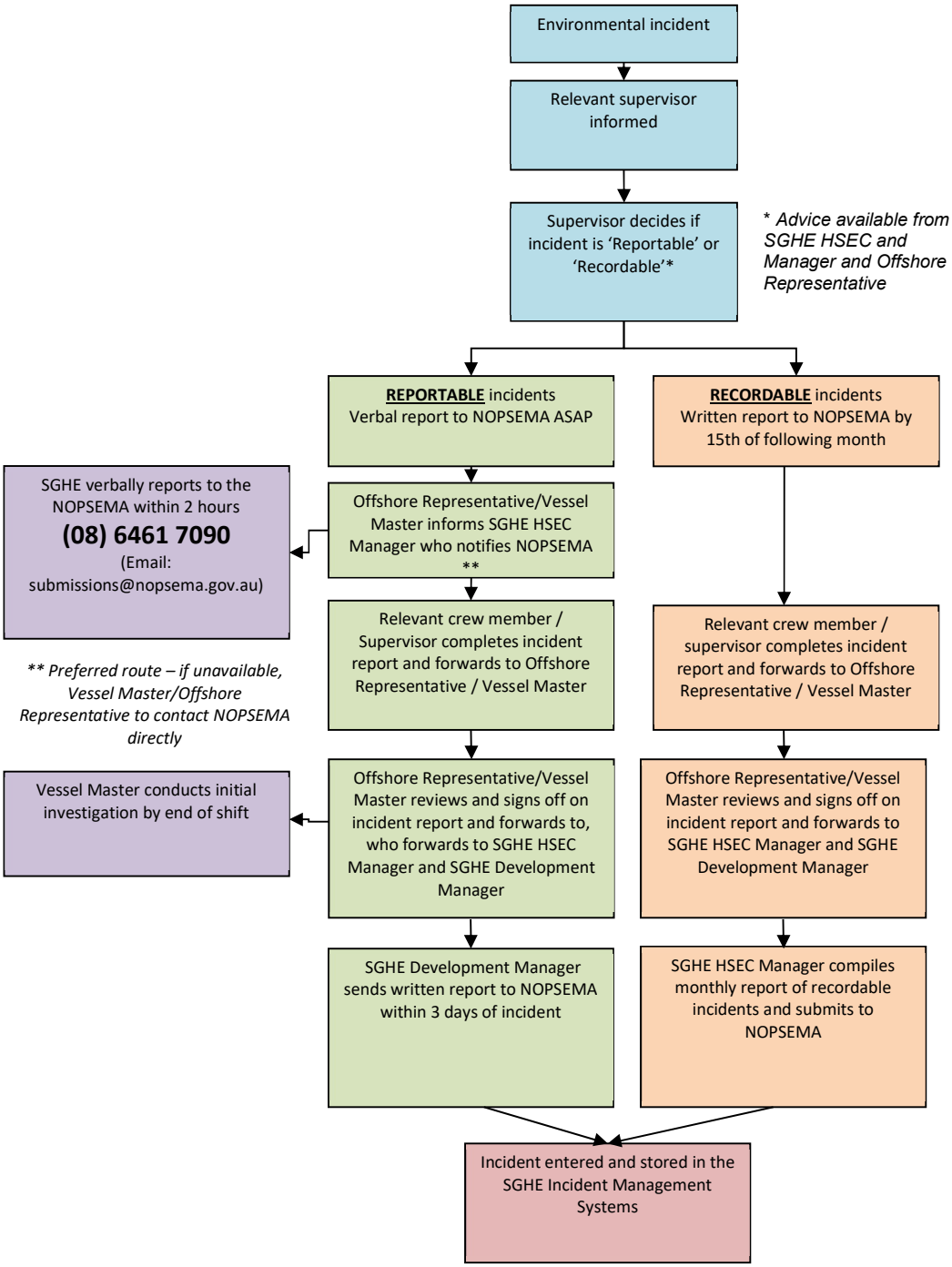


Figure 8-2 Summary of incident reporting and recording requirements

8.7 Monitoring

The SGHE HSEC Management Standard No. 11 (Performance Measurement, Reporting and Communication) guides how monitoring is to be undertaken and reported.

A summary of the environmental monitoring requirements provided in Chapter 6 is outlined in Table 8-4. Results of this monitoring will be included in the annual EP Compliance Reports, and included in monthly recordable incident reports as necessary (e.g., where a breach of EP commitments, objectives, standards or measurement criteria has been identified).

Table 8-4 Environmental monitoring and reporting summary

Aspect	Monitoring	Frequency	Reporting
Various	Process parameters (pressure, temperature, flow)	Continuous	• Incident reports and non compliances contained in monthly report to NOPSEMA. • Results included in Annual EP Compliance Report.
Various	Critical Function Testing of SCSSV, tree valves and HIPPS.	As required by the Pipeline Integrity Management Plan	• Incident reports and non compliances contained in monthly report to NOPSEMA. • Results included in Annual EP Compliance Report.
Operational discharge of hydraulic fluid	Volumetric monitoring of the hydraulic fluid used and discharged.	Monthly.	• Results included in Annual EP Compliance Report.
Impacts on other stakeholders	Stakeholder issues and complaints	Annual and prior to any offshore campaign	• Results included in Annual EP Compliance Report.
Following Condensate spill	Inspection of subsea facilities.	As required following spill event.	• Inspection Report. • Incident reports and non compliances contained in monthly report to NOPSEMA. • Results included in Annual EP Compliance Report.
	Visual observations from any crew members.	Continuous following spill event.	• Incident reports and monthly report to NOPSEMA. • Results included in Annual EP Compliance Report.

Aspect	Monitoring	Frequency	Reporting
	Post-spill monitoring.	Following the spill.	• As per the NEBA and the Operational and Scientific Monitoring Program (OSMP).
Discharge of hydraulic fluid, MEG and methanol	Volumetric monitoring of the hydraulic fluid used and discharged.	Monitored by the gas plant continuosly, Routinely monitored by SGHE and recorded monthly or following a spill.	• Incident reports and non compliances contained in monthly report to NOPSEMA. • Results included in Annual EP Compliance Report.
Cetaceans	Visual observations from any crew members	At all times during maintenance, intervention and tie-in activities.	• Cetacean sighting forms completed and sent to SGHE HSEC Manager.
Sewage/ Putrescible waste discharges	Availability of the sewage treatment plant and macerator.	Daily check during maintenance, intervention and tie-in activities.	• Daily Report • Incident reports and non compliances contained in monthly report to NOPSEMA. • Results included in Annual EP Compliance Report.
Deck/oily water discharges	Availability of the of the oil-in-water analyzer.	Daily check during maintenance, intervention and tie-in activities.	• Daily Report • Incident reports and non compliances contained in monthly report to NOPSEMA. • Results included in Annual EP Compliance Report.
Non-hazardous and hazardous waste discharges	Volumetric monitoring of various waste streams. Waste manifest maintained by Vessel	During maintenance, intervention and tie-in activities.	• Daily Report • Recorded in waste manifest. • Incident reports and non compliances contained in monthly report to NOPSEMA. • Results included in Annual EP Compliance Report.
Various	Availability of vessels navigation equipment.	Daily check during maintenance, intervention and tie-in activities.	• Daily Report • Incident reports and non compliances contained in monthly report to NOPSEMA. • Results included in Annual EP Compliance Report.
Vessel diesel spill	Visual observations from	Continuous following spill event.	• Incident reports and non compliances contained in monthly report to NOPSEMA.

Aspect	Monitoring	Frequency	Reporting
	any crew members.		• Results included in Annual EP Compliance Report.
	Post-spill monitoring.	Following spill event.	• As per the OPEP, NEBA and the OSMP
ROV discharges	Inspection of ROV systems.	During maintenance, intervention and tie-in activities.	• Daily Report • Incident reports and non compliances contained in monthly report to NOPSEMA. • Results included in Annual EP Compliance Report.

In addition to the above monitoring and reporting requirements for NOPSEMA the following items will be reported to the Victorian DEDJTR State Duty Officer by SGHE as soon as practical.

- A spill or non-routine discharge of hydrocarbons or chemicals that creates a sheen visible to other stakeholders on the ocean and likely to have impact on state waters, which includes the simple fact of entering state waters or creating media interest. Visibility is the key issue here, not the size of the spill (eg. litre limit).
- The death or injury of any fauna species such as fish (en masse), seals or cetaceans occurring during any operation (whether caused by that operation or not).
- Excessive flaring, planned or otherwise, that increases the environmental impact of the individual activity, is highly visible and distinguishable from routine flaring.
- Acrimonious interaction with other ocean users, such as fishers (recreational or commercial), shipping, recreational vessels etc.
- Collision with other ocean users, including between SGH' contracted (or otherwise) activity vessels or machinery, fishers, shipping, recreational vessels etc.
- Well blow out or other significant well integrity mishap during exploration or production.
- Occupational accident causing the significant injury or death of any person(s).
- Loss of equipment that poses a risk to other ocean users or that may wash up on a beach at any time in the future (past examples include ROVs or part thereof, CSEM/seismic receivers or sources).
- Any issue that is likely to receive wide coverage in the media, either positive or negative.
- Any activity that is likely to have shore-based impact, whether through support activities or through provision of essential services.
- A pipeline leak that is considered a recordable incident that is likely to be ongoing for any period over 4 weeks (until repaired or stopped).

- Any interruptions to oil, condensate or gas supplies, planned or otherwise, that are critical to normal societal functioning.
- Any significant company related changes that may be notable to our Minister, such as the appointment of new Corporate Officers in Australia.
- Any changes to officer level contacts for EP matters.

8.8 Auditing and Review

The SGHE HSEC Management Standard No. 14 (Audits, Inspections and Reviews) guides how audits and review are to be undertaken and reported.

8.8.1 Formal Audit

SGHE will arrange for pre-mobilisation and annual EP compliance audits. Audit findings will be recorded and communicated to affected parties. Corrective actions will be tracked to closure.

The findings and recommendations of the audit will be documented and distributed to relevant personnel for review. It is almost certain that an audit is likely to result in recommendations for improvement opportunities and, occasionally, breaches of EP commitments may be identified. Any non-compliances are noted and communicated immediately to the SGHE HSEC and Manager, as well as being documented in the audit report, where applicable these will be communicated to NOPSEMA.

Non-compliances identified during a vessel audit will be communicated to the offshore crew during daily pre-tour meetings before each shift and at weekly safety meetings on board the vessel.

The EP compliance audit results will be included in the annual EP Compliance Report submitted to NOPSEMA.

8.8.2 Routine Inspections

On a day-to-day basis, relevant SGHE and offshore contractor personnel will undertake inspections of operations and equipment to ensure EP commitments are being met. For example, the SGHE Offshore Representative will continually review the environment compliance and conformance as part of their routine activities, this will be supplemented by the use of formal HSE checklists to ensure compliance with the EP.

Non-compliances identified during routine inspections are communicated to the offshore crew during daily pre-tour meetings before each shift and at weekly safety meetings on board the vessels.

8.8.3 Reviews

While everyone is responsible for complying with the EP, the SGHE HSEC Manager specifically reviews compliance with the EP as part of their general activities. In the event of a non compliance an incident report is generated in line with the SGHE Incident Management Procedure and this will then be reported in line with section 8.6.

Projects and offshore campaigns will be subject to a lessons learnt review at the end of the campaign to identify what went well and what could be improved.

A review of the Environmental risks and ALARP assessment will be conducted annually by the SGHE Development Manager and SGHE HSEC Manager to ensure the hazards continue to be managed to an acceptable level.

8.9 Emergency Preparedness and Response

SGHE has a Crisis Management Plan (including a Longtom asset specific Emergency Response Plan (ERP)) and an OPEP (see also Section 8.9.1) in place for this activity.

The details of the emergency response team structure, roles and responsibilities and emergency contacts are described in both the CMP and OPEP. Performance objectives, standards and measurement criteria for a spill response are outlined in the OPEP.

The CMP and OPEP will be subject to an annual test or exercise involving an outside company such as AMOSC. This exercise shall test the ability of SGHE to adequately respond to an incident and shall test the knowledge of the key personnel with the OPEP and its requirements. Additional tests shall be conducted in the event of a significant change to the OPEP, i.e. before Longtom-5 is installed and in conjunction with the drill rig – Note drilling of Longtom-5 is subject to a separate EP. The CMP and OPEP will also be formally checked on a quarterly basis to ensure contacts and phone numbers are still valid.

8.9.1 Hydrocarbon Release Contingency Planning

An OPEP has been developed for the project. The OPEP is a live document and is regularly updated, as required.

The OPEP contains the following information:

- Oil spill response priorities.
- Integration with other plans and regulations.
- Responsibilities of SGHE and contractor personnel.
- Tiered response arrangements.
- Reporting requirements.

- Incident control.
- Spill monitoring.
- Response strategies – offshore and onshore.
- Waste management.
- Training requirements.

Hydrocarbon spill response strategies are focused on sensitive environmental resources within the EMBA, as outlined in the NEBA section of the OPEP.

8.9.1.1 Hydrocarbon Release Monitoring

SGHE has in place an Operational and Scientific Monitoring Program (OSMP) that could be deployed in the event of a spill, to advise on the monitoring activities that would be conducted in the event of a spill.

The OSMP is applicable for the life of the project and details the systems, practices and procedures to be used to carry out post-spill environmental monitoring. Roles, responsibilities and arrangements for implementation of the OSMP are also defined.

8.10 Consultation in relation to Implementation Strategy

Regulation 14 (9) of the OPGGS (E) Regulations also defines a requirement for consultation in relation to the implementation strategy.

The Longtom Gas Project implementation strategy is executed primarily by SGHE. The actions which are expected of third parties, and that will be the subject of ongoing consultation, are:

- AMOSC: Provision of suitably experienced observers to assist in aerial surveillance following a spill. Provision of additional resources to support a significant oil spill response. These resources will be identified through the AMOSPlan Mutual Aid Contacts.
- AMSA: Division of responsibilities for spills (Statutory Agency and Combat Agency), as defined in the National Plan.
- DOT: Division of responsibilities (Combat Agency) and coordination of spill response strategies within 3 nm (state waters).

Each of the parties described above have been consulted, will continue to be consulted, and have confirmed their agreement with the defined actions.

In addition, SGHE will consult with relevant authorities of the Commonwealth, the Victorian State and other interested parties as detailed in the consultation section of the EP and the

log in Attachment 3. Specifically stakeholders will be notified and consulted with prior to drilling Longtom-5 any other major offshore campaigns and annually to confirm details.

SGHE (formerly Nexus) has undertaken extensive consultation with stakeholders in relation to the Longtom Gas Project, as described in Section 3. Consultation with stakeholders is ongoing (see Section 3.5) and will continue to develop as required throughout the life of the project. Stakeholders are able to contact SGHE directly through the SGHE HSEC Manager, whose contact details appear on all outgoing consultation correspondence.

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ATTACHMENTS

1 - EPBC Search for EMBA
2 - Stakeholder Consultation Summary
3 - Oil Pollution Emergency Plan