BMG Well Abandonment (Phase 1)

Environment Plan Summary

CONTROLLED DOCUMENT

BMG-EN-EMP-0004 / REV 0

Table of Contents

List of Figures

List of Tables

Document Control

Ownership of this document remains within the Cooper Energy Pty Ltd Drilling and Completions department. Any updates, technical and /or errata, and the subsequent re-distribution of this document remains the responsibility of its author.

Document Revision and Amendment

Rev	Date	Details	Author	Reviewer	Approver
A	12/06/18	Issued for Internal review	C Jerinic / A Fertch	J Earnshaw	I MacDougall

Distribution List

Copy No.	Recipient
1	General Manager Operations – Cooper Energy
2	HSEC Manager – Cooper Energy
3	Drilling HSEC Coordinator – Cooper Energy
4	Incident Operations Centre – Cooper Energy
5	Well Construction Manager – Cooper Energy
6	
7	

Approvals

This Environment Plan Summary has been approved by Cooper Energy Pty Ltd

Name	Signature	Date
Iain MacDougall General Manager Operations Cooper Energy Limited		15 June 2018

1 Introduction

Cooper Energy Limited (Cooper Energy) is the titleholder of Petroleum Retention Leases VIC/RL13 (Basker Field), VIC/RL 14 (Manta Field) and VIC/RL 15 (Gummy Field) in the Gippsland Basin and are located approximately 55 km southeast of the Orbost Gas Plant on the Victorian coast (Figure 1-1). These permits shall be referred to as BMG within this document.

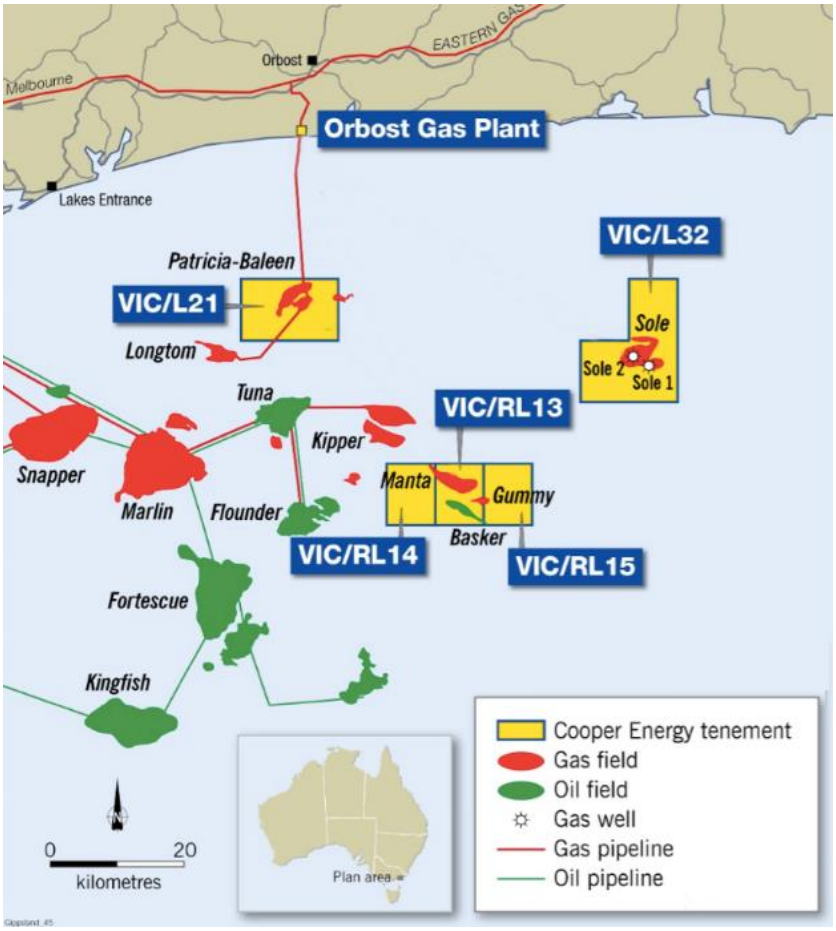


Figure 1-1 Location of VIC/RL13, VIC/RL14 and VIC/RL15

Cooper Energy intends to abandon the existing BMG infrastructure. This will be undertaken in two phases:

- Phase 1 – Plug and abandon the existing Basker and Manta wells (covered under the Environment Plan);
- Phase 2 – Installation support vessel (ISV) decommissioning of seabed infrastructure (activity will be the subject of separate Environment Plan). Phase 2 will commence within 7 years of Phase 1.

1.1 Titleholder Details

VIC/RL13, VIC/RL 14 and VIC/RL titleholder's nominated liaison person is:

Ian MacDougal (General Manager Operations), Cooper Energy Limited

Address: Level 8, 70 Franklin Street, Adelaide, SA, 5000

Phone: (08) 8100 4900

Email: iainm@cooperenergy.com.au

2 Location of the Activity

2.1 Overview

2.1.1 Location

The BMG wells and remaining infrastructure, located in the Retention Leases VIC/RL13 and VIC/RL 14 are situated in the Commonwealth waters of Bass Strait, approximately 55 km from the Victorian Coast (Cape Conran) and 15 km east of the Flounder oil and gas field (Figure 1-1). This Lease covers an area of approximately 67 km^2 with water depths ranging from 135m to 350m (Anzon, 2005).

The coordinates for the BMG wells and manifold are provided in Table 2-1.

Table 2-1 BMG Well and Manifold Coordinates (Surface Locations) (GDA94)

Locations	Longitude (E)	Latitude (S)	Water Depth (m)
Basker-2 Well (B2)	148º 42’ 24.72”	38º 17’ 58.51”	155
Basker-3 Well (B3)	148º 42’ 24.94”	38º 17’ 58.97”	155
Basker-4 Well (B4)	148º 42’ 23.57”	38º 17’ 58.87”	155
Basker-5 Well (B5)	148º 42’ 23.80”	38º 17’ 59.31”	155
Basker-6 Well (B6)	148° 43' 54.70''	38° 19' 17.54''	263
Basker-7 Well (B7)	148° 42' 22.31”	38° 17' 58.79”	155
Manta-2A Well (M2A)	148º 42’ 58.03”	38° 16’ 39.41”	135
Basker-A Manifold (BAM)	148° 42' 24.32”	38° 17' 58.74”	155

2.1.2 Operational Area

The “operational area” for the activities is the area where well abandonment-related activities will take place and will be managed under the EP. This operational area includes:

- A 500 m designated petroleum safety zone (PSZ) around the MODU to manage vessel movements
- An area out to 2 km from the MODU within which anchoring activities will be undertaken (Section 3.2.1)

The transit of the MODU and support vessels is outside the scope of the Plan. These activities are managed under the Commonwealth *Navigation Act 2012*.

2.1.3 Removal of infrastructure

Cooper Energy will remove all remaining infrastructure associated with the BMG field within 7 years of the completion of Phase 1 activities.

2.2 BMG Hydrocarbon System Overview

The BMG field comprises seven subsea wells, flowlines and umbilicals. The wells are split between three locations:

- Basker-A Wells (Basker-2, Basker-3, Basker-4, Basker-5, Basker-7; 15 to 20 m apart)
- Manta-2A Well (2.5 km north of Basker-A group)
- Basker-6ST1 Well (3.3 km south east of Basker-A group)

Table 2-2: Basker Crude Physical Properties (Intertek, 2008)

Fluid Physical Property	Value
API Gravity (ºAPI)	41.8
Specific Gravity (60ºF)	0.8167
Asphaltenes (%mass)	0.1
Kinematic Viscosity @ 40ºC (cSt)	3.467
Kinematic Viscosity @ 50ºC (cSt)	2.717
Pour Point (ºC)	30
Wax Content (% mass)	27.7

3 Description of the Activity

3.1 Timing of Activity

Activities covered under the plan are anticipated to commence Q2/Q3 of 2018 and finish in Q3 or Q4 2018. During this period, any of the activities described in the plan may be undertaken, with normal operations conducted 24-hours a day.

The total expected duration for the BMG well abandonment program is approximately 80 days.

3.2 Reservoir suspension, flowline disconnection and tree removal

3.2.1 MODU Positioning

The MODU engaged to complete this work is the semi-submersible *Ocean Monarch*. The MODU will be towed to location where it is then moored prior to commencing activities. Eight anchors will be required, with each having a footprint of approximately 30 m^2.

Each anchor is located within 2km of the MODU, connected to the MODU via wire and chain. The final mooring analysis will determine the anchor distance from the MODU, and requirements for chain and wire.

3.2.2 Remove Tree Cap from the SST

Before removal of the tree cap, an ROV is deployed and the cap mechanically treated to remove marine growth by jetting pressured seawater from the ROV, or scrubbing the outside of the cap. Chemicals, typically Sulfamic Acid (or equivalent such as Citric Acid), may be used to assist clean-up for removing limescale.

A tool is deployed from the MODU to remove the tree cap from the SSTs and retrieve it to surface. A small amount of trapped gas (~ 1 L) may be present which would be released to the subsea environment during the removal of the tree cap.

3.2.3 Install Pressure Control Equipment

A light intervention pressure control package (or Subsea Intervention Device [SID]) is installed on the top of the SST. The SID is equipped with 3 blowout preventers (BOPs) and a sealing gate valve. Less than 100L of control fluid is discharged if activating all functions in the SID.

Returns are routed via hoses to surface pressure control equipment and well test package, where gas is flared. If the flow of gas is not sufficient to sustain the flare, the gas will be vented.

Each time different equipment is run in/out of the SID, a small volume (in the order of a few litres) of well fluids (e.g. kill weight fluid) is discharged into the environment.

Some valves on the BAM and SSTs are hydraulically actuated, and when operated, will result in a discharge of control fluid (~ 30 L/well).

3.2.4 Bullhead the well

During bullheading operations, tubing content (formation fluid) will be pushed back into the formation and the tubing content replaced with a kill weight brine (e.g. sodium chloride based) of adequate density to control formation pressure. For the well abandonments, kill weight brine may be used for:

- Well kill operations (via bull-heading); and
- Circulating the production tubing and annulus to clean fluid.

3.2.5 Isolate the reservoir (deep set slick line plug)

Once the well is killed, a deep-set plug is to be installed at the level of the production packer via slickline operations.

Another option that may be used (depending on various engineering and integrity considerations) is that cement will be bull headed to the perforation zone. Discharges

associated with the cementing operation include 3 m^3 of cement-contaminated sea-water discharged (from the MODU) per cementing operation (from clean-up of cement unit and blending tanks).

3.2.6 Cut / Perforate production tubing

The production tubing and control lines will be cut or perforated. Any fluid will be discharged overboard after treatment to <30 mg/l OIW (approximate volume 570 bbl (92m^3). If practical the fluid may be bullheaded/reinjected into the reservoir at the next well instead of treatment and discharge.

All gas will be returned to the MODU and flared via a burner boom; where the flow of gas is not sufficient to sustain the flare, it will be vented.

3.2.7 Install cement plug above top packer

The cement plug will be installed above the top production packer. On the wells with deep control lines (most of the wells), the plug will act as a well suspension barrier. On the Manta-2a (the well without deep control lines) the cement plug will act as a permanent abandonment barrier.

During this activity, approximately 3 m^3 of cement-contaminated sea-water will also be discharged (from the MODU) per cementing operation (from clean-up of cement unit and blending tanks.

Upon completion of this activity for both types of wells, the well control barriers Cooper plan to have in place are:

- On the annulus side: production packer, cement plug on annulus side of tubing; kill weight brine; tubing hanger with back pressure valve
- Inside tubing: deep set slick plug; cement plug inside tubing; kill weight brine

3.2.8 Remove pressure control equipment from SST

Once the suspension of the reservoir has been completed, and prior to removal of the SID package, the SID package is flushed with seawater, disconnected from the SST and moved to another well (or pulled to surface).

Upon disconnection, there may be some incidental losses of seawater and residual hydrate inhibition chemicals such as MEG that may be used during this activity of approximately 20L per SID removal.

3.2.9 Disconnect flow lines

An ROV will disconnect the associated flow lines from SSTs, and lay the flowlines down on the seabed for subsequent removal as part of Phase 2 abandonment activities. It is anticipated that the flowlines will remain un-capped at the SST-end, and so their contents may dissipate into the ocean over time.

The PS B6 flowline which will be capped following disconnection to minimise the potential for diesel to enter the marine environment.

3.2.10 Remove SST

Once all necessary barriers are in place, the SST will be disconnected from the wellhead and recovered to the MODU. In the event an SST cannot be retrieved, it may be wet-stored on the seabed until Phase 2 abandonment activities.

It is anticipated that approximately 250 L of brine will be released per SST removal.

3.3 Plug and abandonment of the BMG Wells

3.3.1 Install and pressure test BOP

Once the SST has been removed, the Blowout Preventer (BOP) is installed (latched) onto the wellhead to provide a means for sealing, controlling and monitoring the well during

abandonment operations. After installation, the BOPs are function tested weekly, and pressure tested every 14 days.

The operation of the MODU BOPs is via an electro-hydraulic control system. Each time the BOP is operated (including testing) a small volume of hydraulic fluid is discharged to the marine environment (~ 3100 L of diluted control fluid: Transaqua HT2 or similar).

3.3.2 Remove tubing and control lines

Tubing and control lines will be cut with a wireline tubing cutter above the deep-set cement plug. The tubing hanger, tubing and control lines will then be recovered to the MODU for onshore disposal.

Control line fluids (approximately 0.25m^3 per well) are expected to be released and mix with well fluids (brine) as they are recovered through the well. Subsequent discharges of brine (e.g. during cementing operations) may contain these control fluids. For the purposes of assessment, it is assumed that remnant control line fluids (~ 5 -10 L only) will be discharged at the surface and likely to be comingled and discharges with the MODU bilge.

3.3.3 Mill out section of well casing (contingency activity only)

Engineering assessments indicate that milling will not be required; however, If determined that milling is required, a swarf handling unit will be sourced and installed on the MODU. Approximately 4,200 kg of metal cuttings (swarf) may be created but will be retained on the MODU for disposal onshore.

Milling operations would be undertaken with water-based drilling muds (WBM) down hole of suitable density and viscosity to allow circulation of metal swarf to the surface (MODU). The metal shavings and any residual WBM on the shavings after they go through the swarf recovery process, will be sent ashore for treatment (disposal). Recovered WBM will be circulated until it is no longer needed, at which point it will be discharged overboard (per normal drilling practice).

For each well where contingency milling operations are required, these activities will result in the intermittent release of approximately 100 bbl (16 m^3) of WBM during milling operations. A final discharge of up to 200 bbl (~32 m^3) of WBM may be released (worst case scenario) after all milling operations for the campaign are complete.

3.3.4 Install permanent reservoir barrier (wells with deep control lines)

This step is not applicable to Manta-2a as the cement plug installed above the production packer will act as a permanent reservoir barrier.

After removing the tubing with control lines, a cementing stinger is run in to the hole on drill pipe to the desired depth. There is anticipated to be ~ 3 m^3 of cement-contaminated sea-water discharged (from the MODU) per cementing operation (from clean-up of cement unit and blending tanks); and also, approximately 8 m^3 of cement contaminated brine circulated out of the well and discharged.

The discharge of batches of mixed cement to surface waters may be required in the event of equipment (e.g. cement unit) failure. The cement discharge would be in the order of 60bbl (10m^3).

3.3.5 Perforate the well casing

The production casing is to be perforated in two locations using a perforating tool. Once perforated, existing fluids within the annular space will be displaced to fresh brine, recovered to the MODU and discharged to the marine environment after verifying that fluid condition is acceptable for disposal. This fluid differs depending on the specific well, but includes a mixture of PHPA mud, potassium chloride and polymer mud, and is expected to be ~ 28 m^3 per well.

3.3.6 Set surface plug

Prior to the removal of the BOP a surface cement plug in excess of 30 m will be installed in the innermost casing below the wellhead. There is anticipated to be approximately 3 m^3 (20 bbl) of cement-contaminated sea-water discharged from the MODU (surface discharge) per cementing operation (from clean-up of cement unit and blending tanks).

3.3.7 Remove BOP stack

Prior to disconnecting the BOP stack from the wellhead, the BOP stack will be flushed with seawater. The BOP stack will then be disconnected from the wellhead and recovered to the MODU, or moved to another well.

3.3.8 Conduct ROV survey

Upon completion of these activities, the ROV is deployed from the MODU to conduct a post operation survey. This survey records the condition of the seabed at the completion of the program to ensure that no equipment intended for removal remain on the seabed. This involves a 50 m radius visual check and 100 m sonar inspection from each wellhead location.

If any subsea equipment is wet-parked (stored on the seabed), the ROV survey will also record the geographic coordinates of each piece of equipment.

3.4 Support Operations

The MODU will be supported by two or three vessels, used to tow the MODU, for anchor handling, the supply of provisions, materials and equipment to the MODU and removal of wastes to shore. One vessel will remain on standby and in attendance to the MODU throughout the work program. The transit of the MODU and support vessels outside this area is outside the scope of this EP; these activities are managed under the Commonwealth Navigation Act 2012.

The operation of the MODU and vessels will result in a variety of planned emissions and discharges to the marine environment, such as cooling water and brine, treated bilge, sewage and food waste, and ballast water. Cements are transported as dry bulk to the MODU by support vessels and pneumatically blown to the MODU storage tanks using compressed air.

Most of the abandonment operation will utilise a closed mud circulating system. At the end of abandonment operation, any left-over fluid will be disposal at the well location. Potentially 300 bbls of brine will be disposed on location at the end of the Project.

Personnel will access the Ocean Monarch by helicopter, which is expected to operate out of Tooradin airfield. Flights to the MODU are expected 5-7 days each week. Helicopter operations within the operational area are limited to landing and take-off on the helideck of the MODU.

A remotely operated vehicle (ROV) system will be used during the activities. The ROV is deployed from the MODU/support vessel and can be fitted with various tools and camera systems which can be used to capture imagery of the environment and operations.

The ROV will be used to assist in the running of the well control equipment and umbilicals from the MODU to the subsea infrastructure as well as valve manipulations on the subsea infrastructure.

4 Description of the Environment

4.1 Regional Setting

The BMG assets are located within the South-east Marine Bioregion, on the boundary of the Twofold Shelf (meso-scale IMCRA region), approximately 55 km south of Marlo, and 80 km southwest of Point Hicks in Victoria.

The continental slope is relatively narrow at the Victoria/New South Wales border, and becomes broader and shallower in the southern area of the Gippsland Basin (Barton *et al.*, 2012). The Gippsland Basin consists of rocky-substrate habitat, submarine canyons, and escarpments.

The Bass Canyon is an east-southeast trending funnel-shaped submarine canyon approximately 60 km long and 10–15 km wide at its mouth. The canyon is incised to a depth of >2,000 m and is bounded in the north and south by steep bedrock walls 1,000 m in height. The main canyon floor, in water depths of >4,000 m, is connected to the continental shelf by three large, deeply-incised tributary canyons and numerous smaller valleys (NOO, 2002) and is recognised for having important biological productivity (including significant fisheries) and unique oceanography (Commonwealth of Australia, 2003).

Cold water upwellings are associated with the narrow continental shelf; these upwellings are part of the Upwelling East of Eden Key Ecological Feature (KEF). Wave energy in this bioregion is relatively low. Water temperatures are also generally warmer than elsewhere on the Victorian open coast due to the influence of the East Australian Current.

The coast is dominated by dunes and sandy shorelines, with occasional rock outcrops; and there are extensive areas of inshore and offshore soft sediments habitat (Barton *et al.*, 2012). This region also has occasional low-relief reef immediately beyond the surf zone. The fauna is characterised by distinctive assemblages of reef fish, echinoderms, gastropods and bivalves; this bioregion is notable for the presence of species that also occur along the southern New South Wales coast but not in central or western Victorian waters (IMCRA, 1998).

The VIC/RL13 and VIC/RL 14 leases are located on the mid-outer continental shelf and upper slopes of the Bass Canyon; with the majority of the BMG assets (~135–200 m water depth) on the mid-outer continental shelf north of the Bass Canyon shelf break. The seabed of the area is very slightly undulating (gradients <2°) and smooth. Basker-6 infrastructure lies over the Bass Canyon shelf break on the canyon's upper slopes (~263 m water depth). The Basker-6 flowline (located between the BAM and Basker-6 wellhead) crosses the upper levels of the Bass Canyon scarp (decreasing from ~155–216 m water depth).

There have been no seabed anomalies identified in the area from geophysical surveys (Fugro, 2007). The seabed at and around the BMG wellheads is featureless with the seabed comprised of silty sand. The underlying geological structure is dipping and slightly irregular, grading from silty fine sand at the seabed to over consolidated sandy, silty clay at 10 m below seabed. Seabed sediments along the scarp face comprise predominantly clayey, silty fine sand, and have a relatively high gravel, cobble and shell fragment content. The flowline route also crosses a narrow zone of what has been interpreted as variably cemented silty sand and gravel, which corresponds with the area of steepest gradient along the scarp edge.

4.2 Environment that may be affected

The environment that may be affected (EMBA) is based on the maximum credible hydrocarbon spill event that might occur during petroleum activities. For the activities under the EP, the EMBA is based on hydrocarbon exposures above the impact thresholds for the accidental release of marine diesel oil (MDO) from a vessel collision and the release of crude oil from a loss of well control (LOWC) event. Based on stochastic modelling results (RPS, 2017), the EMBA covers waters from Victoria and Tasmania, through to south-eastern Queensland (Figure 4-1). This EMBA falls within six environment sectors (Bass Strait, Gippsland, Southeast Tasmania, Central NSW, Lord Howe, and Southeast Queensland) described in the Description of the Environment Document (COE-EN-EMP-0001).

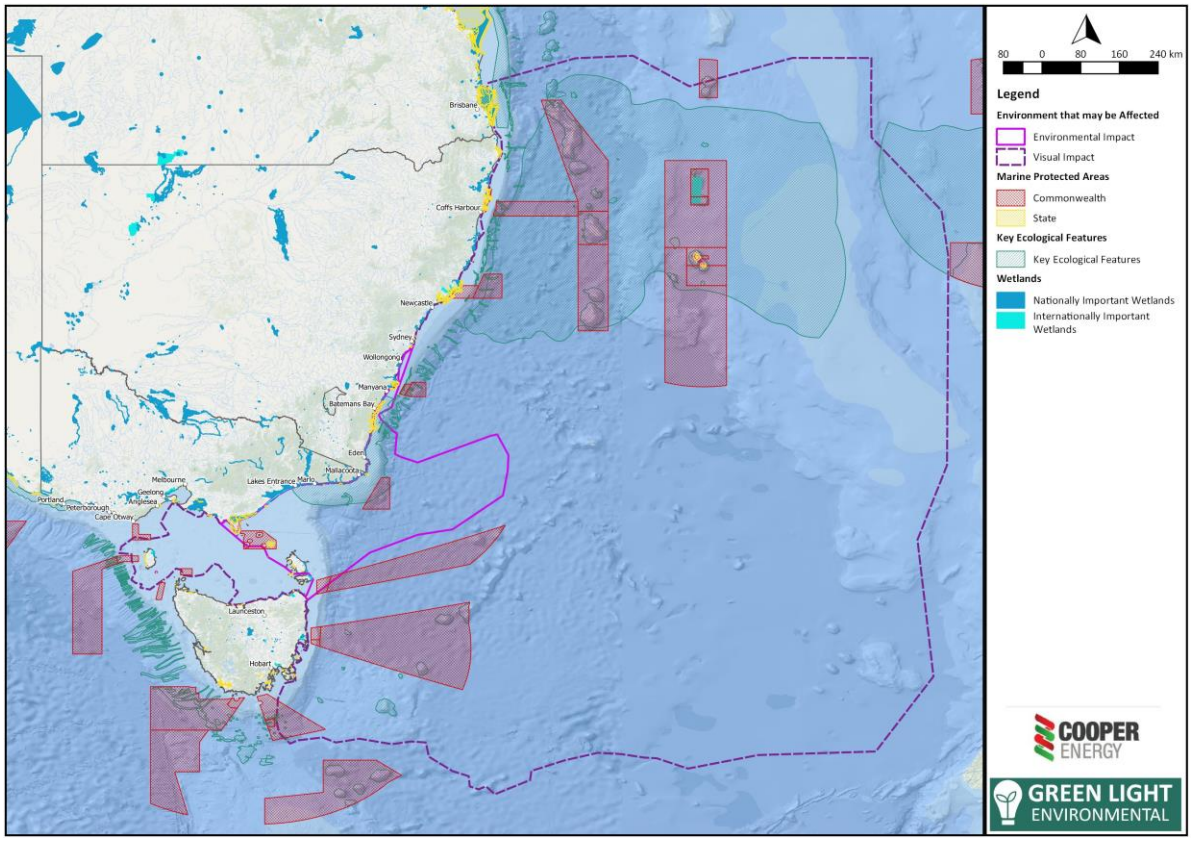


Figure 4-1 BMG Well Abandonment – EMBA with Environmental Features

4.3 Ecological and Social Receptors

The following tables show the presence of ecological (Table 4-1) and social (Table 4-2) receptors that may occur within the operational area and EMBA. Further descriptions and maps of these ecological and social receptors are provided in the Description of the Environment Document (COE-EN-EMP-0001).

Examples of values and sensitivities associated with each of the ecological or social receptors have been included in the tables. These values and sensitivities have been identified based on:

- Presence of listed threatened or migratory species, or threatened ecological communities;
- Presence of BIAs;
- Presence of important behaviours (e.g. foraging, roosting or breeding) by fauna, including those identified in the EPBC Protected Matter searches;
- Provides an important link to other receptors (e.g. nursery habitat, food source, commercial species); or
- Provides an important human benefit (e.g. community engagement, economic benefit).

Table 4-1 Presence of ecological receptors within the Operational Area and the EMBA

Receptor Group	Receptor Type	Receptor Description	Values and Sensitivities	Operational Area1		EMBA2	
Habitat	Shoreline	Cliff	Foraging habitat (e.g. birds) Nesting or Breeding habitat (e.g. birds)	–	Not present.	✓	The coastal environment throughout southern and eastern Australia is varied, and includes areas of cliffs (e.g. offshore islands within Bass Strait), rocky features (e.g. central NSW), and sandy beaches (e.g. Ninety Mile Beach, East Gippsland). Each of these shoreline types has the potential to support different flora and fauna assemblage due to the different physical factors (e.g. waves, tides, light etc.) influencing the habitat; for example: Australian fur-seals are also known to use rocky shores for haul-out and/breeding; Birds species may use sandy, rocky or cliff areas for roosting and breeding sites; Marine turtles use sandy beaches for nesting; Cliff and rocky coasts can provide a hard substrate for sessile invertebrate species (e.g. barnacles, sponges etc) to attach to; Mangroves and saltmarsh assemblages are typically associated with tidal flats; and Artificial structures (e.g. groynes, jetties) while built for other purposes (e.g. shoreline protection, recreational activities) can also provide a hard substrate for sessile invertebrates to attach to.
		Rocky	Foraging habitat (e.g. birds) Nesting or Breeding habitat (e.g. birds, pinnipeds) Haul-out sites (e.g. pinnipeds)	–		✓	
		Gravel/Cobble	Foraging habitat (e.g. birds) Nesting or Breeding habitat (e.g. birds, pinnipeds) Haul-out sites (e.g. pinnipeds)	–		✓	
		Sandy	Foraging habitat (e.g. birds) Nesting or Breeding habitat (e.g. birds, pinnipeds, turtles) Haul-out sites (e.g. pinnipeds)	–		✓	
		Muddy	Foraging habitat (e.g. birds)	–		✓	

Receptor Group	Receptor Type	Receptor Description	Values and Sensitivities	Operational Area1		EMBA2	
		Tidal flat	Foraging habitat (e.g. birds)	–		✓	
		Artificial structure	Community engagement Economic benefit	–		✓	
	Mangroves	Mangrove stands	Nursery habitat (e.g. crustaceans, fish)	–	Not present.	✓	Mangroves have been recorded in all Australian states except Tasmania. One species, *Avicennia marina*, occurs in Victoria; typically, in inlets or estuaries (e.g. Corner Inlet). Species diversity increasing as they occur further to the north in NSW and Queensland.
	Saltmarsh	Saltmarsh ecosystem	Nursery habitat (e.g. crustaceans, fish)	–	Not present.	✓	Saltmarshes are widespread along the coast; species diversity increases with increasing latitude (in contrast to mangroves). Along the Victorian coast, saltmarsh is most extensive within the Corner Inlet-Nooramunga complex, and behind the sand dunes of Ninety Mile Beach in Gippsland. The 'Subtropical and Temperate Coastal Saltmarsh' is listed as a vulnerable Threatened Ecological Community (TEC) under the EPBC Act, and it's known distribution includes the southern and eastern coasts of Australia.
			Threatened Ecological Community	–		✓	
	Coastal Vine Thicket	Littoral Rainforest and Coastal Vine Thickets of Eastern Australia	Threatened Ecological Community	–	Not present.	✓	The 'Littoral Rainforest and Coastal Vine Thickets of Eastern Australia' is listed as a critically endangered TEC under the EPBC Act. The ecological community is a complex of rainforest and coastal vine thickets on the east coast of Australia, including the area from Cape York Peninsula to the Gippsland Lakes in Victoria.

Receptor Group	Receptor Type	Receptor Description	Values and Sensitivities	Operational Area1		EMBA2	
	Soft Sediment	Predominantly unvegetated soft sediment substrates	Key habitat (e.g. benthic invertebrates)	✓	The VIC/RL13 lease is located on the mid-outer continental shelf and upper slopes of the Bass Canyon. The benthic habitat within the operational area is expected to be featureless, with the seabed comprising of silty sand.	✓	Unvegetated soft sediments are a widespread habitat in both intertidal and subtidal areas, particularly in areas beyond the photic zone. The Gippsland Basin is composed of a series of massive sediment flats, interspersed with small patches of reef, bedrock and consolidated sediment.
	Seagrass	Seagrass meadows	Nursery habitat (e.g. crustaceans, fish) Food source (e.g. dugong, turtles)	–	Not present.	✓	Seagrass generally grows in soft sediments within intertidal and shallow subtidal waters where there is sufficient light. In East Gippsland, seagrass meadows are common in sheltered bay environments or around small offshore islands. Species may include *Amphibolis antartica*, *Halophila australis*, *Heterozostera tasmanica*, *Posidonia australis*, *P. angustifolia*, and *Zostera muelleri*. The '*Posidonia australis* seagrass meadows of the Manning-Hawkesbury ecoregion' is listed as an endangered TEC under the EPBC Act. The ecological community occurs mostly within the sheltered environments of permanently open estuaries along the NSW coast.
			Threatened Ecological Community	–		✓	
	Algae	Benthic microalgae	Food source (e.g. gastropods)	–	Not present.	✓	Benthic microalgae are ubiquitous in aquatic areas where sunlight reaches the sediment surface. Macroalgae communities are generally found on intertidal and shallow subtidal rocky substrates. They are not common as a dominant habitat type in East Gippsland, but do occur in mixed reef environments. Species may include Bull Kelp and other brown algae species. The 'Giant Kelp Marine Forests of South East Australia' is listed as an endangered TEC
		Macroalgae	Nursery habitat (e.g. crustaceans, fish) Food source (e.g. birds, fish)	–		✓	
			Threatened Ecological Community	–		✓	

Receptor Group	Receptor Type	Receptor Description	Values and Sensitivities	Operational Area1		EMBA2	
							under the EPBC Act. The ecological community is characterised by a closed to semi-closed surface or subsurface canopy of *Macrocystis pyrifera*. This ecological community occurs on rocky substrate; some patches may occur in Victoria or northern Tasmania.
	Coral	Hard and soft coral communities	Nursery habitat (e.g. crustaceans, fish) Breeding habitat (e.g. fish)	–	Not present.	✓	Hard corals typically only occur as a dominant benthic habitat in warmer Queensland waters, with the southern limit of reef development around Lord Howe Island. However, hard coral species have also been recorded in south-eastern Australia (e.g. Kent Group Marine Protected Area near Flinders Island; Freycinet Commonwealth Marine Park, eastern Tasmania; and Wilsons Promontory National Park, Victoria). Soft corals can be found at most depths throughout the continental shelf, slope and offslope regions, to well below the limit of light penetration. Soft corals (e.g. sea fans, sea whips) occur as part of mixed reef environments in waters along the East Gippsland coast.
Marine Fauna	Plankton	Phytoplankton and zooplankton assemblages	Food Source (e.g. whales, turtles)	✓	Phytoplankton and zooplankton are widespread throughout oceanic environments; however increased abundance and productivity can occur in areas of upwelling (e.g. within the Upwelling East of Eden KEF).	✓	Phytoplankton and zooplankton are widespread throughout oceanic environments; however increased abundance and productivity can occur in areas of upwelling (e.g. around the Upwelling East of Eden and Bass Cascade KEFs).
	Seabirds and Shorebirds		Listed Marine Species	✓	31 seabird and shorebird species (or species habitat) may occur within the operational area;	✓	127 seabird and shorebird species (or species habitat) may occur within the EMBA; with
			Threatened Species	✓		✓	

Receptor Group	Receptor Type	Receptor Description	Values and Sensitivities	Operational Area1		EMBA2	
		Birds that live or frequent the coast or ocean	Migratory Species	✓	a full species list is included iin the Description of the Environment Document (COE-EN-EMP-0001). One species, the Australian Fairy Tern, had a foraging behaviour identified (presence with no other important behaviour, was noted for the remaining species). However, the operational area does intersect foraging BIAs for: Antipodean Albatross, Wandering Albatross, Buller's Albatross, Shy Albatross, Campbell Albatross, Black-browed Albatross, and the Common Diving-Petrel.	✓	breeding, foraging and roosting behaviours identified for many species. The EMBA intersects foraging and/or breeding BIAs for a number of albatross, petrel, shearwater, terns and other (e.g. Little Penguin, Masked Booby) species. Known breeding sites within the EMBA are typically coastal areas or offshore islands, and include: Lord Howe Island group; Cabbage Tree Island, Solitary Island, and Muttonbird Island in NSW; Wilson's Promontory and surrounding islands (e.g. Seal island), and Gabo Island in Victoria; and Furneaux Island group (e.g. Flinders Island, Babel Island) in Bass Strait.
			BIA – Aggregation	–		✓	
			BIA – Breeding	–		✓	
			BIA – Foraging	✓		✓	
			Behaviour – Breeding	–		✓	
			Behaviour – Foraging	✓		✓	
			Behaviour - Roosting	–		✓	
	Marine Invertebrates	Benthic and pelagic invertebrate communities	Food Source (e.g. whales, turtles) Commercial Species	✓	Marine invertebrates may occur within the operational area. Epifauna is expected to be sparse given the water depths and coverage of silty sand. Studies of infauna in shallower waters of east Gippsland has indicated a high species diversity and abundance. Infauna may also be present within the sediment profile of the operational area. Given the lack of suitable habitat, commercially important species (e.g. Rock Lobster, Giant Crab) are unlikely to occur in significant numbers within the operational area.	✓	A variety of invertebrate species may occur within the EMBA, including sponges and arthropods. Infauna studies along the Victorian coast showed high species diversity, particularly in East Gippsland. Commercially important species (e.g. Rock Lobster, Giant Crab) may occur within the EMBA.

Receptor Group	Receptor Type	Receptor Description	Values and Sensitivities	Operational Area1		EMBA2	
	Fish and Sharks	Fish	Threatened Species	–	Not present.	✓	Three threatened fish species (or species habitat) may occur within the EMBA: The Australian Grayling is diadromous, and while typically found in freshwater streams (Victoria, New South Wales and Tasmania), does appear to spend part of its lifecycle in coastal waters. The Black Rock Cod is typically found in coastal NSW (up to 50 m water depth), in near-shore rocky and offshore coral reef areas. The Red and Ziebell's Handfish are found in shallow (<20 m) coastal waters in eastern and southern Tasmania.
			Commercial Species	✓	Commercial fish species may occur within the operational area, however given the lack of suitable benthic habitat, their abundance is expected to be low.	✓	Commercial fish species may occur within the EMBA, including species of wrasse, flathead, warehou, scallop, crab and lobster.
		Sharks and Rays	Threatened Species	✓	Four shark species (or species habitat) may occur within the operational area; a full species list is included in the Description of the Environment Document (COE-EN-EMP-0001). No important behaviours were identified for the species present. The operational area occurs within a distribution BIA for the Great White Shark.	✓	Eight shark and two ray species (or species habitat) may occur within the EMBA; with breeding and foraging behaviours identified for some species (e.g. Great White Shark, Green Sawfish). The Great White Shark has known aggregation areas within eastern Victoria waters, including foraging and breeding BIAs, and a wider distribution BIA. There are foraging and migration BIAs for the Grey Nurse Shark in coastal waters of NSW and Queensland.
			Migratory Species	✓		✓	
			BIA – Aggregation	–		✓	
			BIA – Breeding	–		✓	
			BIA – Distribution	✓		✓	
			BIA – Foraging	–		✓	
			Behaviour – Breeding	–		✓	
			Behaviour – Congregation/Aggregation	–		✓	
			Behaviour – Foraging	–		✓	

Receptor Group	Receptor Type	Receptor Description	Values and Sensitivities	Operational Area1		EMBA2	
		Syngnathids	Listed Marine Species	✓	28 syngnathid species (or species habitat) may occur within the operational area; a full species list is included in the Description of the Environment Document (COE-EN-EMP-0001). No important behaviours or BIAs have been identified.	✓	75 syngnathid species (or species habitat) may occur within the EMBA. No important behaviours of BIAs have been identified.
	Marine Reptiles	Turtles	Listed Marine Species	✓	Three marine turtle species (or species habitat) may occur within the operational area; a full species list is included in the Description of the Environment Document (COE-EN-EMP-0001). No important behaviours or BIAs have been identified.	✓	Six marine turtle species (or species habitat) may occur within the EMBA. BIAs for foraging (Green Turtle) and nesting (Loggerhead Turtle) have been identified within Queensland waters. While foraging and breeding behaviours have been identified in the EPBC Protected Matters Search as present throughout the EMBA, no known aggregation areas or habitat critical to the survival of the species (except the BIAs noted above) are known to occur within the EMBA.
			Threatened Species	✓		✓	
			Migratory Species	✓		✓	
			BIA – Foraging	–		✓	
			BIA – Internesting	–		✓	
			BIA – Nesting	–		✓	
			Behaviour – Breeding	–		✓	
			Behaviour – Foraging	–		✓	
		Sea Snakes	Listed Marine Species	–	Not present.	✓	13 sea snake species (or species habitat) may occur within the EMBA. No important behaviours of BIAs have been identified. All sea snake species only occur in the northern extent of the EMBA (i.e. northern NSW and Queensland).
	Marine Mammals	Pinnipeds	Listed Marine Species	–	Not present.	✓	Two pinniped species (or species habitat) may occur within the EMBA; with breeding behaviours identified for one species (Australian Fur-seal). Main breeding sites for the Australian Fur-seal include the islands within Bass Strait. Both the Australian and New Zealand Fur-seals have been recorded using Beware Reef (approximately 50 km north-northeast of the BMG wells) as a haul-out site.
			Behaviour – Breeding	–		✓	
			Behaviour – Foraging	–		✓	

Receptor Group	Receptor Type	Receptor Description	Values and Sensitivities	Operational Area1		EMBA2	
		Sirenians	Listed Marine Species	–	Not present.	✓	One sirenian species (or species habitat) may occur within the EMBA. No important behaviours of BIAs have been identified. The dugong only occurs in the northern extent of the EMBA (i.e. northern NSW and Queensland).
			Migratory Species	–		✓	
		Whales	Listed Marine Species	✓	20 whale species (or species habitat) may occur within the operational area; a full species list is included in the Description of the Environment Document (COE-EN-EMP-0001). Three species, Sei, Fin and Pygmy Right whales, had foraging behaviours identified (presence with no other important behaviour, was noted for the remaining species). The operational area is also within a foraging BIA for the Pygmy Blue Whale, and a distribution BIA for the Southern Right Whale.	✓	29 whale species (or species habitat) may occur within the EMBA. Of these, six species (Sei, Bryde's, Blue, Fin, Pygmy Right, and Humpack Whales) may use the area for foraging; with a BIA for foraging identified for the Blue Whale throughout Victorian and Tasmanian waters. The EMBA also intersects a distribution and migration BIA for the Southern Right Whale, and a migration and resting BIA for the Humpback Whale.
			Threatened Species	✓		✓	
			Migratory Species	✓		✓	
			BIA – Connecting Habitat	–		✓	
			BIA – Distribution	✓		✓	
			BIA – Foraging	✓		✓	
			BIA – Migration	–		✓	
			BIA – Resting	–		✓	
			Behaviour – Breeding	–		✓	
			Behaviour – Foraging	✓		✓	
		Dolphins	Listed Marine Species	✓	Seven dolphin species (or species habitat) may occur within the operational area; a full species list is included in the Description of the Environment Document (COE-EN-EMP-0001). No important behaviours of BIAs have been identified.	✓	14 dolphin species (or species habitat) may occur within the EMBA; with breeding behaviours identified for one of the species (Indo-Pacific Humpback Dolphin). Breeding and foraging BIAs along the NSW and Queensland coasts have been identified for the Indo-Pacific Humpback Dolphin and Indian Ocean Bottlenose Dolphin.
			Migratory Species	✓		✓	
			BIA – Breeding	–		✓	
			BIA – Foraging	–		✓	
			Behaviour - Breeding	–		✓	

Notes:

1. Combination of an EPBC Protected Matters Search for a two-kilometre buffer around the BMG wells, and characteristics of the Gippsland environment sector described in the Description of the Environment Document (COE-EN-EMP-0001), have been used to describe ecological receptors that may occur within the operational area).

2. Combination of an EPBC Protected Matters Search for the BMG EMBA area, and characteristics of the Bass Strait, Gippsland, SE Tasmania, Central NSW, SE Queensland and Lord Howe environment sectors described in the Description of the Environment Document (COE-EN-EMP-0001) , have been used to describe ecological receptors that may occur within the EMBA

Table 4-2 Presence of social receptors within the Operational Area and the EMBA

Receptor Group	Receptor Type	Receptor Description	Values and Sensitivities	Operational Area1		EMBA2	
Natural System	Commonwealth Areas, Parks and Reserves	Key Ecological Features	High productivity Aggregations of marine life Unique seafloor features Biodiversity and endemism	✓	The operational area is within the South-east marine region; and intersects with one KEF: Upwelling East of Eden.	✓	Multiple KEFs intersect with the EMBA, including: Bass Cascade; Big Horseshoe Canyon; Canyons on the Eastern Continental Slope; East Tasmania Subtropical Convergence Zone; Elizabeth and Middleton Reefs; Lord Howe Seamount Chain; Seamounts South and East of Tasmania; Shelf Rocky Reefs and Hard Substrates; Shelf Rocky Reefs; Tasman Front and Eddy Field; Tasmantid Seamount Chain; Upwelling East of Eden; and Upwelling off Fraser Island.
		Australian Marine Parks	Important migration, foraging and/or breeding areas Maritime heritage	–	Not present.	✓	Multiple AMPs intersect with the EMBA including: Apollo; Beagle; Boags;

Receptor Group	Receptor Type	Receptor Description	Values and Sensitivities	Operational Area1		EMBA2	
			Unique sea floor features High productivity Biodiversity				Central Eastern; Cod Grounds; East Gippsland; Flinders; Freycinet; Gifford; Hunter; Huon; Jervis; Lord Howe; Solitary Islands; and Zeehan. The closest to the BMG assets is East Gippsland Marine Park, approximately 130 km to the east.
		Commonwealth National Park	Biodiversity Important foraging and/or breeding areas Indigenous heritage	–	Not present.	✓	The Booderee National Park is located in central NSW. The Park stretches across 6,379 ha at Jervis Bay, and includes 875 ha of marine environment, and 80 ha of Botanic Garden.
	State Parks and Reserves	Marine Protected Areas	Aggregations of marine life Important foraging and/or breeding areas Maritime heritage	–	Not present.	✓	Numerous State marine protected areas intersect with the EMBA. The two closest to the BMG assets are: Beware Reef Marine Sanctuary (approximately 50 km away); and

Receptor Group	Receptor Type	Receptor Description	Values and Sensitivities	Operational Area1		EMBA2	
							Point Hicks Marine National Park (approximately 75 km away).
		Terrestrial Protected Areas	Shoreline habitat	–	Not present.	✓	Numerous State terrestrial protected areas have a coastal boundary that intersects with the EMBA. The closest Coastal Park to the BMG assets is the Cape Conran Coastal Park, approximately 52 km to the north. The closet National Park is The Lakes National Park, approximately 115 km to the northwest; however, the coastal boundary is within the Gippsland Lakes estuary system.
	Wetlands	International (Ramsar) Importance	Biodiversity Habitat for threatened and/or migratory species Cultural and Indigenous heritage	–	Not present.	✓	Four Ramsar wetlands intersect with the (environmental impact) EMBA: Corner Inlet; East Coast Cape Barren Island Lagoons; Gippsland Lakes; and Logan Lagoon. The wetlands are located on the Victorian coast, or offshore islands within the Furneaux Group (in Bass Strait).
		National Importance	Biodiversity Habitat for threatened and/or migratory species Cultural and Indigenous heritage	–	Not present.	✓	Numerous wetlands of international importance (with a coastal or marine connection) intersect with the EMBA. The three closest to the BMG assets are: Lower Snowy River Wetlands System (approximately 55 km to the north);

Receptor Group	Receptor Type	Receptor Description	Values and Sensitivities	Operational Area1		EMBA2	
							Ewings Marsh (approximately 61 km to the northwest); and Sydenham Inlet Wetlands (approximately 62 km to the northeast).
Human System	Commercial Fisheries	Commonwealth-managed	Economic benefit	✓	While the operational area occurs within the management areas of a number of Commonwealth-managed commercial fisheries, active fishing effort (based off previous fishing intensity data) within this area is expected to be limited to: Southern and Eastern Scalefish and Shark Fishery; and Southern Squid Jig Fishery. The fishing intensity data also indicates that the following fisheries may be present, but no catch was recorded: Eastern Tuna and Billfish Fishery Southern Bluefin Tuna Fishery. The abundance of demersal fish and invertebrate species residing within the operational area is expected to be low given the lack of suitable benthic habitat features within the operational area; therefore, commercial fishing effort within the area would also be low. Note, any existing PSZs around infrastructure would preclude fishing activity within the direct area.	✓	A number of Commonwealth-managed fisheries have management areas that intersect with the EMBA. Fishing intensity data suggests that the Southern and Eastern Scalefish and Shark Fishery and the Southern Squid Jig Fishery are the two with activity closets to the BMG assets.

Receptor Group	Receptor Type	Receptor Description	Values and Sensitivities	Operational Area1		EMBA2	
		State-managed	Economic benefit	✓	While the operational area occurs within the management areas of the Giant Crab and Rock Lobster State-managed commercial fisheries, active fishing effort within the operational area is considered very unlikely. There has been no recent fishing effort within the eastern zone of the Giant Crab fishery in Victoria, and most of the catch for Rock Lobster is typically in waters <100 m deep (BMG well depth varies 135–263 m).	✓	A number of State-managed fisheries have management areas that intersect with the EMBA. Fishing intensity data is not available; however, it is possible that the Giant Crab, Rock Lobster, Scallop and Wrasse fisheries may be active within the East Gippsland area.
	Recreational Fisheries	State-managed	Community engagement	✓	Recreational fishing may occur within the operational area, but activity is expected to be minimal given its location >50 km offshore. Note, any existing PSZs around operational infrastructure would preclude fishing activity within the direct area.	✓	Most recreational fishing typically occurs in nearshore coastal waters, and within bays and estuaries; offshore (>5 km) fishing only accounts for approximately 4% of recreational fishing activity in Australia. The East Gippsland waters have a moderate fishing intensity (relative to other areas within the South-East Marine Region).
	Coastal Settlements		Community engagement Economic benefit	–	Not present.	✓	The communities of Lakes Entrance and Marlo (within the Shire of East Gippsland) are the closest coastal settlements to the BMG assets. The closest heavily populated Victorian urban area, is Melbourne.
	Recreation and Tourism		Community engagement	✓	Marine-based recreation and tourism may occur within the operational area, but	✓	The Australian coast provides a diverse range of recreation and tourism

Receptor Group	Receptor Type	Receptor Description	Values and Sensitivities	Operational Area1		EMBA2	
			Economic benefit		activity is expected to be minimal given its location >20 km offshore.		opportunities, including scuba diving, charter boat cruises, and surfing. In East Gippsland, primary tourist locations include Marlo, Cape Conran, Lakes Entrance and Mallacoota. The area is renowned for its nature-based tourism, recreational fishing and water sports.
	Industry	Shipping	Community engagement Economic benefit	✓	The south-eastern coast is one of Australia's busiest in terms of shipping activity and volumes. The operational area occurs to the north of major shipping routes.	✓	The south-eastern coast is one of Australia's busiest in terms of shipping activity and volumes. However, the BMG assets do not coincide with major routes; with higher volumes of traffic located to the south of the wells.
		Oil and Gas	Economic benefit	✓	Petroleum activity within the operational area is based on Cooper Energy assets.	✓	Petroleum infrastructure in Gippsland Basin is well developed, with a network of pipelines transporting hydrocarbons produced offshore to onshore petroleum processing facilities at Longford and Orbost.
		Cables and Pipelines	Economic benefit	–	Not present.	✓	Submarine cables located in Bass Strait are limited to the subsea floor between Tasmania and the Australian mainland. Three communication cables also extend offshore from Sydney.
		Military	Protection and surveillance	–	Not present.	✓	The Australian Defence Force conducts a range of training, research activities, and preparatory operations within the EMBA. The closest major base to the BMG assets is the multi-purpose wharf at

Receptor Group	Receptor Type	Receptor Description	Values and Sensitivities	Operational Area1		EMBA2	
							Twofold Bay; and closest primary training ground is the East Australia Exercise Area in southern NSW.
	Heritage	Maritime	Shipwrecks	–	Not present.	✓	Numerous shipwrecks have been recorded in nearshore and coastal Australian waters. The one in closest proximity to the BMG assets is Struan, approximately 33 km to the northwest.
		Cultural	World Heritage Properties Commonwealth Heritage Places National Heritage Places	–	Not present.	✓	There is one World Heritage Properties within the EMBA: Lord Howe Island Group. There are four Commonwealth Heritage Places within the EMBA: Beecroft Peninsula; Jervis Bay Territory; Malabar Headland; and Snapper Island. There are two National Heritage Places within the EMBA: Kurnell Peninsula Headland; and Lord Howe Island Group.
		Indigenous	Indigenous use or connection Native Title	–	Not present.	✓	The coastal area of south-east Australia was amongst the most densely populated regions of pre-colonial Australia. Through cultural traditions, Aboriginal people maintain their connection to their ancestral lands and waters. The

Receptor Group	Receptor Type	Receptor Description	Values and Sensitivities	Operational Area1		EMBA2	
							Gunaikurnai, Monero and the Bidhawel (Bidwell) Indigenous people are recognised as the traditional custodians of the lands and waters within the East Gippsland Shire. The Gunaikurnai people have an approved non-exclusive native title area area extending from West Gippsland in Warragul, east to the Snowy River and north to the Great Dividing Range; and 200 m offshore.

Notes:

1. Combination of an EPBC Protected Matters Search for a two-kilometre buffer around the BMG wells, and characteristics of the Gippsland environment sector described in the Description of the Environment Document (COE-EN-EMP-0001), have been used to describe social receptors that may occur within the operational area.
2. Combination of an EPBC Protected Matters Search for the BMG EMBA area, and characteristics of the Bass Strait, Gippsland, SE Tasmania, Central NSW, SE Queensland and Lord Howe environment sectors described in the Description of the Environment Document (COE-EN-EMP-0001), have been used to describe ecological receptors that may occur within the EMBA.

4.4 Conservation Values within the EMBA

The following table provides details of the features present within the EMBA for those receptors identified within by Regulation 13(3) of the OPGGS(E) Regulations (Table 4-3). Descriptions of the features or species and species habitat is provided in Existing Environment document.

Table 4-3 Summary of conservation values and sensitivities within the EMBA

Receptor Type	Conservation Value	Features present within the EMBA
Commonwealth Marine Area, Parks and Reserves	Key Ecological Feature	• Bass Cascade • Big Horseshoe Canyon • Canyons on the Eastern Continental Slope • East Tasmania Subtropical Convergence Zone • Elizabeth and Middleton Reefs • Lord Howe Seamount Chain • Seamounts South and East of Tasmania • Shelf Rocky Reefs and Hard Substrates • Shelf Rocky Reefs • Tasman Front and Eddy Field • Tasmantid Seamount Chain • Upwelling East of Eden • Upwelling off Fraser Island
	Australian Marine Parks	• Apollo AMP • Beagle AMP • Boags AMP • Central Eastern AMP • Cod Grounds AMP • East Gippsland AMP • Flinders AMP • Freycinet AMP • Gifford AMP • Hunter AMP • Huon AMP • Jervis AMP • Lord Howe AMP • Solitary Islands AMP • Zeehan AMP
	Commonwealth National Parks	• Booderee National Park
Wetlands	Ramsar Wetlands	• Corner Inlet • East Coast Cape Barren Island Lagoons • Gippsland Lakes • Logan Lagoon
Heritage	World Heritage Property	• Lord Howe Island Group
	National Heritage Places	• Kurnell Peninsula Headland • Lord Howe Island Group
	Commonwealth Heritage Places	• Beecroft Peninsula • Jervis Bay Territory • Malabar Headland

Receptor Type	Conservation Value	Features present within the EMBA
		• Snapper Island
Seabirds and Shorebirds	Threatened and/or migratory species	• Numerous threatened (42) and migratory (70) species or species habitat may be present within the EMBA; including various albatross, petrel, plover, sandpiper, shearwater and tern species.
Fish and Sharks	Threatened and/or migratory species	• Four threatened fish species or species habitat (Red and Ziebell's Handfish, Black Rockcod, Australian Grayling) may be present within the EMBA. • Five threatened (Grey Nurse Shark, Great White Shark, Green Sawfish, Whale Shark and Maugean Skate), and seven migratory (Narrow Sawfish, Great White Shark, Shortfin and Longfin Mako Sharks, Porbeagle Shark, and Whale Shark) shark species or species habitat may be present within the EMBA. • Two migratory ray (Giant Manta Ray, Reef Manta Ray) species of species habitat may be present within the EMBA.
Marine Reptiles	Threatened and/or migratory species	• Six threatened and migratory marine turtle species or species habitat (Loggerhead, Green, Leatherback, Hawksbill, Olive Ridley, and Flatback Turtles) may be present within the EMBA.
Marine Mammals	Threatened and/or migratory species	• One migratory sirenian species or species habitat (Dugong) may be present within the EMBA. • Five threatened (Sie, Blue, Fin, Southern Right, and Humpback Whales), and ten migratory (Antartic Minke, Sie, Bryde's, Blue, Fin, Pygmy Right, Southern Right, Humpback, Killer, and Sperm Whales) whale species or species habitat may be present within the EMBA. • Three migratory dolphin species or species habitat (Dusky, Irrawaddy, and Indo-Pacific Humpback Dolphins) may be present within the EMBA.

5 Environmental Impact and Risk Assessment Methodology

This section describes the environmental impact and risk assessment methodology employed for activities to be undertaken as part of the Phase 1 BMG Well Abandonment, adopting Cooper Energy's risk assessment framework and toolkit to evaluate the potential impacts and risks. Section 6 reflects the risk register and shows all identified risks and impacts to be closed out by addressing the required preventative and mitigative controls.

For the Cooper Energy offshore activities, environmental aspects, impacts and risks have been identified and risk-assessed undertaking the following steps:

- Establish the context for the assessment by defining the activity and associated environmental aspects
- Identifying the impact or risk associated with the environmental aspects
- Identifying the environmental and social values and sensitivities with the potential to be exposed to the impact or risk
- Evaluate the potential impact or risk (consequence);
- Determine the ALARP decision context and identify control measures;
- Evaluate the likelihood of the impact or risk (consequence) occurring;
- Assigning residual risk rating (after control measures are implemented) utilising Cooper Energy's qualitative risk matrix. In accordance with Cooper Energy's acceptance criteria, the impacts and risks continue to be reassessed until it is demonstrated the impact or risk is reduced to a level which is as low as reasonably practicable (ALARP) and is acceptable according to Cooper Energy's acceptance criteria;
- Evaluate the acceptability of the potential impact and risk.

Figure 5-1 provides the process adopted for managing impacts and risks associated with the petroleum activity.

Figure 5-1 AS/NZS ISO 31000 – Risk Management Methodology

5.1 Impact and Risk Evaluation

5.1.1 Establish the context

After describing the petroleum activity, an assessment was carried out to identify potential interactions between the petroleum activity and the receiving environment. The outcomes of stakeholder consultation also contributed to aspect identification.

Based upon an understanding of the environmental interactions, relevant impacts or risks were defined. Ecological and social receptors identified (described in Section 4.3) with the potential to be exposed to an aspect and subsequent impacts or risks were then summarised enabling a systematic evaluation to be undertaken.

5.1.2 Evaluate the potential impact (consequence)

After identifying the potential impacts or risks; consequences were determined based on the:

- Spatial scale or extent of potential impact or risk of the environmental aspect within the receiving environment;
- Nature of the receiving environment (from Section 4) (within the spatial extent), including proximity to sensitive receptors, relative importance, and sensitivity or resilience to change;
- Impact mechanisms (cause and effect) of the environmental aspect within the receiving environment (e.g. persistence, toxicity, mobility, bioaccumulation potential);
- Duration and frequency of potential effects and time for recovery; and
- Potential degree of change relative to the existing environment or to criteria of acceptability.

Consequence definitions are provided in Table 5-1.

Table 5-1 Definition of Consequence

Descriptor	Environment	Regulatory, reputation, community and media
5. Critical	Severe long-term impact on highly-valued ecosystems, species populations or habitats. Significant remedial/recovery work to land/water systems over decades (if possible at all).	Critical impact on business reputation &/or international media exposure. High-level regulatory intervention. Potential revocation of License/Permit. Operations ceased.
4. Major	Extensive medium to long-term impact on highly-valued ecosystems, species populations or habitats. Remedial, recovery work to land or water systems over years (~5-10 years).	Significant impact on business reputation and/or national media exposure. Significant regulatory intervention. Operations ceased.
3. Moderate	Localised medium-term impacts to species or habitats of recognized conservation value or to local ecosystem function. Remedial, recovery work to land/water systems over months/year.	Moderate to small impact on business reputation. Potential for state media exposure. Significant breach of regulations, attracting regulatory intervention.

Descriptor	Environment	Regulatory, reputation, community and media
2. Minor	Localised short-term impacts to species/habitats of recognised conservation value but not affecting local ecosystem functioning. Remedial, recovery work to land, or water systems over days/weeks. No significant impacts to third parties.	Some impact on business reputation and/or industry media exposure. Breach of regulations - event reportable to authorities.
1. Negligible	Temporary localised impacts or disturbance to plants/animals. Nil to negligible remedial/recovery works on land/water systems.	Minimal impact on business reputation. Negligible media involvement. No regulatory breaches or reporting.

5.1.3 Determine the ALARP decision context and identify control measures

In alignment with NOPSEMA's ALARP Guidance Note (N-04300-GN0166, Rev 6, June 2015), Cooper Energy have adapted the approach developed by Oil and Gas UK (OGUK) (formerly UKOOA; OGUK, 2014) for use in an environmental context to determine the assessment technique required to demonstrate that potential impacts and risks are ALARP (Figure 5-2).

Specifically, the framework considers impact severity and several guiding factors:

- Activity type;
- Risk and uncertainty; and
- Stakeholder influence.

A **Type A** decision is made if the risk is relatively well understood, the potential impacts are low, activities are well practised, and there are no conflicts with company values, no partner interests and no significant media interests. However, if good practice is not sufficiently well-defined, additional assessment may be required.

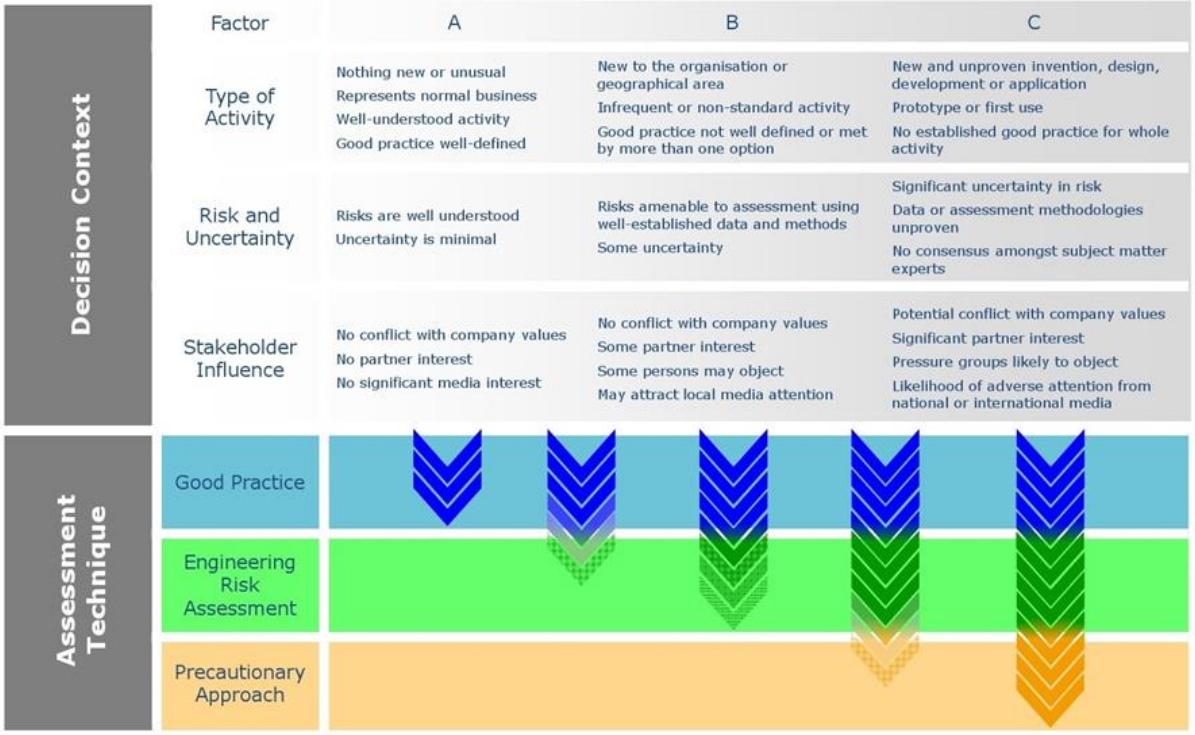
A **Type B** decision is made if there is greater uncertainty or complexity around the activity and/or risk, the potential impact is moderate, and there are no conflict with company values, although there may be some partner interest, some persons may object, and it may attract local media attention. In this instance, established good practice is not considered sufficient and further assessment is required to support the decision and ensure the risk is ALARP.

A **Type C** decision typically involves sufficient complexity, high potential impact, uncertainty, or stakeholder influence to require a precautionary approach. In this case, relevant good practice still must be met, additional assessment is required, and the precautionary approach applied for those controls that only have a marginal cost benefit.

In accordance with the regulatory requirement to demonstrate that environmental impacts and risks are ALARP, Cooper Energy has considered the above decision context in determining the level of assessment required. This is applied to each aspect described in Section 6.

The assessment techniques considered include:

- Good practice;
- Engineering risk assessment; and
- Precautionary approach.



(Source: NOPSEMA Decision-making – Criterion 10A(c) Acceptable level. N-04750-GL1637, Rev 0, Nov 2016)

Figure 5-2 ALARP Decision Support Framework

5.1.4 Evaluate the likelihood of the impact (consequence) occurring

The likelihood of a defined consequence occurring was determined, considering the control measures that have been previously identified. Likelihood levels are determined according to the Cooper Energy qualitative risk matrix (Table 5-3). Likelihood definitions are provided in Table 5-2.

Table 5-2 Definition of Likelihood

Descriptor	Description
A. Almost certain	Common event, expected to occur in most circumstances within Cooper Energy operations (i.e., several times a year).
B. Likely	Event likely to occur once or more during a campaign, ongoing operations or equipment design life.
C. Possible	Infrequent event that may occur during a campaign, ongoing operations or equipment design life.
D. Unlikely	Unlikely event, but could occur at sometime within Cooper Energy operations (has occurred previously in similar industry).
E. Remote	Rare event. May occur in exceptional circumstances of Cooper Energy operations (not heard of in recent similar industry history).

5.1.5 Assigning residual risk rating

Based upon the identified consequence and likelihood levels, Cooper Energy use the qualitative risk matrix (Table 5-3) to rate the residual risk level.

Table 5-3 Cooper Energy Qualitative Risk Matrix

		CONSEQUENCE				
		1. Negligible	2. Minor	3. Moderate	4. Major	5. Critical
LIKELIHOOD	Almost Certain	M	M	H	H	H
	Likely	M	M	M	H	H
	Possible	L	M	M	H	H
	Unlikely	L	L	M	M	H
	Remote	L	L	L	M	M

5.1.6 Evaluate the acceptability of the potential impact and risk

Cooper Energy considers a range of factors when evaluating the acceptability of environmental impacts or risks associated with its activities. This evaluation works at several levels, as outlined in Table 5-4 and is based on NOPSEMA's Guidance Notes for EP Content Requirements (N04750-GN1344, Rev 3, April 2016) and guidance issued in Decision-making – Criterion 10A(c) Acceptable Level (N-04750-GL1637, Rev 0, Nov 2016). The acceptability evaluation for each aspect associated with this activity is undertaken in accordance with Table 5-4.

Table 5-4 Cooper Energy Acceptability Evaluation

Factor	Criteria / Test
Cooper Energy Risk Process	• Is the level of risk High? (if so, it is considered unacceptable)

Principles of Ecologically Sustainable Development (ESD) [See below]	• Is there the potential to affect biological diversity and ecological integrity? (Consequence Level Major [4] and Critical [5])
	• Do activities have the potential to result in serious or irreversible environmental damage?
	  ○ If yes: Is there significant scientific uncertainty associated with aspect?
	  ○ If yes: Has the precautionary principle been applied to the aspect?

Legislative and Other Requirements	• Confirm that all good practice control measures have been identified for the aspect including those identified in relevant EPBC listed species recovery plans or approved conservation advices.
Internal Context	• Confirm that all Cooper Energy HSEC MS Standards and Risk Control Processes have been identified for this aspect
External Context	• What objections and claims regarding this aspect have been made, and how have they been considered / addressed?

ESD Principles are:

A. Decision making processes should effectively integrate both long term and short term economic, environmental, social and equitable considerations

This principle is inherently met through the EP assessment process. This principal is not considered separately for each acceptability evaluation.

B. If there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

   An evaluation is completed to determine if the activity will result in serious or irreversible environmental damage. Where the activity has the potential to result in serious or irreversible environmental damage, an assessment is completed to determine if there is significant uncertainty in the evaluation.

C. The principle of inter-generational equity—that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.

   Where the potential impacts and risk are determined to be serious or irreversible the precautionary principle is implemented to ensure the environment is maintained for the benefit of future generations.

D. The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision making

   An assessment is completed to determine if there is the potential to impact biological diversity and ecological integrity

E. Improved valuation, pricing and incentive mechanisms should be promoted

   Not relevant to the EP

5.2 Monitor and Review

Monitoring and review activities are incorporated into the impact and risk management process to ensure that controls are effective and efficient in both design and operation. This is achieved for the Phase 1 BMG Well Abandonment activities through the environmental performance outcomes, standards and measurement criteria that are described for each environmental hazard in Section 6 of the EP. Additional aspects of monitoring and review are described in the Implementation Strategy in Section 7 of the EP include:

- Analysing and lessons learnt from events (including near-misses), changes, trends, successes and failures;
- Detecting changes in the external and internal context (e.g. new conservation plans issued); and
- Identifying emerging risks.

6 Risk and Impact Evaluation

This section summarises the impacts and risks associated with the petroleum activity appropriate to the nature and scale of each impact and risk, and details the control measures that are used to reduce the risks to ALARP and an acceptable level.

6.1 Physical Interaction – Collision with Marine Fauna

Table 6-1 provides a summary of the environmental impact assessment (EIA) / environmental risk assessment (ERA) for Physical Interaction (Collision with Marine Fauna).

Table 6-1 Physical Interaction (Collision with Marine Fauna) EIA / ERA

Cause of Aspect	The movement of vessels within the operational area and the physical presence of the vessel has the potential to result in collision with marine fauna.
Summary of impact(s)	Interaction with fauna has the potential to result in: • injury or death of marine fauna
Consequence Evaluation	
Receptor(s)	**Description of Potential Environmental Impact**
Megafauna	Marine megafauna are the species most at risk from this hazard and thus are the focus of this evaluation. Cetaceans are naturally inquisitive marine mammals that are often attracted to offshore vessels and facilities, however, the reaction of whales to the approach of a vessel is quite variable. Some species remain motionless when in the vicinity of a vessel, while others are curious and often approach ships that have stopped or are slow moving, although they generally do not approach, and sometimes avoid, faster-moving ships (Richardson *et al.*, 1995). Collisions between larger vessels with reduced manoeuvrability and large, slow-moving cetaceans occur more frequently where high vessel traffic and cetacean habitat occurs (Whale and Dolphin Conservation Society, 2006). Laist *et al.* (2001) identified that larger vessels with reduced manoeuvrability moving in excess of 10 knots may cause fatal or severe injuries to cetaceans, with the most severe injuries caused by vessels travelling faster than 14 knots. Vessels typically used to support these activities do not have the same limitations on manoeuvrability and would not be moving at these speeds when conducting activities within the scope of the EP, inside the operational area. As identified in Section 4, several marine mammals (whale, dolphin) and turtle species, including those listed as either threatened and/or migratory under the EPBC Act have the potential to occur within the operational area. The operational area is located within a foraging BIA for the Pygmy Blue Whales, and a distribution BIA for the Southern Right Whale and Great White Shark. While the operational area is within the foraging BIA for the Pygmy Blue Whale, this species is not expected to be in high abundance. The area in East Gippsland is only listed as 'potential foraging' in the Conservation Management Plan (DoE, 2015b), and no feeding aggregation for the Pygmy Blue Whale has been associated with the Upwelling East of Eden feature (i.e. the upwelling feature that does overlap with the operational area) (DoE, 2018). The major migratory routes for this species are also further west (west of Tasmania) (DoE, 2015b; 2018). With respect to the Southern Right Whale, while the operational area is within a distribution BIA, it does not intersect with known aggregation areas (again occurring further west). Similarly, for the Great White Shark, known aggregation areas (foraging, breeding), while in eastern Victoria, occur beyond the vicinity of the operational area. As

	such, both species are also not expected to be observed in high abundance within the operational area. Both the Southern Right Whale and Great White Shark migrate north along the east coast of Australia, typically beginning in autumn; and return in spring (Great White Shark) or early-summer (Southern Right Whale). The Great White Shark has been recorded in higher numbers during November/December in Victorian waters (coinciding with seal pupping season). Marine turtles may have a presence within the operational area, but no important behaviour (e.g. foraging or breeding) is associated with these offshore waters (the Description of the Environment Document (COE-EN-EMP-0001). As such, any presence is likely to be of a transient nature only. The duration of fauna exposure to vessel strike is limited to the duration of works under the EP (Section 3); expected to be approximately 100 days. If a fauna strike occurred and resulted in death, it is not expected that it would have a detrimental effect on the overall population. Consequently, the potential impacts and risks from fauna strike are considered to be **Minor (2)** as this type of event may result in a localised short-term impact to species of recognised conservation value but is not expected to affect the population or local ecosystem function
ALARP Decision Context	**A**
Summary of Control Measures	
• Adherence to EPBC Regulations 2000 – Part 8 Division 8.1 interacting with cetaceans – The Australian Guidelines for Whale and Dolphin Watching describes strategies to ensure whales and dolphins are not harmed during offshore interactions with people. • Incident reporting	

Likelihood	**Unlikely (D)**	**Residual Risk**	Low

6.2 Physical Interaction – Other Marine Users

Table 6-2 provides a summary of the EIA / ERA for Physical Interaction (Other Marine Users).

Table 6-2 Physical Interaction (Other Marine Users) EIA / ERA

Cause of Aspect	The movement of vessels within the operational area, and the physical presence of the MODU and vessels has the potential to result in interactions with other marine users.
Summary of impact(s)	Interaction with other marine users has the potential to result in: • Disruption to commercial activities.
Consequence Evaluation	
Receptor(s)	**Description of Potential Environmental Impact**
Commonwealth Fisheries Other Marine Users	Several commercial fisheries have management areas that overlap the operational area associated with the EP. Two stakeholders have indicated concern over possible cumulative impacts from multiple wells and associated exclusion zones, which may impact on the total area available for fishing. Currently a PSZ between 300 m and 500 m exists around BMG infrastructure. During plug and abandonment activities covered under the EP, the PSZ to be placed around the MODU will only be temporary, being revoked once the MODU departs the area. In the period between Phase 1 and Phase 2 (up to seven years), the existing BMG PSZ will remain in force to minimise any potential damage to either subsea equipment or other marine users, specifically fishing gear. The current PSZ surrounding the BMG infrastructure (as outlined in Gazettal Notice: A443819) commenced in 2015, is in force until its revocation, and is covered under the existing BMG NPP EP. It should be noted that the PSZ ranges between 300 m and 500 m and that the removal of some equipment, and trenching the B-6 flowline in 2012, released 64% of an area which was previously isolated from fisheries during BMG Development activities. Further reduction in the radius of the PSZ is not considered responsible given the possibility of increased risk to equipment integrity from third party (marine) users activities. Once Phase 2 decommissioning is complete (not covered under the EP) and subsea infrastructure is removed, the existing permanent PSZ will be removed and the area will be fishable. There currently exists a PSZ around BMG infrastructure. The PSZ to be implemented around the MODU during operations, will be only slightly larger than that currently in place, and will be temporary only. Based on annual fishing records, the size of the fishing grounds, and that no new PSZ will be created, the proposed activities are not expected to result in a significant impact to commercial operations (via loss of catches, loss of fishing grounds or damage to fishing equipment). The south-eastern coast is one of Australia's busiest in terms of shipping activity and volumes. However, the operational area does not coincide with major routes; with higher volumes of traffic located to the south of the wells (the Description of the Environment Document (COE-EN-EMP-0001). Therefore, relatively small numbers of vessels are likely to be encountered within the operational area. The most credible impact to other marine users would be the minor deviation of commercial vessels around MODU PSZ. The PSZ is limited to 500 m, so any required deviations would be minor and thus have negligible impact on travel times or fuel use of these vessels. Based on the above assessment, any impacts would be **Negligible (1),** with little to no potential impacts to external stakeholders.

ALARP Decision Context	**A**		
Summary of Control Measures			
• Petroleum Safety Zones • Pre-start notifications • Wellheads will be removed and recovered in Phase 2 of the abandonment campaign			
Likelihood	**Remote (E)**	**Residual Risk**	Low

6.3 Light Emissions

Table 6-3 provides a summary of the EIA / ERA for Light Emissions.

Table 6-3 Light Emissions EIA / ERA

Cause of Aspect	During the activity, the MODU and support vessels will generate light while in the operational area. Lighting is used for marine safety to ensure clear identification of vessels to other marine users and to allow activities to be undertaken safely 24 hours a day. Lighting will typically consist of bright white (i.e. metal halide, halogen, fluorescent) lights, and are not dissimilar to other offshore activities in the region, including fishing and shipping.
Summary of impact(s)	A change in ambient light levels has the potential to result in: • Attraction of light-sensitive species such as seabirds, and some other marine fauna (e.g. fish, squid) which may in turn affecting predator-prey dynamics; and • Alteration of behaviour that may affect species during breeding periods (e.g. shearwaters, turtle hatchlings).
Consequence Evaluation	
Receptor(s)	**Description of Potential Environmental Impact**
Seabirds, squid and zooplankton	High levels of marine lighting can attract and disorient seabird species resulting in species behavioural changes (e.g. circling light sources leading to exhaustion or disrupted foraging), injury or mortality near the light source. Studies conducted between 1992 and 2002 in the North Sea confirmed that artificial light was the reason that birds were attracted to and accumulated around illuminated offshore infrastructure (Marquenie *et al.*, 2008) and that lighting can attract birds from large catchment areas (Weise *et al.*, 2001). These studies indicate that migratory birds are attracted to lights on offshore platforms when travelling within a radius of 5 km from the light source, but their migratory paths are unaffected outside this zone (Shell, 2010). Although the operational area overlaps several foraging BIAs for seabirds, it is not expected that light emissions acting as an attractant to a small number of individual seabirds would result in any impact to the individual or to the greater population. 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. Other marine life may also be attracted to the MODU or support vessels (e.g. fish, squid) that can aggregate directly under downward facing lights. These are prey species to many species of marine fauna and given the nature of the activity, any impacts arising from light emissions will be localised and temporary. Consequently, the potential impacts and risks from light emissions are considered to be **Negligible (1)** as this type of event may result in temporary localised impacts or disturbance to animals but is not expected to affect the population or local ecosystem function.
Turtles, seabirds	**Alteration of behaviour from light-sensitive species during breeding periods** <u>Turtles</u> Light pollution can be an issue along, or adjacent to, turtle nesting beaches where emerging hatchlings orient to, and head towards, the low light of the horizon unless distracted by other lights which disorient and affect their passage from the beach to the

	sea (EA, 2003). Given the absence of known turtle nesting in Victoria, impacts to turtle hatchlings are not expected. Pendoley (2000) discovered that in the absence of illumination from the moon, glow from tower flares may influence the orientation of turtles at close range (30–100 m). Given that the wells are located approximately 55 km offshore, impacts to nesting adult turtles is not expected. <u>Seabirds</u> Artificial light can cause significant impacts on burrow-nesting petrels and shearwaters. Fledglings often become disoriented and grounded because of artificial light adjacent to rookeries as they attempt to make their first flights to sea, a phenomenon known as 'fallout' (Birdlife International, 2012). Rodrigez *at al.* (2014) investigated the effects of artificial lighting from road lighting on short-tailed shearwater fledglings. The study established by removing the light source from nesting areas, there was a decrease in grounded fledglings and a corresponding reduction in bird fatalities. The wells are located approximately 55 km from the closest shoreline. Given the distance offshore, changes to ambient light levels in seabird breeding areas are not expected to occur, thus impacts to breeding periods from light emissions are not expected.		
ALARP Decision Context	**A**		
Summary of Control Measures			
• Lighting will be limited to that required for safe work and navigation.			
Likelihood	**Possible (C)**	**Residual Risk**	Low

6.4 Underwater Sound Emissions

Table 6-4provides a summary of the EIA / ERA for Underwater Sound Emissions.

Table 6-4 Underwater Sound Emissions EIA / ERA

Cause of Aspect	Underwater sound emissions will be generated from: • Sonar inspection (e.g. ROV mounted sonar survey during and after well abandonment) • Support operations (MODU/vessel operations); • Support operations (helicopter operations)
Summary of impact(s)	The potential impacts of underwater sound emissions in the marine environment are: • Localised and temporary fauna behavioural disturbance that significantly affects migration or social behaviours; and • Auditory impairment, Permanent Threshold Shift (PTS).
Consequence Evaluation	
Receptor(s)	**Description of Potential Environmental Impact**
Marine mammals Marine turtles Fish and sharks Commercial Fisheries	**Localised and Temporary Fauna Behavioural Disturbance** <u>Marine Mammals</u> Using the National Marine Fisheries Service (NMFS) guidance for sounds such as vessel noise, behavioural disturbance may occur within 4km of the MODU / vessel. The operational area is located within a foraging BIA for the Pygmy Blue Whale, and a distribution BIA for the Southern Right Whale; both species typically occur as individuals or in small (2–3 individuals) groups. Therefore, within the open water environment of the operational area, it is anticipated that cetacean numbers would be low, and so it is not expected that exposure to these sound levels would result in a significant change to foraging behaviours or natural movement that would result in further impact at either the individual or local population levels. Consequently, the potential impacts and risks from noise emissions to marine mammals are considered to be **Minor (2).** <u>Marine Turtles</u> Using the limited information available, it has been reported that behavioural and masking changes are likely to occur at levels above 120 dB re 1µPa. The operational area is not within an identified turtle BIA and approximately55 km from the coast. Within the open water environment of the operational area, it is anticipated that turtle numbers would be low, and so it is not expected that exposure to these sound levels would result in a significant change to foraging behaviours or natural movement that would result in further impact at either the individual or local population levels. Consequently, the potential impacts and risks from noise emissions on marine turtles are considered to be **Minor (2).** <u>Fish and Sharks</u> Sound levels are expected to reach that which will result in recoverable injury for fish that have high or medium hearing sensitivity. For some fish, a strong ‘startle’ response has been observed at lower sound levels, with fish shown to move away from the noise source. Using a conservative approach, Cooper Energy has adopted a very conservative threshold level of 130 dB re 1µPa RMS at which point behavioural changes in fish may occur. Consequently, the potential impacts and risks from noise emissions are **Negligible (1)**. <u>Commercial Fisheries</u>

	As identified in Section 4, several commercial fisheries have management areas that overlap the operational area associated with the EP. Localised and temporary behaviour changes in fish have the potential to adversely affect commercial fishing operations. During stakeholder consultation, concern was raised by South East Trawl Fishing Industry Associate (SETFIA) regarding the potential impact of seismic survey on marine invertebrates and fish. Cooper Energy responded to SETFIA concerns, providing sufficient information to show that, as seismic surveys will not be undertaken, impacts from the well abandonment activities are unlikely to result in impacts to fish or affect commercial fishing. Further information on consultation with SETFIA is provided in Section 9. As potential impacts and risks from noise emissions to fish and sharks is determined to have a negligible consequence, impacts and risks to commercial fisheries from noise emissions are also considered to be **Negligible (1)**.
Marine mammals Fish and sharks Marine invertebrates Marine turtles	**Auditory Impairment, Permanent Threshold Shift (PTS)** The pulsed sound generated by sonar survey may exceed proposed threshold levels in close proximity to the source. <u>Marine Mammals</u> The criteria set by Southall *et al.* (2007) suggests that to cause an instantaneous injury to cetaceans resulting in a permanent loss in hearing, the sound must exceed 230 dB re 1 µPa (Peak SPL). Received source levels are estimated to drop below this threshold within 2 m of the sound source. Temporary auditory threshold shifts, and avoidance behaviour by cetaceans may extend further afield; sound levels which could induce avoidance behaviour are predicted to be localised, limited to individuals within approximately 500-1000 m of the source based on upper response criteria of 180 dB re 1µPa (Southall et al., 2007). Given the sonar surveys are limited in duration (a matter of hours), any avoidance of the area would be temporary. Impacts to marine mammals are therefore predicted to be **Minor (2)**. <u>Fish</u> Popper et al. (2009) have previously proposed that peak-to-peak SPL (~207 dB re 1 µPa) has the potential to result in a recoverable injury in fish that have high or medium hearing sensitivity. The sound pressure levels produced by the sonar may therefore have the potential to effect fish in the near vicinity. Based on the sound propagation estimates (Table 6 4) sound levels of 207 dB re 1uPa would be limited to within 30 m of the sonar. Behavioural responses are expected to be short-lived, with duration of effect less than or equal to the duration of exposure. For some fish, strong 'startle' responses have been observed at sound levels of 200 to 205 dB re 1µPa, indicating that sounds at or above this level may cause fish to move away from the sound source. Such levels are only expected within approximately 50 to 100 m of the sound source. Other studies (McCauley et al. 2003) have found that active avoidance may occur in some fish species at sound levels of approximately 161–168 dB re 1µPa rms (~186-193 SPLpeak), which may occur within 3 km of the sonar. Whilst fish may initially be startled, moving away from the sound source; once the source moves on fish would be expected to move back into the area. Sonar surveys will be short in duration and hence any small disturbance to fish communities in the area would be negligible from a temporal perspective. Any potential impacts are expected to be limited, with short-term effects to populations in the area. Impacts to fish are therefore predicted to be **Minor (2)**. <u>Marine Invertebrates</u>

	Assuming a potential impact threshold of 202 dB re 1 µPa (peak-to-peak SPL) invertebrates, only those within 50 m of the source might be impacted. Unlike fish, the (relatively slow) motility of invertebrates is unlikely to allow them to avoid the sound propagated from the sonar. However, given the short duration of the sonar surveys, and the reduction in sound levels to below threshold levels over a short distance, only low numbers of invertebrates have the potential to be affected. Potential impacts to invertebrate communities are therefore predicted to be **Minor (2)**. Turtles Using the limited information available, it has been reported that physical injury and/or instantaneous permanent hearing damage to adult turtles is likely to occur at 240 dB re 1 µPa (SVT Engineering Consultants 2009). No supporting literature is available to determine levels of continuous noise that results in threshold hearing loss for marine turtles. Based on the sound levels produced during sonar survey, physical injuries to turtles due to sonar pulses are not expected.
ALARP Decision Context	**A**
Summary of Control Measures	
• Planned maintenance system (PMS) • Adherence to EPBC Regulations 2000 – Part 8 Division 8.1 interacting with cetaceans	

Likelihood	**Unlikely (D)**	**Residual Risk**	Low

6.5 Physical Presence – Seabed Disturbance

Table 6-5 provides a summary of the EIA / ERA for Physical Presence (Seabed Disturbance).

Table 6-5 Physical Presence (Seabed Disturbance) EIA / ERA

Cause of Aspect	During the activity, the MODU will be anchored to the seabed to enable abandonment activities to be undertaken. During the abandonment program, it is expected that the MODU will be positioned at three locations within the BMG PSZ. These locations will be the Basker-A manifold (BAM), the Manta-2a and Basker-6 wells. Some infrastructure will be stored on the seabed until Phase 2 abandonment activities (i.e. SST if not safe to retrieve).
Summary of impact(s)	Seabed disturbance has the potential to impact on receptors, including benthic habitats and assemblages, through: • Smothering and alteration of benthic habitats; and • Localised and temporary increase in turbidity near the seabed.
Consequence Evaluation	
Receptor(s)	**Description of Potential Environmental Impact**
Benthic habitats and fauna	**Smothering and Alteration of benthic habitat** The area of benthic habitat expected to be disturbed by planned activities at each anchoring location is approximately 30 m^2 per anchor (8 anchors in total). Total disturbance area from anchoring is therefore expected to approximately 1,100 m^2 per anchoring location (allowing 30 m^2 for the anchors and 100 m^2 per anchor for chain disturbance) plus an additional area (estimated 15 m^2) for the wet storage of the subsea tree if required. If wet stored (contingency only), there is the potential for seabed scouring as the currents erode sediments around the structure over time. Any impact will be limited to the immediate vicinity of the well locations, and thus the extent of potential impact is considered to be localised. The type of damage that could be sustained by smothering may include destruction of habitat. However, due to the similarity of surrounding habitat, and lack of sensitive benthic habitats, it is expected that recovery is likely. There are minimal pressures on this value and the damage would only occur within a small area. It is expected that any localised impacts from anchoring and wet storage would rapidly recolonise and recover following any disturbance, therefore the potential impact has been determined as **Negligible (1)**. **Localised and temporary increase in turbidity near the seabed** Benthic habitat may be disturbed through the temporary increase in turbidity near the seafloor because of seabed disturbance. Processes which may cause sediment to suspend in the water column are when the anchor and chains are laid down, or picked up, from the seabed; plus any subsequent movement of the anchor chain over the seabed. The mechanical impact from anchoring is too small to create suspension on a hard substrate; and for sandy substrate, the high settling velocity ensures the particles do not remain in suspension for an extended period of time (Ramboll Danmark, 2008). Given the silty sand (i.e. predominantly sand sized particles, with a proportion of finer material) nature of the substrate within the operational area, the area of increased turbidity is likely to temporally and spatially be a very small area, and localised around the disturbance points where anchors or wet-stored equipment sit on the seabed.

	While anchored, the MODU will remain stationary, and therefore no significant sweep (i.e. movement of anchor chain over seabed surface) is expected to occur. The location of the wells within a homogenous seabed area, and lack of sensitive benthic features, means that turbidity resulting from the described activities is expected to result in only temporary and localised impacts or disturbance, therefore the potential impact has been determined as **Negligible (1)**.
ALARP Decision Context	**A**

Summary of Control Measures			
• Undertake mooring analysis • Monitor mooring line tensions • Wet stored infrastructure will be removed in Phase 2 of the abandonment campaign			
Likelihood	**Unlikely (D)**	**Residual Risk**	Low

6.6 Atmospheric Emissions

Table 6-6 provides a summary of the EIA / ERA for Atmospheric Emissions.

Table 6-6 Atmospheric Emissions EIA / ERA

Cause of Aspect	The following activities were identified as having the potential to result in air emissions: • Use of fuel (support vessels and MODU); • Flaring and venting of gas via the liquid/gas separator package during cutting and / or perforation of the production tubing or well casing or during installation of pressure control equipment. Flaring or venting will be undertaken intermittently over a few days. Volumes released are controlled such that only small amounts are released at any given time.
Summary of impact(s)	Generation of atmospheric emissions has the potential to result in: • Chronic effects to sensitive receptors from localised and temporary decrease in air quality; and • Contribution to the global greenhouse gas (GHG) effect.
Consequence Evaluation	
Receptor(s)	**Description of Potential Environmental Impact**
Seabirds Marine megafauna that surface for air (e.g. cetaceans and marine turtles)	**Localised and temporary decrease in air quality from diesel combustion** The use of fuel (specifically marine-grade diesel) to power engines, generators and mobile and fixed plant (e.g., ROV, back-deck crane, generator), and the flaring and venting of natural gas, will result in gaseous emissions of greenhouse gases (GHG). The quantities of atmospheric emissions generated by fuel consumption, and related impacts, will be similar to other vessels and helicopters operating in the South-east Marine Region for both petroleum and non-petroleum activities. Emissions from engines, generators and deck equipment may be toxic, odoriferous or aesthetically unpleasing, and will result in a localised, temporary reduction in air quality. Modelling of nitrogen dioxide (NO_2) emissions from MODU power generation for an offshore project (BP, 2013) indicates that, although emissions will result in a temporary increase in ambient NO_2 concentration, any exposure from these operations would be expected to be below Australian Ambient Air Quality National Environmental Protection (Air Quality) Measures (NEPM) standards. Any exposure from these operations would be expected to be below NEPM standards. Potential receptors above the sea surface within 5 km of the activity that may be exposed to reduced air quality include seabirds and marine megafauna that surface for air (e.g. cetaceans and marine turtles). The operational area is within known foraging BIAs for the Pygmy Blue Whale, and some seabird (e.g. albatross and petrel) species. Emissions will be small in quantity and will dissipate quickly into the surrounding atmosphere, therefore any reduction in air quality will be localised and impacts would be limited. Given the slow release rates and volumes associated with venting and flaring, it is not expected to generate exposures significant enough to result in impacts to any identified environmental receptors. Consequently, the potential impacts and risks from atmospheric emissions are considered to be **Minor (2)** as this type of event may result in localised short-term impacts to species of recognised conservation value, but is not expected to affect local ecosystem functions. Contribution to the global GHG effect

	While these emissions add to the GHG load in the atmosphere, which adds to global warming potential, they are relatively small on a global scale, and temporary, representing an insignificant contribution to overall GHG emissions (DoEE, 2017a). Any exposure from these operations would be expected to be insignificant, therefore no further evaluation of this aspect has been undertaken.
ALARP Decision Context	**A**

Summary of Control Measures			
• Reduced sulphur content fuel • All vessels will comply with Marine Orders – Part 97: Marine Pollution Prevention – Air Pollution (appropriate to vessel class) • Adherence to MARPOL 73/78 Annex VI. • Operation of engines, generators and deck equipment in accordance with manufacturer's instructions and ongoing maintenance to ensure efficient operation			
Likelihood	**Remote (E)**	**Residual Risk**	Low

6.7 Planned Discharge – Cooling Water and Brine

Table 6-7 provides a summary of the EIA / ERA for Planned Discharge – Cooling Water and Brine.

Table 6-7 Planned Discharge (Cooling Water and Brine) EIA / ERA

Cause of Aspect	Seawater is used as a heat exchange medium for cooling machinery engines on vessels. Upon discharge, it will be warmer than the surrounding ambient water and may contain low concentrations of residual biocide if used to control biofouling. Concentrated brine is a waste stream created through the vessels desalination equipment for potable water generation. Brine will also be used, and subsequently discharged, during wellbore clean-up.
Summary of impact(s)	Planned discharge of cooling and brine waters has the potential to result in chronic effects to fauna through: • Increased water temperature; • Increased water salinity; and • Potential chemical toxicity in the water column.
Consequence Evaluation	
Receptor(s)	**Description of Potential Environmental Impact**
Transient marine fauna, including whales, sharks, fish, and reptiles	**Increased Temperature** Modelling of continuous wastewater discharges (including cooling water) found that discharge water temperature decreases quickly as it mixes with the receiving waters (WEL, 2014). Marine mammals and fish passing through the area will be able to actively avoid entrainment in any heated plume (Langford, 1990), and reptiles and sharks would be expected to behave similarly. Acclimation of test organisms at 15, 20 and 25°C allowed them to tolerate temperature increments of 8-9°C without damage (UNEP, 1983). Given the open nature of the receiving environment, the short duration of the activity, and the lack of sensitive environmental receptors, the impact of increased temperature is expected to be **Negligible (1)**. **Potential Chemical Toxicity** Scale inhibitors and biocide used in the heat exchange and desalination process to avoid fouling of pipework are inherently safe at the low dosages used; they are usually consumed in the inhibition process, so there is little or no residual chemical concentration remaining upon discharge. Larger pelagic species are mobile; at worst, it is expected that they would be subjected to very low levels of chemicals for a very short time as they swim near the discharge plume. As transient species, they are not expected to experience any chronic or acute effects. Any impacts from chemical discharge will be localised and short-term. Given the open nature of the receiving environment, the intermittent nature of the activity, and the lack of sensitive environmental receptors, the impact of potential chemical toxicity is expected to be **Minor (2)**.
Pelagic Fish Plankton	**Increased Salinity** Brine water will sink through the water column where it will be rapidly mixed with receiving waters and dispersed by ocean currents. As such, any potential impacts are expected to be limited to the source of the discharge where concentrations are highest.

	Changes in salinity can affect the ecophysiology of marine organisms Most marine species are able to tolerate short-term fluctuations in salinity in the order of 20% to 30% (Walker and McComb, 1990). However, larval stages, which are crucial transition periods for marine species, are known to be more susceptible to impacts of increased salinity (Neuparth, Costa and Costa, 2002). Pelagic species are mobile; it is expected that at worst, they would be subjected to slightly elevated salinity levels (~10-15% higher than seawater) for a very short period which they are expected to be able to tolerate. As such, transient species are not expected to experience chronic or acute effects. Given the open nature of the receiving environment, the short duration of the activity, and the lack of sensitive environmental receptors, the impact of increased salinity is expected to be **Negligible (1)**.		
ALARP Decision Context	**A**		
Summary of Control Measures			
• Planned Maintenance Schedule			
Likelihood	**Remote (E)**	**Residual Risk**	Low

6.8 Planned Discharge – Treated Bilge

Table 6-8 provides a summary of the EIA / ERA for Planned Discharge - Treated Bilge.

Table 6-8 Planned Discharge (Treated Bilge) EIA / ERA

Cause of Aspect	Bilge water consists of water, oily fluids, lubricants, cleaning fluids, and other similar wastes that have accumulated in the lowest part of the vessel / MODU typically from closed deck drainage and machinery spaces. Bilge water is treated onboard the vessel or MODU using the oil water separator (OWS) to reduce any oily residue to below regulated level, before being discharged at surface.		
Summary of impact(s)	A discharge of this material has the potential to result in chronic effects to plankton through: • Potential toxicity in the water column.		
Consequence Evaluation			
Receptor(s)	**Description of Potential Environmental Impact**		
Fish embryo, larvae, and other plankton Species which rely on plankton as a food source	OSPAR (2014) indicates that the predicted no effect concentration (PNEC) for marine organisms exposed to dispersed oil is 70.5 ppb. It should be noted that this PNEC is based upon no observed effect concentrations (NOEC) after exposure to certain concentrations for an extended period that was greater than seven days (OSPAR, 2014). A discharge of treated bilge is non-continuous and infrequent. Modelling by Shell (2009) indicates that upon discharge, hydrocarbon and other chemical concentrations are rapidly diluted and expected to be below PNEC within a relatively short period of time. Given the nature of this discharge, marine fauna most susceptible to toxic impacts are mainly limited to less mobile fish embryo, larvae, and other plankton. There is potential for short-term impacts to species that rely on plankton as a food source. Any impact to prey species would be temporary as the duration of exposure would be limited, and fish larvae and other plankton are expected to rapidly recover as they are known to have high levels of natural mortality and a rapid replacement rate (UNEP, 1985). Consequently, the potential impacts and risks from planned discharge of treated bilge are considered to be localised and short-term, and have been rated as **Minor (2)**.		
ALARP Decision Context	**A**		
Summary of Control Measures			
• Adherance to AMSA Marine Order Part 91 (Marine Pollution Prevention - Oil) which gives effect to parts of MARPOL Annex I. MARPOL is the International Convention for the Prevention of Pollution from Ships • Planned maintenance system			
Likelihood	**Remote (E)**	**Residual Risk**	Low

6.9 Planned Discharge – Sewage and Food Waste

Table 6-9 provides a summary of the EIA / ERA for Planned Discharge - Sewage and Food Waste.

Table 6-9 Planned Discharge (Sewage and Food Waster) EIA / ERA

Cause of Aspect	The use of ablution, laundry and galley facilities by personnel will result in the surface discharge of sewage and grey water. The generation of food waste from feeding personnel will result in the discharge of food waste from the galley.
Summary of impact(s)	A discharge of food waste, sewage and greywater has the potential to result in impacts to marine fauna from: • Temporary and localised reduction in water quality (nutrients and biological oxygen demand [BOD]); and • Changing predator / prey dynamics from increased scavenging behaviours.
Consequence Evaluation	
Receptor(s)	**Description of Potential Environmental Impact**
Transient marine fauna, including whales, sharks, fish and reptiles	**Temporary and localised reduction in water quality (nutrients and BOD)** Monitoring of sewage discharges for another offshore project (WEL, 2014), determined that a 10 m^3 sewage discharge reduced to ~1% of its original concentration within 50 m of the discharge location. Studies into the effects of nutrient enrichment from offshore sewage discharges indicate that the influence of nutrients in open marine areas is much less significant than that experienced in enclosed areas (McIntyre and Johnson, 1975) and suggest that zooplankton composition and distribution in areas associated with sewage dumping grounds are not affected. In addition, regardless of receptor sensitivity to BOD, Black *et al.* (1994) state that BOD of treated effluent is not expected to lead to oxygen depletion in the receiving waters. Consequently, the potential impacts and risks from the planned discharge of sewage and greywater have been evaluated as **Minor (2)**, given this type of event may result in localised short-term impacts to a species of conservation value (seabirds; Pygmy Blue Whale) through impacting their foraging habitat.
Plankton Large pelagic fauna (e.g. marine mammals, fish and seabirds)	**Changing predator / prey dynamics from increased savaging behaviours** The overboard discharge of sewage and macerated food waste creates a localised and temporary food source for scavenging marine fauna or seabirds whose numbers may temporarily increase as a result, thus increasing the food source for predatory species. The rapid consumption of this food waste by scavenging fauna, and physical and microbial breakdown, ensures that the impacts of food waste discharges are insignificant and temporary, and receptors that may potentially be in the water column are not impacted. Plankton communities are not affected by sewage discharges, and thus impacts to the Pygmy Blue Whale (or other fauna) food source and any predator-prey dynamics is not expected to occur. Consequently, the potential impacts and risks from the planned discharge of sewage and greywater have been evaluated as **Minor (2)**, given this type of event may result in localised short-term impacts to a species of conservation value (seabirds; Pygmy Blue Whale) through impacting their foraging habitat.

ALARP Decision Context	**A**		
Summary of Control Measures			
• MARPOL-approved sewage treatment plant (STP) • Food waste macerated (MARPOL Annex V) • Planned Maintenance System			
Likelihood	**Unlikely (D)**	**Residual Risk**	Low

6.10 Planned Discharge – Ballast Water and Biofouling

Table 6-10provides a summary of the EIA / ERA for Planned Discharge - Ballast Water and Biofouling.

Table 6-10 Planned Discharge (Ballast Water and Biofouling) – EIA / ERA

Cause of Aspect	The operation of the MODU and vessels may result in the discharge of ballast water within the operational area. The operation of the MODU and vessels also have the potential to result in biofouling, resulting in the same hazard. Consequently, both biofouling and ballast water discharge are evaluated below.
Summary of impact(s)	Planned discharge of ballast water, or biofouling, has the potential to introduce a marine pest.
Consequence Evaluation	
Receptor(s)	**Description of Potential Environmental Impact**
Benthic Habitat	IMP are likely to have little or no natural competition or predators, thus potentially outcompeting native species for food or space, preying on native species, or changing the nature of the environment. 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. For example, the introduction of the Northern Pacific Seastar (*Asterias amurensis*) in Victorian and Tasmanian waters was linked to a decline in scallop fisheries (DSE, 2004). Marine pests can also damage marine and industrial infrastructure, such as encrusting jetties and marinas or blocking industrial water intake pipes. By building up on vessel hulls, they can slow the vessels down and increase fuel consumption. The benthic habitat within the operational area is characterised by a soft sediment and shell/rubble seabed, infauna communities, and sparse epibenthic communities (e.g. sponges). Areas of higher value or sensitivity are located further afield (e.g. it is approximately 50 km to Beware Reef Marine Sanctuary, 75 km to Point Hicks Marine National Park, and 130 km to the East Gippsland AMP). Once established, some pests can be difficult to eradicate (Hewitt *et al.,* 2002) and therefore there is the potential for a long-term or persistent change in habitat structure. Successful colonisation in the recipient region would be difficult given the nature of the benthic habitats near the operational area (i.e. predominantly bare sands with patchy occurrences of hard substrate), and lack of light due to deep waters (i.e. >135 m). If an IMP was introduced, and if it did colonise an area, it is expected that any colony would remain fragmented and isolated, and only within the vicinity of the wells (i.e. it would not be able to propagate to nearshore environments, and protected marine areas present in the wider region). Therefore, there is the potential for a localised, but irreversible, impact to habitat resulting in a **Moderate (4)** consequence.
ALARP Decision Context	**B**
Summary of Control Measures	

• Maritime Arrivals Reporting System (MARS)
• Adherence to Australian Ballast Water Management Requirements (version 7; DAWR, 2017), including:
  ○ Ballast Water Management Plan
  ○ Report ballast water discharges
  ○ Maintain a ballast water record system
• Anti-fouling certificate
• Biofouling management plan
• Biofouling record book			

Likelihood	**Possible (C)**	**Residual Risk**	Medium

6.11 Operational Discharges – Subsea

Table 6-11 provides a summary of the EIA / ERA for Operational Discharges - Subsea.

Table 6-11 Operational Discharge (Subsea) – EIA / ERA

Cause of Aspect	The following activities have been identified as resulting in subsea discharges: • Remove Tree Cap from the SST • Install Pressure Control Equipment • Remove pressure control equipment from SST • Disconnect the flowlines • Remove SST • Install and pressure test BOP • Cementing
Summary of impact(s)	A planned discharge of various fluids during well abandonment activities has the potential to result in chronic and acute impacts to marine fauna via: • Potential chemical toxicity • Localised smothering and increased turbidity • Localised and temporary decrease in water quality
Consequence Evaluation	
Receptor(s)	**Description of Potential Environmental Impact**
Soft sediment, infauna communities, and sparse epibiotic communities Transient marine fauna, including whales, sharks, fish, and reptiles	**Chemical Discharge** All chemicals used and discharged will be assessed using the Cooper Energy Offshore Environmental Chemical Assessment Process (COE-MS-RCP-0042) which uses the CHARM OCNS ranking in conjunction with toxicity, biodegradation and bioaccumulation data to determine potential impacts to the environment and acceptability of planned discharges. Little to no impact is expected on benthic fauna at the release location given the low toxicity, low bioaccumulation and biodegradability characteristics of the proposed chemical discharges, and the dispersion characteristics of the release. For seabed invertebrates present near the wellhead, it is possible that low-level concentrations of chemical may be present on a short-term and episodic basis, however given the low toxicity of the chemicals, the low frequency and short-term nature of the exposure, **Negligible (1)** impacts are expected. For mobile demersal and pelagic species which may be present at the wellheads during the activity, given the localised and short-term nature of the discharge, the low toxicity and low-frequency nature of the discharge and the species mobility which limits exposure, the environmental impact is expected to have a **Negligible (1)** impact to these species. **Gas** The main concern regarding a gas (methane) release is the possibility that the action of methane-consuming microbes (methanotrophic bacteria) could exhaust oxygen in the water column. As gas is positively buoyant, upon release it will rise through the water column causing the small volume to rapidly disperse and dilute. Consequently, receptors exposed would be limited to transient marine fauna. Based upon the expected volumes (in the order of 0.0001 m^3), to transient marine fauna is not expected to occur at concentrations that could feasibly result in an impact. Thus, this release has not been discussed further. **Flowlines (Inhibited Fluids)**

	The density of fluids that are currently within the flowlines is affected by temperature and salinity. The flowlines comprise depressurised inhibited water, expected to be at ambient temperature. The system is depressurised prior to flowline disconnection. Once disconnected from the SST, as there is no pressure or temperature differential; hydraulic exchange between the flowlines and ocean will not result in large plume/ release but expected to result in slow leaching / fluid exchange over a period of time. This will cause an incidental reduction in water quality around the end of the flowlines. Given the open nature of the receiving environment, the intermittent nature of the activity, and the lack of sensitive features that would result in sedentary fauna behaviour, this impact has not been evaluated further. **Flowlines (Diesel)** Diesel is less dense than seawater, and as such will rise through the water column. During this rise, some of the diesel may become entrained and start to naturally biodegrade. Any volume that reaches the surface, is expected to disperse quickly. Evaporation becomes the dominant weathering process at the surface, however additional entrainment is also possible due to the effects of surface currents and waves. Assuming all (0.1 m^3) diesel reaches the surface, estimates from ADIOS modelling indicates that for a larger volume (0.3 m^3 – which is the minimum ADIOS volume input) no diesel is expected to remain on the surface within 24 hours. While diesel can be toxic to marine flora and fauna (see discussion on MDO in Section 6.17), the small volume and short exposure associated with the possible release from PS-B6 is considered to have a **Negligible (1)** impact.
ALARP Decision Context	**A**
Summary of Control Measures	
• Cooper Energy Offshore Environment Chemical Assessment Process (COE-MS-RCP-0042) • Capping of PS-B6 flowline	

Likelihood	**Unlikely (D)**	**Residual Risk**	Low

6.12 Operational Discharges – Surface

Table 6-12 provides a summary of the EIA / ERA for Operational Discharge - Surface.

Table 6-12 Operational Discharge (Surface) – EIA / ERA

Cause of Aspect	The following activities have been identified as resulting in surface discharges: • Isolate the reservoir (deep set slick line plug) • Cut / Perforate production tubing • Install cement plug • Install permanent reservoir barrier (wells with deep control lines) • Perforate the well casing • Cement annulus between production and surface casing • Set surface plug
Summary of impact(s)	A planned discharge of fluid during well abandonment activities has the potential to result in chronic and acute impacts to marine fauna via: • Potential toxicity; and • Increased turbidity.
Consequence Evaluation	
Receptor(s)	**Description of Potential Environmental Impact**
Whales, sharks, fish and plankton	**Toxicity** All chemicals used and discharged will be assessed using the Cooper Energy Offshore Environmental Chemical Assessment Process (COE-MS-RCP-0042) which uses the CHARM OCNS ranking in conjunction with toxicity, biodegradation and bioaccumulation data to determine potential impacts to the environment and acceptability of planned discharges. Based upon the offshore location of the activity with no identified obstructions and open ocean currents, potential exposures are expected to be limited to the operational area. Given the infrequent nature of the discharge, it is expected that any exposure will be limited in duration with rapid dilution and dispersion experienced. Consequently, the potential impacts and risks from the operational discharges at the surface are considered to be **Negligible (1)**, due to the localised and short-term nature of the discharge, the low toxicity and low-frequency nature of the discharge and the species mobility which limits exposure.
Fish Plankton	**Turbidity** The discharge expected to cause turbidity are cement-contaminated seawater. Cementing fluids are not continually discharged to the marine environment, however, volumes of a cement/water mix will be released to surface waters during various stages of the well abandonment process. The cement particles will disperse under action of waves and currents, and eventually settle out of the water column; the initial discharge will generate a downwards plume, increasing the initial mixing of receiving waters. Given the lack of suitable benthic habitat features within the operational area, any fish species in the area are expected to be of a transient nature only. In addition, while commercial fisheries have management areas that overlap with the operational area, active fishing effort within this area is expected to be minimal. Jenkins and McKinnon (2006) reported that levels of suspended sediments greater than 500 mg/L are likely to produce a measurable impact upon larvae of most fish species, and that levels of 100 mg/L will affect the larvae of some species if exposed for periods

	greater than 96 hours. Jenkins and McKinnon (2006) also indicated that levels of 100 mg/L may affect the larvae of several marine invertebrate species and that fish eggs and larvae are more vulnerable to suspended sediments than older life stages. Modelling of the release of 18 m^3 of cement wash water by de Campos *et al.* (2017) indicate an ultimate average deposition of 0.05 mg/m^2 of material on the seabed; with particulate matter deposited within the three-day simulation period. Given the low concentration of the deposition of the material, it is therefore expected that the in-water suspended solids (i.e. turbidity) created by the discharge is not likely to be high for an extended period of time, or over a wide area; even when scaling this volume up to the expected discharge for activities under the EP. Modelling of larger cement discharges (approximately 78 m^3 over a one-hour period) has also previously been undertaken for BP (2013). Results of this modelling showed that within two hours suspended solid concentrations ranged between 5-50 mg/L within the extent of the plume (approximately 150 m horizontal and 10 m vertical); and by four hours post-discharge, that concentrations were <5 mg/L. Given the estimated discharge rate for activities (including alternate/contingency volumes) under the EP are similar to the total volume estimated by BP, and noting that the BMG discharges would not be released in one continuous volume, it is therefore expected that the concentration of suspended sediments expected in the vicinity of BMG wells would be not be higher than that predicted in the above modelling by BP. Neither the modelling by de Campos *et al* (2017) or BP (2013) suggest that suspended solids concentrations from a discharge of the cement will be at or near levels required to cause an effect on fish or invertebrate larvae, i.e. predicted levels were well below a 96-hr exposure at 100 mg/L, or instantaneous 500 mg/L exposure Based upon the estimated discharge volumes identified for this program, and the potential impact thresholds as identified by McKinnon (2006), a discharge of cement from the surface is expected to result in a very short exposure of increased turbidity such that potential impacts would be expected to be localised (i.e. within 150m) and short-term (a few hours), and consequences are considered to be **Negligible (1)**.
ALARP Decision Context	**A**
Summary of Control Measures	
• Cooper Energy Offshore Environment Chemical Assessment Process (COE-MS-RCP-0042) • OIW treatment: gas / liquid separator • Cementing procedures	

Likelihood	**Unlikely (D)**	**Residual Risk**	Low

6.13 Operational Discharges – Mill Cuttings and Fluids

Table 6-13 provides a summary of the environmental impact assessment (EIA) for Operational Discharge – Milling Cuttings and Fluid.

Table 6-13 Operational Discharge (Milling Cuttings and Fluids) – EIA / ERA

Cause of Aspect	Well abandonment activities may require milling of existing well casing prior to installation of abandonment plugs. For each well where contingency milling operations are required, these activities will result in the intermittent release of WBM.		
Summary of impact(s)	A discharge of WBM (already separated from mill cuttings) has the potential to result in effects to ecological and social receptors through: • Potential chemical toxicity and oxygen depletion impacts to flora and fauna in the water column and sediment.		
Consequence Evaluation			
Receptor(s)	**Description of Potential Environmental Impact**		
Pelagic fish Plankton	Neff (2005) states that in well-mixed ocean waters (as is likely to be the case within the drilling area), drilling mud is diluted by more than 100-fold within 10 m of the discharge point, indicating that, following dilution, concentrations would be well below acute impact levels. This is further demonstrated by Melton et al. (Ref. 86), who used modelling to demonstrate that WBM within the water column fall below the United States Environment Protection Agency (USEPA) minimum 96-hour LC50 for drilling fluids within the first few metres of a surface discharge point. Neff (2010) explains that the lack of toxicity and low bioaccumulation potential of the drilling muds means that the effects of the discharges are highly localised and are not expected to spread through the food web. Consequently, the potential impacts and risks from chemical toxicity are considered to be **Minor (2)** as this type of event may result in localised short-term impacts to species of recognised conservation value, but is not expected to affect local ecosystem function.		
ALARP Decision Context	**A**		
Summary of Control Measures			
• Cooper Energy Offshore Environment Chemical Assessment Process (COE-MS-RCP-0042) • Use of water based drill fluids only • Swarf Handling Until			
Likelihood	**Unlikely (D)**	**Residual Risk**	Low

6.14 Accidental Release – Waste

Table 6-14 provides a summary of the EIA / ERA for Accidental Release - Waste.

Table 6-14 Accidental Release (Waster) – EIA / ERA

Cause of Aspect	The handling and storage of materials and waste on board MODUs and vessels has the potential for accidental over-boarding of hazardous/non-hazardous materials and waste.		
Summary of impact(s)	The potential environmental impacts associated with the accidental release of waste are: • Marine pollution (litter and a temporary and localised reduction in water quality); • Injury and entanglement of marine fauna and seabirds; and • Smothering or pollution of benthic habitats.		
Consequence Evaluation			
Receptor(s)	**Description of Potential Environmental Impact**		
Plankton and pelagic fish Benthic Habitats	**Hazardous Materials and Waste** Hazardous materials and wastes released to the sea cause pollution and contamination, with either direct or indirect effects on marine organisms. For example, chemical spills can impact on marine life from plankton to pelagic fish communities, causing physiological damage through ingestion or absorption through the skin. Impacts from an accidental release would be limited to the immediate area surrounding the release, prior to the dilution of the chemical with the surrounding seawater. In an open ocean environment such as the operational area, it is expected that any minor release would be rapidly diluted and dispersed, and thus temporary and localised. Solid hazardous materials, such as paint cans containing paint residue, batteries and so forth, would settle on the seabed if dropped overboard. Over time, this may 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. Given the size of materials release it is expected that only very localised impacts to benthic habitats within the operational area would be affected and unlikely to contribute to a significant loss of benthic habitat or species diversity.		
ALARP Decision Context	**A**		
Summary of Control Measures			

• Adherence to MARPOL Annex V, including:
  ○ Garbage / waste management plan
  ○ Garbage record book
• Waste management training / induction			

Likelihood	**Unlikely (D)**	**Residual Risk**	Low

6.15 Accidental Release – LOC (Minor)

Table 6-15 provides a summary of the EIA / ERA for Accidental Release – Loss of Containment (Minor).

Table 6-15 Accidental Release (LOC – Minor) – EIA / ERA

Cause of Aspect	The operation of the MODU and support vessels includes handling, use and transfer of hazardous materials, and consequently the following pathways were identified as potentially leading to a loss of containment (LOC) event: • Use, handling and transfer of hazardous materials and chemicals on board; • Hydraulic line failure from equipment; and • Transfer of hazardous materials between the MODU and Vessel (refuelling).		
Summary of impact(s)	A minor LOC has the potential to result in chronic and acute impacts to marine fauna via: • Potential toxicity.		
Consequence Evaluation			
Receptor(s)	**Description of Potential Environmental Impact**		
Marine Fauna Pelagic species	A loss of 50 m^3 of diesel or chemicals upon release would be expected to result in changes to water quality in both surface waters and the pelagic environment. As evaluated in Section 6.17, the potential impacts associated with a larger loss of diesel fuel were determined to be **Minor (2)**, thus impacts from these types of events are not expected to be any larger (and thus have not been considered further).		
ALARP Decision Context	**A**		
Summary of Control Measures			
• Bulk transfer process • Hoses and connections • Planned Maintenance Schedule • Development and adherence to vessel SMPEP (or equivalent) • Accidental release / waste management training / induction			
Likelihood	**Unlikely (D)**	**Residual Risk**	Low

6.16 Accidental Release – LOC (BMG Infrastructure)

Table 6-16 provides a summary of the EIA / ERA for Accidental Release – LOC (BMG Infrastructure).

Table 6-16 Accidental Release (LOC – BMG Infrastructure) – EIA / ERA

Cause of Aspect	Anchoring of the MODU and transferring materials to and from the MODU (and resulting dropped objects) were identified as the pathways in which interaction with existing subsea infrastructure may lead to a LOC event.		
Summary of impact(s)	A loss of containment event from interaction with BMG infrastructure has the potential to result in chronic and acute impacts to marine fauna via: • Localised and temporary decrease in water quality.		
Consequence Evaluation			
Receptor(s)	**Description of Potential Environmental Impact**		
Marine Fauna Pelagic species	The wells have been shut in with the reservoir isolated by a minimum of two barriers, and the contents of the BMG infrastructure were flushed and inhibited in 2012. Consequently, if there is a LOC event resulting from interacting with BMG Infrastructure the loss would be limited to inhibited seawater with ambient temperature and salinity. As the system is depressurised any impact and risk is expected to be similar to that described in Section 6.11 (Operational Discharges – Subsea, which described the potential consequence as being **Minor (2)**.		
ALARP Decision Context	**A**		
Summary of Control Measures			
• NOPSEMA accepted safety case • Mooring analysis			
Likelihood	**Remote (E)**	**Residual Risk**	Low

6.17 Accidental Release – LOC (Vessel Collision)

Table 6-17 provides a summary of the EIA / ERA for Accidental Release – LOC (Vessel Collision).

Table 6-17 Accidental Release – LOC (Vessel Collision) EIA / ERA

Cause of Aspect	The following activities have the potential to result in a spill of marine diesel oil (MDO): • A collision between the support vessel and the MODU or a third-party vessel that results in a tank rupture and MDO loss.
Summary of impact(s)	A vessel collision event has the potential to expose ecological and social receptors to different hydrocarbon expressions and concentrations. Hydrocarbon expressions include: • Surface; • In water (entrained only). These exposures have the potential to result in potential impacts directly via: • Potential toxicity effects / physical oiling • Potential for reduction in intrinsic values / visual aesthetics. Or indirectly as a result of the potential impacts noted above, there is the potential to result in • Potential damage to commercial businesses.
Consequence Evaluation	
Receptor(s)	**Description of Potential Environmental Impact**
Seabirds and Shorebirds	When first released, the MDO has higher toxicity due to the presence of volatile components. Individual birds making contact close to the spill source at the time of the spill (i.e. out to 38 km for a significant offshore MDO spill) may suffer impacts however it is unlikely that a large number of birds will be affected. Seabirds rafting, resting, diving or feeding at sea have the potential to come into contact with localised areas of sheen >10 µm and may experience lethal surface thresholds, however the area of contact is localised and temporary (~36 hrs). Contact with areas of high hydrocarbon exposure is highly unlikely. As such, acute or chronic toxicity impacts (death or long-term poor health) to small numbers of birds are possible, however this is not considered significant at a population level. Consequently, the potential impacts and risks to seabirds from a vessel collision event are considered to be **Minor (2)**, as they could be expected to result in localised short-term impacts to species/habitats of recognised conservation value but not affecting local ecosystem functioning.
Marine Turtles	Marine turtles are vulnerable to the effects of oil at all life stages. Marine turtles can be exposed to surface oil externally (i.e. swimming through oil slicks) or internally (i.e. swallowing the oil). Ingested oil can harm internal organs and digestive function. Oil on their bodies can cause skin irritation and affect breathing. The number of marine turtles that may be exposed is expected to be low due to the location of the hydrocarbon above the relevant threshold, and the limited duration of exposure above the threshold, before the hydrocarbon weathered further. Therefore, potential impact would be limited to individuals, with population impacts not anticipated.

	Consequently, the potential impacts and risks to marine turtles are considered to be **Negligible (1),** as they could be expected to result in localised short-term impacts to species/habitats of recognised conservation value but not affecting local ecosystem functioning.
Pinnipeds	Exposure to surface oil can result in skin and eye irritations and disruptions to thermal regulation. Fur seals are particularly vulnerable to hypothermia from oiling of their fur – however the characteristics of MDO mean this is not likely. The number of pinnipeds exposed is expected to be low, with population impacts not anticipated. Due to the rapid weathering of MDO, the potential exposure time is short. Consequently, the potential impacts and risks to pinnipeds are considered to be **Negligible (1)**, as they could be expected to result in localised short-term impacts to species/habitats of recognised conservation value but not affecting local ecosystem functioning.
Cetaceans	Physical contact by individual whales is therefore unlikely to lead to any long-term impacts. Given the mobility of whales, only a small proportion of the migrating population would surface in the affected areas, resulting in short-term and localised consequences, with no long-term population viability effects. If whales are foraging at the time of the spill, a greater number of individuals may be present in the plume, however due to the short duration of the surface exposure above the impact threshold (36 hours), this is not likely. Consequently, the potential impacts and risks to cetaceans are considered to be **Negligible (1),** as they could be expected to result in localised short-term impacts to species/habitats of recognised conservation value but not affecting local ecosystem functioning.
Natural Systems	Relatively low concentrations of hydrocarbon are toxic to plankton. Plankton risk exposure through ingestion, inhalation and dermal contact. Plankton are numerous and widespread, and therefore, an oil spill in any one location is unlikely to have long-lasting impacts on plankton populations at a regional level. Once background water quality conditions have re-established, the plankton community may take weeks to months to recover (ITOPF, 2011f), allowing for seasonal influences on the assemblage characteristics. Consequently, the potential impacts to plankton are considered to be **Minor (2)**, as they could be expected to cause short-term and localised impacts, but not affecting local ecosystem functioning.
Human Systems	Visible surface hydrocarbons (i.e. a rainbow sheen) have the potential to reduce the visual amenity of the area for tourism, and discourage recreational activities. However, the relatively short duration, and distance from shore means there may be short-term and localised consequences, which are ranked as **Minor (2)**.
Heritage	Visible surface hydrocarbons (i.e. a rainbow sheen) have the potential to reduce the visual amenity of known heritage sites. The relatively short duration, and distance from shore means there may be short-term and localised consequences, which are ranked as **Minor (2)**.
Coral	Exposure of entrained hydrocarbons to shallow subtidal corals has the potential to result in lethal or sublethal toxic effects, resulting in acute impacts or death at moderate to high exposure thresholds (Shigenaka, 2001). Contact with corals may lead to reduced growth rates, tissue decomposition, and poor resistance and mortality of sections of reef (NOAA, 2010).

	However, given the lack of hard coral reef formations, and the sporadic cover of soft corals in mixed reef communities, such impacts are considered to be limited to isolated corals. Consequently, the potential impacts to corals are considered to be **Minor (2)**, as they could be expected to result in localised short-term impacts to species/habitats of recognised conservation value, but not affecting local ecosystem functioning.
Macroalgae	Reported toxic responses to oils have included a variety of physiological changes to enzyme systems, photosynthesis, respiration, and nucleic acid synthesis (Lewis & Pryor 2013). A review of field studies conducted after spill events by Connell *et al* (1981) indicated a high degree of variability in the level of impact, but in all instances, the algae appeared to be able to recover rapidly from even very heavy oiling. However, given the lack of dominant macroalgae habitat, such impacts are considered to be limited. Consequently, the potential impacts to macroalgae are considered to be **Minor (2)**, as they could be expected to result in localised short-term impacts to species/habitats of recognised conservation value, but not affecting local ecosystem functioning.
Seagrass	There is the potential that exposure could result in sub-lethal impacts, more so than lethal impacts, possibly because much of seagrasses' biomass is underground in their rhizomes (Zieman *et al.,* 1984). Consequently, the potential impacts to seagrass are considered to be **Minor (2)**, as they could be expected to result in localised short-term impacts to species/habitats of recognised conservation value, but not affecting local ecosystem functioning.
Plankton	Relatively low concentrations of hydrocarbon are toxic to both plankton [(including zooplankton and ichthyoplankton (fish eggs and larvae)]. Plankton risk exposure through ingestion, inhalation and dermal contact. Plankton are numerous and widespread, but do act as the basis for the marine food web, meaning that an oil spill in any one location is unlikely to have long-lasting impacts on plankton populations at a regional level. Once background water quality conditions have re-established, the plankton community may take weeks to months to recover (ITOPF, 2011f), allowing for seasonal influences on the assemblage characteristics. Consequently, the potential impacts to plankton are considered to be **Minor (2)**, as they could be expected to cause short-term and localised impacts, but not affecting local ecosystem functioning.
Invertebrates	Acute or chronic exposure through contact and/or ingestion can result in toxicological risks. However, the presence of an exoskeleton (e.g. crustaceans) reduces the impact of hydrocarbon absorption through the surface membrane. Invertebrates with no exoskeleton and larval forms may be more prone to impacts. Localised impacts to larval stages may occur which could impact on population recruitment that year. Consequently, the potential impacts and risks to commercially-fished invertebrates from an MDO LOC are considered to be **Minor (2)**, as they could be expected to result in localised short-term impacts to species/habitats of recognised conservation value but not affecting local ecosystem functioning.
Fish and sharks	Pelagic free-swimming fish and sharks are unlikely to suffer long-term damage from oil spill exposure because dissolved/entrained hydrocarbons in water are not expected to be sufficient to cause harm (ITOPF, 2010). Subsurface hydrocarbons could potentially result in acute exposure to marine biota such as juvenile fish, larvae, and planktonic organisms, although impacts are not expected cause population-level impacts.

	There is the potential for localised and short-term impacts to fish communities; the consequences are ranked as **Minor (2)**. Impacts on eggs and larvae entrained in the upper water column are not expected to be significant given the temporary period of water quality impairment, and the limited areal extent of the spill. As egg/larvae dispersal is widely distributed in the upper layers of the water column it is expected that current induced drift will rapidly replace any oil affected populations. Impact is assessed as temporary and localised and are considered **Minor (2)**.
Pinnipeds	Exposure to low/moderate effects level hydrocarbons in the water column or consumption of prey affected by the oil may cause sub-lethal impacts to pinnipeds, however given the temporary and localised nature of the spill, their widespread nature, the low-level exposure zones and rapid loss of the volatile components of MDO in choppy and windy seas (such as that of the EMBA), impacts at a population level are considered very unlikely. Impact is assessed as temporary and localised and are considered **Minor (2)**.
Cetaceans	Cetacean exposure to entrained hydrocarbons can result in physical coating as well as ingestion (Geraci and St Aubin, 1988). Such impacts are associated with 'fresh' hydrocarbon; the risk of impact declines rapidly as the MDO weathers. The potential for environmental impacts would be limited to a relatively short period following the release and would need to coincide with migration to result in exposure to a large number of individuals. However, such exposure is not anticipated to result in long-term population viability effects. A proportion of the migrating population of whales could be affected for a single migration event, which could result in temporary and localised consequences, which are ranked as **Negligible (1)**.
Commonwealth Areas, Parks and Reserves	Relatively low concentrations of hydrocarbon are toxic to plankton. Plankton risk exposure through ingestion, inhalation and dermal contact. Plankton are numerous and widespread, and therefore, an oil spill in any one location is unlikely to have long-lasting impacts on plankton populations at a regional level. Once background water quality conditions have re-established, the plankton community may take weeks to months to recover (ITOPF, 2011f), allowing for seasonal influences on the assemblage characteristics. Consequently, the potential impacts to plankton are considered to be **Minor (2)**, as they could be expected to cause short-term and localised impacts, but not affecting local ecosystem functioning.
State Marine Protected areas	The consequence to protected marine areas is assessed as localised and short term, and ranked as Minor (2).
Human Systems	Any acute impacts are expected to be limited to small numbers of juvenile fish, larvae, and planktonic organisms, which are not expected to affect population viability or recruitment. Impacts from entrained exposure are unlikely to manifest at a fish population viability level. Any exclusion zone established would be limited to the immediate vicinity of the release point, and due to the rapid weathering of MDO would only be in place 1-2 days after release, therefore physical displacement to vessels is unlikely to be a significant impact. The consequence to commercial fisheries is assessed as localised and short term, and ranked as **Minor (2)**.
Recreation and Tourism	Any impact to receptors that provide nature-based tourism features (e.g. whales) may cause a subsequent negative impact to recreation and tourism activities. However, the

	relatively short duration, and distance from shore means there may be short-term and localised consequences, which are ranked as **Minor (2)**.		
ALARP Decision Context	**A**		
Summary of Control Measures			
• Adherence to AMSA Marine Order Part 3 (Seagoing Qualifications) • Adherence to AMSA Marine Order Part 30 (Prevention of Collisions) • Development and adherence to vessel SMPEP (or equivalent) • Development and adherence to Cooper Energy's OPEP • Development and adherence to Cooper Energy's OSMP • Use of pre-start notifications including Notice to Mariners, as required under the *Navigation Act 2014*			
Likelihood	**Unlikely (D)**	**Residual Risk**	Low

6.18 Accidental Release – LOWC (Loss of Well Control)

Table 6-18 provides a summary of the EIA / ERA for Accidental Release - LOWC.

Table 6-18 Accidental Release – LOWC event EIA / ERA

Cause of Aspect	A loss of well control (LOWC) event has the potential to be caused by: • Temporary abandonment of the well (during the disconnection of BMG infield flowlines and removal of the subsea tree).
Summary of impact(s)	A LOWC event has the potential to expose ecological and social receptors to different hydrocarbon expressions and concentrations. Hydrocarbon expressions include: • Surface; • In-water; and • Shoreline. These expressions have the potential to result in potential impacts directly via: • Potential toxicity effects / physical oiling • Potential for reduction in intrinsic values / visual aesthetics. Or indirectly as a result of the potential impacts noted above, there is the potential to result in: • Potential damage to commercial businesses and tourism and recreation.
Consequence Evaluation	
Receptor(s)	**Description of Potential Environmental Impact**
Seabirds and Shorebirds	Birds foraging or resting at sea have the potential to directly interact with oil on the sea surface. Direct contact with hydrocarbons can foul feathers, which may result in hypothermia due to a reduction in the ability of the bird to thermo-regulate and impair water-proofing. Direct contact with surface hydrocarbons may also result in dehydration, drowning and starvation. Oiling of birds can also suffer from damage to external tissues, including skin and eyes, as well as internal tissue irritation in their lungs and stomachs. Toxic effects may result where the oil is ingested as the bird attempts to preen its feathers, or via consumption of oil-affected prey. Fresh crude has been shown to be more toxic than weathered crude to birds. Due to the solidified tar balls/waxy flake-like nature of the oil, minimal impact from direct oiling is expected, and therefore this is not considered a significant impact at a population level. Consequently, the potential impacts and risks to seabirds from a LOWC event are considered to be **Minor (2)**, as they could be expected to result in localised short-term impacts to species/habitats of recognised conservation value but not affecting local ecosystem functioning.
Marine Reptiles	Marine turtles are vulnerable to the effects of oil at all life stages. Marine turtles can be exposed to surface oil externally (i.e. swimming through oil slicks) or internally (i.e. swallowing the oil). Ingested oil can harm internal organs and digestive function. Oil on their bodies can cause skin irritation and affect breathing. Due to the solidified tar balls/waxy flake-like nature of the oil, minimal impact from direct oiling is expected, and therefore this is not considered a significant impact at a population level. Consequently, the potential impacts and risks to marine turtles from a LOWC event are considered to be **Minor (2)**, as they could be expected to result in localised short-term

	impacts to species/habitats of recognised conservation value but not affecting local ecosystem functioning.
Marine Mammals (Pinnipeds)	Pinnipeds are vulnerable to sea surface exposures given they spend much of their time on or near the surface of the water, as they need to surface regularly to breathe. Pinnipeds have high site fidelity and can be less likely to exhibit avoidance behaviours, thus staying near established colonies and haul-out areas. Exposure to surface oil can result in skin and eye irritations and disruptions to thermal regulation. Fur seals are particularly vulnerable to hypothermia from oiling of their fur. Exposure to oil may also results in physiological effects from toxic fume inhalation, biological impacts from ingestion of the oil, and may reduce reproduction levels. Ingested hydrocarbons can irritate or destroy epithelial cells that line the stomach and intestine, thereby affecting motility, digestion and absorption. However, pinnipeds have been found to have the enzyme systems necessary to convert absorbed hydrocarbons into polar metabolites which can be excreted in urine (Engelhardt, 1982; Addison & Brodie, 1984; Addison et al., 1986). Due to the solidified tar balls/waxy flake-like nature of the oil, minimal impact from direct oiling is expected, and therefore this is not considered a significant impact at a population level. Consequently, the potential impacts and risks to pinnipeds from a LOWC event are considered to be **Minor (2)**, as they could be expected to result in localised short-term impacts to species/habitats of recognised conservation value but not affecting local ecosystem functioning.
Marine Mammals (Cetaceans)	Cetaceans can be exposed to the chemicals in oil through: internal exposure by consuming oil or contaminated prey; inhaling volatile oil compounds when surfacing to breathe; external exposure by swimming through oil and having oil directly on the skin and body; and maternal transfer of contaminants to embryos (NRDA, 2012). Baleen whales (e.g. Blue Whales) are more susceptible to ingestion of surface oil as they feed by skimming the surface; whereas, toothed whales and dolphins are less susceptible as they feed at depth. Evidence suggests that many cetacean species are unlikely to detect and avoid spilled oil (Harvey & Dahlheim 1994, Matkin et al. 2008). However, as highly mobile species, it is not expected that these animals will be constantly exposed to concentrations of hydrocarbons for continuous durations (e.g. >96 hours) that would lead to chronic effects. Note also, many marine mammals appear to have the necessary liver enzymes to metabolise hydrocarbons and excrete them as polar derivatives Due to the solidified tar balls/waxy flake-like nature of the oil, minimal impact from direct oiling is expected, and therefore this is not considered a significant impact at a population level. Consequently, the potential impacts and risks to cetaceans are considered to be **Minor (2)**, as they could be expected to result in localised short-term impacts to species/habitats of recognised conservation value but not affecting local ecosystem functioning.
Commonwealth Areas, Parks and Reserves	Based on the potential risks of key receptors (i.e. seabirds, cetaceans), the potential impacts and risks to Commonwealth Marine Parks are considered to be **Minor (2)**, as they could be expected to result in localised short-term impacts to species/habitats of recognised conservation value but not affecting local ecosystem functioning. Relatively low concentrations of hydrocarbon are toxic to plankton. Plankton risk exposure through ingestion, inhalation and dermal contact. Refer also to:

	• Seabirds and Shorebirds; and Marine mammals (Cetaceans).
State Marine Protected Areas	Based on the potential risks of key receptors (i.e. seabirds, cetaceans), the potential impacts and risks to Commonwealth Marine Parks are considered to be **Minor (2)**, as they could be expected to result in localised short-term impacts to species/habitats of recognised conservation value but not affecting local ecosystem functioning. Marine mammals (Cetaceans).
Coastal Settlements	Visible surface hydrocarbons have the potential to reduce the visual amenity of the area for public use and activities. Given the nature of the oil, it is expected to remain in solidified tar balls/waxy flake-like state; and in most cases is not expected to the visible from shore. Consequently, the potential impacts and risks to coastal settlements from a LOWC event are considered to be **Minor (2)** as they could be expected to result in localised short-term impacts
Recreation and Tourism	Visible surface hydrocarbons have the potential to reduce the visual amenity of the area for tourism, and discourage recreational activities. It is expected that the majority of these activities are undertaken in coastal waters, not at large distances offshore. Given the nature of the oil, it is expected to remain in solidified tar balls/waxy flake-like state; and in most cases is not expected to the visible from shore. Consequently, the potential impacts and risks to recreation and tourism from a LOWC event are considered to be **Minor (2)** as they could be expected to result in localised short-term impacts
Heritage	Visible surface hydrocarbons have the potential to reduce the visual amenity of known heritage sites along the coast. Given the nature of the oil, it is expected to remain in solidified tar balls/waxy flake-like state; and in most cases is not expected to the visible from shore. Consequently, the potential impacts and risks to heritage from a LOWC event are considered to be **Minor (2)** as they could be expected to result in localised short-term impacts
Seagrass	Seagrasses can exhibit lethal and sub-lethal effects from direct contact (i.e. smothering), or indirect contact (e.g. chemical update from oil affected sediments or through plant membranes). Once internal, the toxic components of the oil tend to accumulate in the chloroplasts, therefore affecting photosynthesis abilities. Studies report that the phytotoxic effect of petroleum oil on seagrasses can lead to a range of sub-lethal responses including reduced growth rates (Howard & Edgar, 1994), bleaching, decrease in the density of shoots, and reduced flowering success (den Hartog & Jacobs, 1980; Dean *et al.,* 1998). Exposure does not always induce toxic effects, with variability in impact in both laboratory studies and actual spill events. There is the potential that exposure could result in sub-lethal impacts, more so than lethal impacts, possibly because much of seagrasses biomass is underground in their rhizomes (Zieman *et al.* 1984). Due to the nature of the oil, only a small percentage of the oil will become entrained or dissolved components in the water column. Seagrass in this region isn't considered a significant food source for marine fauna. Consequently, the potential impacts to seagrass are considered to be **Minor (2)**, as they could be expected to result in localised short-term impacts to species/habitats of recognised conservation value, but not affecting local ecosystem functioning.

Macroalgae	The effect of hydrocarbons however is largely dependent on the degree of direct exposure and how much of the hydrocarbon adheres to algae. Toxic responses of macroalgae to oils include a variety of physiological changes to enzyme systems, photosynthesis, respiration, and nucleic acid synthesis (Lewis & Pryor 2013). A review of field studies conducted after spill events by Connell *et al* (1981) indicated a high degree of variability in the level of impact, but in all instances, the algae appeared to be able to recover rapidly from even very heavy oiling. Other studies have indicated that oiled kelp beds had a 90% recovery within 3-4 years of impact, however full recovery to pre-spill diversity may not occur for long periods after the spill (French-McCay, 2004). Due to the nature of the oil, only a small percentage of the oil will become entrained or dissolved components in the water column. Consequently, the potential impacts to macroalgae are considered to be **Minor (2)**, as they could be expected to result in localised short-term impacts to species/habitats of recognised conservation value, but not affecting local ecosystem functioning.
Plankton	Phytoplankton are typically not sensitive to the impacts of oil, though they do accumulate it rapidly (Hook et al., 2016). Phytoplankton exposed to hydrocarbons may directly affect their ability to photosynthesize and impact for the next trophic level in the food chain (Hook *et al.*, 2016). Zooplankton (microscopic animals such as rotifers, copepods and krill that feed on phytoplankton) are vulnerable to hydrocarbons (Hook *et al.,* 2016). Water column organisms that come into contact with oil risk exposure through ingestion, inhalation and dermal contact (NRDA, 2012), which can cause immediate mortality or declines in egg production and hatching rates along with a decline in swimming speeds (Hook et al., 2016). Plankton is generally abundant in the upper layers of the water column and is the basis of the marine food web, so an oil spill in any one location is unlikely to have long-lasting impacts on plankton populations at a regional level. Reproduction by survivors or migration from unaffected areas is likely to rapidly replenish losses (Volkman et al., 2004). Oil spill field observations show minimal or transient effects on plankton (Volkman *et al.,* 2004). Once background water quality is re-established, plankton takes weeks to months to recover (ITOPF, 2011a). Due to the nature of the oil, only a small percentage of the oil will become entrained or dissolved components in the water column. Consequently, the potential impacts to plankton are considered to be **Minor (2)**, as they could be expected to cause short-term and localised impacts, but not affecting local ecosystem functioning.
Invertebrates	Acute or chronic exposure, through direct contact, and/or ingestion can result in toxicological impacts, reproductive impacts, smothering and potentially cause death. However, the presence of an exoskeleton (e.g., crustaceans) will reduce the impact of hydrocarbon absorption through the surface membrane. Other invertebrates with no exoskeleton and larval forms may be more sensitive to impacts from hydrocarbons. If invertebrates are contaminated by hydrocarbons, tissue taint can remain for several months, but can eventually be lost. Due to the nature of the oil, only a small percentage of the oil will become entrained or dissolved components in the water column; and will only be present in surface waters. Consequently, the potential impacts and risks to invertebrates from a LOWC event are considered to be **Minor (2)**, as they could be expected to result in localised short-term

	impacts to species/habitats of recognised conservation value but not affecting local ecosystem functioning.
Fish and Sharks	Fish can be exposed to oil through a variety of pathways, including: direct dermal contact (e.g. swimming through oil); ingestion (e.g. directly or via food base); and inhalation (e.g. elevated dissolved contaminant concentrations in water passing over the gills). Exposure to hydrocarbons in the water column can be toxic to fishes. Studies have shown a range of impacts including changes in abundance, decreased size, inhibited swimming ability, changes to oxygen consumption and respiration, changes to reproduction, immune system responses, DNA damage, visible skin and organ lesions, and increased parasitism. However, many fish species can metabolize toxic hydrocarbons, which reduces the risk of bioaccumulation of contaminants (NRDA, 2012). Pelagic free-swimming fish and sharks are unlikely to suffer long-term damage from oil spill exposure because dissolved/entrained hydrocarbons in water are not expected to be sufficient to cause harm (ITOPF, 2010). Pelagic species are also generally highly mobile and as such are not likely to suffer extended exposure (e.g. >96 hours) at concentrations that would lead to chronic effects due to their patterns of movement. Demersal fish are not expected to be impacted given the presence of in-water hydrocarbons in surface layers only. Fishes are most vulnerable to hydrocarbon discharges during their embryonic, larval and juvenile life stages. Impacts on eggs and larvae entrained in the upper water column are not expected to be significant given the temporary period of water quality impairment, and the limited areal extent of the spill. As egg/larvae dispersal is widely distributed in the upper layers of the water column it is expected that current induced drift will rapidly replace any oil affected populations. Due to the solidified tar balls/waxy flake-like nature of the oil, minimal impact from direct oiling is expected. Similarly, due to the small spatial and temporal extent, minimal impact from indirect pathways are also expected. Therefore, this is not considered a significant impact at a population level. Consequently, the potential impacts and risks to cetaceans are considered to be **Minor (2)**, as they could be expected to result in localised short-term impacts to species/habitats of recognised conservation value but not affecting local ecosystem functioning.
Cetaceans	Exposure to in-water hydrocarbons can result in physical coating as well as ingestion. Cetaceans can be exposed to the chemicals in oil through: internal exposure by consuming oil or contaminated prey; external exposure by swimming through oil and having oil directly on the skin and body; and maternal transfer of contaminants to embryos (NRDA, 2012). Baleen whales (e.g. Blue Whales) are less susceptible to ingestion of in-water hydrocarbons as they feed by skimming the surface; whereas, toothed whales and dolphins are more susceptible as they feed at depth. Evidence suggests that many cetacean species are unlikely to detect and avoid spilled oil (Harvey & Dahlheim 1994, Matkin et al. 2008). However, as highly mobile species, it is not expected that these animals will be constantly exposed to concentrations of hydrocarbons for continuous durations (e.g. >96 hours) that would lead to chronic effects. Note also, many marine mammals appear to have the necessary liver enzymes to metabolise hydrocarbons and excrete them as polar derivatives Due to the solidified tar balls/waxy flake-like nature of the oil, minimal impact from direct oiling is expected. Similarly, due to the small spatial and temporal extent, minimal impact from indirect pathways are also expected. Therefore, this is not considered a significant impact at a population level.

	Consequently, the potential impacts and risks to cetaceans are considered to be **Minor (2)**, as they could be expected to result in localised short-term impacts to species/habitats of recognised conservation value but not affecting local ecosystem functioning.
Commonwealth Areas, Parks and Reserves	Based on the potential risks of key receptors (e.g. cetaceans, plankton), the potential impacts and risks to State marine protected areas are considered to be **Minor (2)**, as they could be expected to result in localised short-term impacts to species/habitats of recognised conservation value but not affecting local ecosystem functioning.
State Parks and Reserves	Based on the potential risks of key receptors (e.g. fish), the potential impacts and risks to State marine protected areas are considered to be **Minor (2)**, as they could be expected to result in localised short-term impacts to species/habitats of recognised conservation value but not affecting local ecosystem functioning.
Commercial Fisheries	Commercial fishing has the potential to be impacted through exclusion zones associated with the spill, the spill response and subsequent reduction in fishing effort. Exclusion zones may impede access to commercial fishing areas, for a short period of time, and nets and lines may become oiled. Actual or potential contamination of seafood can affect commercial and recreational fishing, and can impact seafood markets long after any actual risk to seafood from a spill has subsided (NOAA, 2002) which can have economic impacts to the industry. In-water exposure to hydrocarbons may result in a reduction in commercially targeted marine species, resulting in impacts to commercial fishing (refer to previous assessment of impacts to fish and sharks). Consequently, the potential impacts and risks to cetaceans are considered to be **Minor (2)**, as they could be expected to result in some impact on business reputation and/or localised short-term impacts to species/habitats of recognised conservation value but not affecting local ecosystem functioning.
Recreation and Tourism	In-water hydrocarbons have the potential to affect ecological receptors (e.g. fish, cetaceans) that form the basis of offshore recreational and tourism activities. However, given that recreation and tourism is expected to be minimal in offshore areas, no significant disruption to these industries from in-water hydrocarbon is expected. Consequently, the potential impacts and risks to recreation and tourism are considered to be **Minor (2)** as they could be expected to result in localised short-term impacts.
ALARP Decision Context	**A**
Summary of Control Measures	
• Adherence to the Cooper Energy Well Engineering Standards and Well Management System • Adherence to the Cooper Energy WOMP • Development and adherence to the Cooper Energy well program • Planned Maintenance Schedule • Development and adherence to the Cooper Energy OPEP and FSP • Development and adherence to the Cooper Energy OSMP	

Likelihood	**Unlikely (D)**	**Residual Risk**	Low

7 Ongoing Monitoring of Environmental Performance

Cooper Energy retains full and ultimate responsibility as the Titleholder of the activity and is responsible for ensuring that the BMG Well Abandonment activities are implemented in accordance with the performance outcomes outlined in the EP.

The systems in place to ensure that environmental performance and the standards in the EP are met are summarised in this section.

7.1 Cooper Energy's Health Safety Environment and Community Management System (HSEC MS)

The HSEC MS is Cooper Energy's corporate system which provides the framework for the delivery of Cooper Energy's values, policies, standards and practices related to health, safety, environment and community. The HSEC MS applies to all:

- Workplaces, sites and activities operated by Cooper Energy and under Cooper Energy's management or control;
- Exploration, construction and development activities under Cooper Energy management or control;
- Cooper Energy employees, contractors and visitors on Cooper Energy sites, in offices and on activities such as offshore inspections, construction and development projects.

All personnel are expected to be familiar with, and comply with, the requirements of the HSEC MS.

7.2 Environmental Performance Monitoring & Reporting

7.2.1 Emissions and Discharges

For MODU / vessel-based activities the Cooper Energy Offshore Representative is responsible for collecting emissions and discharges data and reporting to the Cooper Energy Drilling HSEC Advisor

A summary of these results will be reported in the annual EP performance report submitted to NOPSEMA.

7.2.2 Audit and Inspection

Environmental performance of the activities will be audited and reviewed in several ways in accordance with HSEMS Standard 18: Audit and Assessment. These reviews are undertaken to ensure that:

- Environmental performance standards to achieve the EPOs are being implemented, reviewed and where necessary amended;
- Potential non-compliances and opportunities for continuous improvement are identified; and
- All environmental monitoring requirements are being met.

The following arrangements review the environmental performance of the activity:

- An on-hire audit / pre-activity inspection will be undertaken for the MODU and vessels. This will include a site inspection for the MODU and at least one of the support vessels; additional vessels will be subject to site inspection depending on the outcomes of the initial site inspection, and desktop inspection which will encompass all vessels.
- Campaign inspections of the MODU / vessel by the Cooper Energy Site Representative to continually verify vessel activities are in compliance with the EP. Ongoing inspections throughout the campaign will be undertaken. These will include desk based reviews of administrative controls including MODU and vessel daily reports, incident reports, and

direct communications with Cooper Energy Representatives offshore, with particular attention to higher risk areas such as spills and leaks and vessel strike. At least one MODU (site) inspection will be undertaken which incorporates commitments from the EP. The inspection will cover EP commitments that relate to controls for higher risk activities, or which may have otherwise been highlighted of particular interest during the day to day written and verbal progress reporting from the offshore crews, or from previous inspections.

7.2.3 Management of Non-conformance

In response to any EP non-compliances, corrective actions will be issued by the Well Construction Manager in accordance with the Cooper Energy Incident management, Non-Conformity and Corrective Action Standard Instruction (COE-MS-STI-0020).

Corrective actions will specify the remedial action required to fix the breach and prevent its reoccurrence and is delegated to the person deemed most appropriate to fulfil the action. The action is closed out only when verified by the appropriate Manager and signed off. This process is maintained by the Cooper Energy HSEC & Compliance Administrator through the Cooper Energy corrective action tracking system.

Cooper Energy will carry forward any non-compliance items for consideration in future operations and drilling and completion activities to assist with continuous improvement in environmental management controls and performance outcomes.

7.2.4 Management of Change

The *MoC Standard Instruction (COE-MS-STI-0013)* describes the requirements for dealing with managing change.

Environmentally relevant changes include:

- New activities, assets, equipment, processes or procedures proposed to be undertaken or implemented that have the potential to impact on the environment and have not been:
    - Assessed for environmental impact previously, in accordance with the relevant standard' and
    - Authorised in the existing management plans, procedures, work instructions or maintenance plans.
- Proposed changes to activities, assets, equipment, processes or procedures that have the potential to impact on the environment or interface with the environmental receptor;
- Changes to the existing environment including (but not limited to) fisheries, tourism and other commercial and recreational uses, and any changes to protective matter requirements; and
- Changes to the requirements of an existing external approval (e.g. changes to conditions of environmental licences).

For any MoC with identified environmental impacts or risks, an impact/risk assessment will be undertaken to consider the impact of the proposed change on the environmental impacts/risks and the adopted control measures.

Additional controls identified as part of the MoC must be effective in reducing the environmental impact and risk to a level which is ALARP and acceptable; and meets the nominated EPOs and EPSs set out in the accepted EP for the activity.

7.2.5 Revisions to the EP

If the proposed change introduces a significant new environmental impact or risk, results in a significant increase to an existing risk, or through a cumulative effect of a series of changes there is a significant increase in environmental impact or risk, this EP will be revised for re-submission to NOPSEMA.

In addition, the titleholder is obligated to ensure that all specific activities, tasks or actions required to complete the activity are provided for in the EP. Section 17(5) of the regulations

require that where there is a significant modification or new stage of the activity (that is, change to the spatial or temporal extent of the activity) a proposed revision of the EP will be submitted to NOPSEMA. The MoC Standard Instruction (COE-MS-STI-0013) describes this requirement.

8 Emergency Response Overview

Cooper Energy manages emergencies from offshore Victoria activities in accordance with the Cooper Emergency Management Plan (CEMP). Within that document the following environmental incidents are recognised as emergencies together with the appropriate notification requirements. Relevant environmental emergencies, as they apply to the impacts and risks identified in the EP include the following:

- IMS introduction (notifiable to DELWP);
- Wildlife affected by an oil spill (notifiable to DELWP); and
- Marine pollution incidents (notifiable to Port of Portland, DEDJTR [Level 2] and AMSA).

Further emergency response arrangements as it relates to oil spill emergencies is detailed below.

8.1 Oil Spill response strategies

There are 2 credible spill scenarios for this activity that have been assessed in the EP.

1. LOC - Vessel collision resulting in a ruptured tank and spill of MDO (MDO spill)
2. LOC - Loss of well control (LOWC)

By conducting an Operational and Net Benefit Assessment, Cooper Energy has identified the following response strategies as being appropriate for a response to these events (Table 8-1).

Table 8-1 Suitability of Response Options for MDO and Basker Crude Spills

Response Option	Description	LOC – Vessel Collision (MDO)	Viable Response?	Net Benefit?	LOC – LOWC (BMG Crude spill)	Viable Response?	Net Benefit?
Source Control	Limit flow of hydrocarbons to environment.	Achieved by vessel SMPEP	✓	✓	<u>For wellhead issues:</u> In accordance with the Offshore Victoria Source Control Plan (VIC-DC-ERP-0001). The plan provides a response to release incidents from wellheads (refer Section 7.1).	✓	✓
Monitor & Evaluate	Direct observation – Aerial or marine; Vector Calculations; Oil Spill Trajectory Modelling; Satellite Tracking Buoys To maintain situational awareness, all monitor and evaluate options suitable.	MDO spreads rapidly to thin layers. Aerial surveillance is considered more effective than vessel to inform spill response and identify if oil has contacted shoreline or wildlife. Vessel surveillance limited in effectiveness in determining spread of oil. Manual calculation based upon weather conditions will be used at the time to provide guidance to aerial observations. Oil Spill trajectory modelling utilised to forecast impact areas. Deployment of oil spill monitoring buoys at the time of vessel incident will assist in understanding the local current regime during the spill event.	✓	✓	Monitor and evaluate is applicable to all types of emergency spills as it provides a suite of non-invasive activities that aid to provide observations and data to inform operational awareness and support response decisions and tool selection. For a continuous significant spill event (well blowout) hydrocarbons will be present at the surface for the duration of the release. To maintain situational awareness, all monitor and evaluate techniques will be considered during spill incidents to understand the possible impacts.	✓	✓
Dispersant Application	Breakdown surface spill & draw droplets into upper layers of water column.	MDO, while having a small persistent fraction, spreads rapidly to thin layers. Insufficient time to respond while suitable surface thicknesses are present.	**X**	**X**	Dispersant application is generally applied for one of two reasons. 1. Reduce volatile organic compounds above within vicinity of the LOWC event source; and	**X**	**X**

Response Option	Description	LOC – Vessel Collision (MDO)	Viable Response?	Net Benefit?	LOC – LOWC (BMG Crude spill)	Viable Response?	Net Benefit?
	Increases biodegradation and weathering and provides benefit to sea-surface /air breathing animals.	Dispersant application can result in punch-through where dispersant passes into the water column without breaking oil layer down if surface layers are too thin. Application can contribute to water quality degradation through chemical application without removing surface oil. Considered not to add sufficient benefits.			2. Reduce the volume of surface hydrocarbons to minimise shoreline loadings. As any crude spilt from the BMG facilities will be solid at the temperatures of the Bass Strait (particularly at depth), treatment by chemical dispersant on the surface or subsea, will not be effective as the solidification of the oil would prevent penetration of the dispersant. Cooper was unable to confirm the effectiveness of dispersant via efficacy testing given difficulties in obtaining a current sample of the Basker Crude. The wells are currently suspended, and recovery of product is not feasible via the abandonment program. However, as information available to Cooper indicates dispersant would not be effective for this hydrocarbon type, and so this response technique is not considered appropriate for this event. Regardless, dispersant use will remain in the suite of contingency strategies to be investigated further during an actual event to determine if there is any effectiveness.		
Contain & Recover	Booms and skimmers to contain surface oil where there is a	MDO spreads rapidly to less than 10 µm and suitable thicknesses for recovery are only present for 12-24 hrs following	X	X	As any crude spilt from the BMG facilities will be solid at the temperatures of the Bass Strait, containment and recovery may be effective if appropriate equipment	✓	✓

Response Option	Description	LOC – Vessel Collision (MDO)	Viable Response?	Net Benefit?	LOC – LOWC (BMG Crude spill)	Viable Response?	Net Benefit?
	potential threat to environmental sensitivities. Relies on calm sea conditions, thicknesses >10µm to collect and adequate deployment timeframes.	a 160 m^3 spill. Insufficient mobilisation time to capture residues. In general, method only recovers approximately 10-15% of total spill residue, creates significant levels of waste, requires significant manpower and suitable weather conditions (calm) to be deployed.			is selected, and operational constraints such as weather conditions enable its implementation Consequently, this response technique is considered appropriate for this event within operational constraints.		
Protect & Deflect	Booms and skimmers deployed to protect environmental sensitivities. Environmental conditions (e.g., current, waves limit application)	Although MDO has persistent components and has the potential to reach shorelines, predictive modelling indicates no shoreline exposures are expected. Consequently, implementing this type of response technique is not required.	**X**	**X**	As any crude spilt from the BMG facilities will be solid at the temperatures of the Bass Strait, and expected to be present as a slick consisting of solid waxy sheets or balls. Consequently, the hydrocarbons are expected to be effectively corralled and contained by nearshore booms where access is possible to deploy this equipment.	Possible (certain areas where access is possible)	Possible
Shoreline Clean-up	Where shoreline impact is predicted, shoreline clean-up assessment technique (SCAT) assessment is initiated. If SCAT and NEBA assess clean-up is of net benefit, initiate clean-up.	Although MDO has persistent components and has the potential to reach shorelines, predictive modelling indicates no shoreline exposures are expected. Consequently, implementing this type of response technique is not required.	**X**	**X**	As modelling indicates shoreline exposure is possible, and as there are various shoreline techniques that are appropriate for this type of hydrocarbon, a shoreline clean-up would be an effective technique for reducing shoreline loadings where access to shorelines is possible.	Possible (certain areas where access is possible)	Possible

Response Option	Description	LOC – Vessel Collision (MDO)	Viable Response?	Net Benefit?	LOC – LOWC (BMG Crude spill)	Viable Response?	Net Benefit?
	Shoreline clean-up is a last response strategy due to the potential environmental impact; heavy resource requirements; health and safety concerns to responders; logistical complexities and waste management considerations						
Oiled wildlife Response (OWR)	Consists of capture, cleaning and rehabilitation of oiled wildlife. May include hazing or pre-spill captive management.	Given limited size and rapid spreading of the MDO spill, large scale wildlife response is not expected. Although MDO has persistent components and has the potential to reach shorelines, predictive modelling indicates no shoreline exposures are expected. Consequently, implementing this type of response technique is not required.	X	X	OWR may offer net benefits to both seabirds which come into contact and area affected by residues. OWR is both a viable and prudent response option for this spill type.	✓	✓

8.1.1 Spill Response: Source Control

Source control arrangements for significant vessel spills resulting from fuel tank perforation includes:

- closing water tight doors
- checking bulkheads;
- determining whether vessel separation will increase spillage;
- isolating penetrated tanks;
- tank lightering, etc.

Source control relies heavily upon the activation of the vessels SOPEP / SMPEP (or equivalent).

Well-related source control activities may range from:

- ROV intervention utilising specialist ROV tooling; and/or
- Well capping; and/or
- Relief well installation.

8.1.2 Spill Response: Monitor and Evaluate

Ongoing monitoring and evaluation of the oil spill is a key strategy and critical for maintaining situational awareness and to complement and support the success of other response activities. In some situations, monitoring and evaluation may be the primary response strategy where the spill volume/risk reduction through dispersion and weathering processes is considered the most appropriate response. Monitor and evaluate will apply to all marine spills. Higher levels of surveillance such as vessel/aerial surveillance, oil spill trajectory modelling and deployment of satellite tracking drifter buoys will only be undertaken for Level 2/3 spills given the nature and scale of the spill risk.

It is the responsibility of the Control Agency to undertake operational monitoring during the spill event to inform the operational response. Operational monitoring may include the following:

- Aerial observation;
- Vessel observation;
- Computer-based tools:
    - Oil spill trajectory modelling;
    - Vector analysis (manual calculation); and
    - Automated Data Inquiry for Oil Spills (ADIOS) (a spill weathering model).
- Utilisation of satellite tracking drifter buoys.

For vessel-based spills, the responsibility for operational monitoring lies with AMSA (Commonwealth waters). For a LOWC event the responsibility lies with Cooper Energy.

8.1.3 Spill Response: Contain and Recover

Containment and recovery includes use of offshore vessels to deploy boom and skimmers to collect surface hydrocarbons. It is anticipated that this response technique is only appropriate for LOWC events given the nature of the hydrocarbons.

8.1.4 Spill Response: Protect and Deflect

Shoreline protection includes use of a boom or sand berm to create a physical barrier to separate hydrocarbons from sensitive resources, to deflect hydrocarbons to other areas for recovery or towards an area where there will be reduced impact (compared to more sensitive sites).

While response to spills originating from vessels while in Victorian waters is the responsibility of DEDJTR or AMSA, this information has been provided to demonstrate Cooper Energy's capacity to assist with response operations and minimise impacts to ALARP. All shoreline operations for Level 2+ spills will be undertaken in consultation with, and under the control of DEDJTR, the Control Agency for Victoria, of Control Agencies of other potentially impacted states and appropriate land managers of the shoreline affected.

8.1.5 Spill Response: Shoreline Assessment and Clean-up

Any shoreline operations will be undertaken in consultation with, and under the control of DEDJTR EMD, the Control Agency for Victoria or Control Agencies for NSW or Tasmania, and the appropriate land managers of the shoreline affected.

Shoreline clean-up consists of different manual and mechanical recovery techniques to remove oil and contaminated debris from the shoreline to reduce ongoing environmental contamination and impact.

Shorelines within the EMBA are predominantly sandy beaches with numerous estuaries present along the Victorian Coastline.

The shoreline behaviour of BMG Crude is expected to be similar to a heavy crude, where solidified hydrocarbons / tar balls wash up along the shore and persist until physically removed, (unless they melt on the shoreline) in which case they may need to be dug up and removed. Based upon this behaviour, the following clean-up methods may have environmental benefit:

- Manual clean-up; and
- Mechanical collection – use of machinery to collect and remove stranded oil and contaminated material;

8.1.6 Spill Response: Oiled Wildlife Response

In the event of a Level 2 or 3 hydrocarbon spill, the impacts on wildlife are determined by the types of fauna present, the type of oil spilled and the extent of exposure. A review of the species likely to be present within the EMBA identifies marine birds, shorebirds and fur-seals could be affected.

Oiled wildlife response consists of a three-tiered approach involving:

- Primary: Situational understanding of the species/populations potentially affected (ground-truth species presence and distribution by foot, boat or aerial observations);
- Secondary: Deterrence or displacement strategies (e.g., hazing by auditory bird scarers, visual flags or balloons, barricade fences; or pre-emptive capture); and
- Tertiary: Recovery, field stabilisation, transport, veterinary examination, triage, stabilisation, cleaning, rehabilitation, release.

8.2 Risk Assessment of Oil Spill Response Strategies

This section provides a risk assessment of the oil spill response options, based on two credible spill scenarios:

3. LOC - Vessel collision resulting in a ruptured tank and spill of MDO (MDO spill)
4. LOC - Loss of well control (LOWC)

The potential impacts and risks associated with undertaking source control, monitor and evaluate, or contain and recover response strategies have been covered under the aspects evaluated in this EP and will not be repeated here. Relevant control measures will be adopted in the event of an incident.

8.2.1 Protect and Deflect

Table 8-2 provides a summary of the EIA / ERA for Protect and Deflect activities.

Table 8-2 Protect and deflect EIA / ERA

Cause of Aspect	The following hazards are associated with protection and deflection activities: • Boom deployment and management (especially anchored boom); and • Waste collection.
Summary of impact(s)	The known and potential impacts of booming activities are: • Loss of seabed vegetation and impacts to associated fauna habitats while deploying boom; • Disturbance to estuarine habitats from boom anchors; • Restricting access to the area for recreational activities;
Consequence Evaluation	
Receptor(s)	**Description of Potential Environmental Impact**
Nearshore habitats (such as seagrass) Shoreline habitats (sandy beach habitats).	Potential impacts of protect and deflect vary, depending on the method used and the nearshore / shoreline habitat. Particular values and sensitivities in the area that may be affected by the spill include nearshore habitats (such as seagrass) and shoreline habitats (sandy beach habitats). The consequence of these shoreline activities may potentially result in short-term and localised incidental damage to or alteration of habitats and ecological communities, and are ranked as Minor (5).
ALARP Decision Context	**A**
Summary of Control Measures	
• Maintain protect and deflect capability • Consultation • Monitor response effectiveness • Use of Existing Tracks and Pathways	

Likelihood	**Remote (E)**	**Residual Risk**	Low

8.2.2 Shoreline Assessment and Clean-up

Table 8-3 provides a summary of the EIA / ERA for Shoreline Assessment and Clean-up activities.

Table 8-3 Shoreline Assessment and Clean-up EIA / ERA

Cause of Aspect	The following hazards are associated with shoreline clean-up activities and may interfere with environmental sensitivities: • Personnel and equipment access to beaches; • Shoreline clean-up; and • Waste collection and disposal
Summary of impact(s)	The known and potential impacts of these activities are: • Damage to or loss of vegetation; • Disturbance to fauna habitat and fauna from noise, air and light emissions from response activities; • Temporary exclusion of the public from amenity beaches. Sandy beaches have been used for the consequence evaluation as they are considered to provide a comprehensive indication of possible worst-case consequences as a result of implementing shoreline response activities (due to presence of potential sensitivities and the invasive nature of techniques such as mechanical collection). This is not to say that sandy beaches themselves are considered more sensitive than other habitats.

Consequence Evaluation	
Receptor(s)	**Description of Potential Environmental Impact**
Shoreline fauna and habitats Cultural heritage Recreation	The noise and general disturbance created by shoreline clean-up activities could potentially disturb the feeding, breeding, nesting or resting activities of resident and migratory fauna species that may be present (such as seabirds, penguins and fur-seals). Any erosion caused by responder access to sandy beaches, or the removal of sand, may also bury nests. In isolated instances, this is unlikely to have impacts at the population level. Based upon the persistence and behaviour of the BMG Crude (i.e. that it solidifies and would be expected to wash up on shore in its solid form) significant vertical infiltration of oil into shoreline sediments is not expected to occur. However, over the course of the entire spill response effort there is a possibility that temperatures would increase to a point where the solid residue on the shoreline melts. If this was to occur, then vertical migration through shoreline sediments could occur, with clean-up efforts expected to result in more of a disturbance to the coastline as mechanical recovery would then be required (resulting in excavation of shorelines). If not done correctly, any excavation of hydrocarbon contaminated materials along the coast could exacerbate beach erosion to a point where its recovery longer term recovery. The very presence of stranded oil and clean-up operations will necessitate temporary beach closures (likely to be weeks but depends on the degree of oiling and nature of the shoreline). This means recreational activities (such as swimming, walking, fishing, boating) in affected areas will be excluded until access is again granted by local authorities. Given the prevalence of rocky shorelines in the EMBA, this is unlikely to represent a significant social or tourism drawback. Consequently, the potential impacts and risks from these activities are considered to be **Moderate (3)**.
ALARP Decision Context	**A**
Summary of Control Measures	
• Maintain shoreline assessment and clean-up capability • Consultation • Use of Existing Tracks and Pathways	

Likelihood	**Remote (E)**	**Residual Risk**	Low

8.2.3 Oiled Wildlife Response

Table 8-4 provides a summary of the EIA / ERA for Oiled Wildlife Response activities.

Table 8-4 Oiled Wildlife Response EIA / ERA

Cause of Aspect	The hazards associated with OWR are: • Hazing of target fauna may deter non-target species from their normal activities (resting, feeding, breeding, etc.); • Distress, injury or death of target fauna from inappropriate handling and treatment; • Euthanasia of target individual animals that cannot be treated or have no chance of rehabilitation;
Summary of impact(s)	The potential impacts of this activity are disturbance, injury or death of fauna.

Consequence Evaluation	
Receptor(s)	**Description of Potential Environmental Impact**
Marine Megafauna	Untrained resources capturing and handling native fauna may cause distress, injury and death of the fauna. To prevent these impacts, only appropriately trained oiled wildlife responders will approach and handle fauna. This will eliminate any handling impacts to fauna from untrained personnel and reduce the potential for distress, injury or death of a species. It is preferable to have oil-affected animals that have no prospect of surviving or being successfully rehabilitated and released to the environment humanely euthanized than to allow prolonged suffering. The removal of these individuals from the environment has additional benefits in so far as they are not consumed by predators/scavengers, avoiding secondary contamination of the food-web. Hazing and exclusion of wildlife from known congregation, resting, feeding, breeding or nesting areas may have a short- or long-term impact on the survival of that group if cannot access preferred resources. These effects may be experienced by target and non-target species. For example, shoreline booming or ditches dug to contain oil may prevent penguins from reaching their burrows after they've excited the water and low helicopter passes flown regularly over a beach to deter coastal birds from feeding in an oil-affected area may also deter penguins from leaving their burrows to feed at sea, which may impact on their health. Due to the potential for localised short-term impacts to species/habitats of recognised conservation value but not affecting local ecosystem functioning, the potential impacts form this activity have been identified as **Minor (2).**
ALARP Decision Context	**A**
Summary of Control Measures	
• Maintain shoreline assessment and clean-up capability • Consultation • Use of Existing Tracks and Pathways	

Likelihood	**Remote (E)**	**Residual Risk**	Low

8.3 Testing Oil Spill Response Arrangements

In accordance with the Commonwealth OPGGS(E)R Regulation 14 (8C) and in accordance with *HSEC MS Standard 16: Crisis and Emergency Preparedness and Response*, the OPEP will be tested:

- Prior to the commencement of a drilling campaign;
- When there is a significant amendment to the OPEP;
- Not later than 12 months after the most recent test; and
- In accordance with the schedule outlined in the EP.

8.4 Operational and Scientific Monitoring Plan (OSMP)

The Operational and Scientific Monitoring Program (OSMP) (VIC-ER-EMP-0002) contains detail regarding the triggers for commencing operational and scientific monitoring, who will

conduct the monitoring and what will be monitored. This document supports the BMG Abandonment OPEP by:

- Detailing operational monitoring (Type I) requirements to be implemented in a spill to inform spill response activities; and
- Scientific monitoring (Type II) to quantify the nature of extent, severity and persistence of environmental impacts from a spill event and inform on appropriate remediation activities.

9 Stakeholder Consultation

Cooper has undertaken stakeholder engagement in preparation of the BMG Well Abandonment Environment Plan.

Determining the stakeholders for the BMG abandonment activity involved the following:

- Reviewing existing stakeholders identified as relevant and contained within the Cooper Energy stakeholder register (Gippsland Basin);
- Reviewing previous BMG consultation records (Cooper and Santos records);
- Conversing with existing stakeholders to identify potential new stakeholders;
- Reviewing Commonwealth and State fisheries jurisdictions and fishing effort in the region; and
- Determining the Titleholders of nearby exploration permits and production licences through the National Offshore Petroleum Titles Administrator (NOPTA) website.

Stakeholders identified and contacted for this activity, grouped by the categories listed under OPGGS(E)R Regulation 11A, are listed in Table 9-1:

Table 9-1: Stakeholders for the BMG well abandonment activity

Department or agency of the Commonwealth to which the activities to be carried out under the EP may be relevant	
Australian Fisheries Management Authority (AFMA)	Australian Hydrological Service (AHS)
Australian Border Control	Australian Maritime Safety Authority (AMSA)
Department of Agriculture and Water Resources (DAWR)	Department of Communications
Department of Defence (DoD)	Department of Environment and Energy (DoEE) - Marine Protected Areas Branch
Department of Innovation, Industry and Science (DIIS)	Geoscience Australia
Marine Border Command	National Native Title Tribunal (NNTT)
Each Department or agency of a State or the Northern Territory to which the activities to be carried out under the EP may be relevant	
DEDJTR – Earth Resources Regulation (ERR)	DEDJTR – Victorian Fishery Authority
DEDJTR - Transport Victoria - Marine Pollution Team	DELWP - Marine National Parks and Marine Parks
DELWP -Victorian Coastal Council	DELWP - Wildlife Emergencies and Biodiversity Regulation
NSW Department of Primary Industries (Fisheries)	Transport Safety Victoria (Maritime Safety)
Tasmania Department of Primary Industries, Parks, Water and Environment (DPIPWE) (Fisheries)	
The Department of the responsible State Minister, or the responsible Northern Territory Minister	
DEDJTR – Earth Resources Regulation (ERR)	NSW Department of Primary Industries
A person or organisation whose functions, interests or activities may be affected by the activities to be carried out under the EP	

Fisheries:	
Abalone Council Australia	Abalone Victoria (Central Zone) (AVCZ)
Australian Southern Bluefin Tuna Industry Association	Commonwealth Fisheries Authority
Eastern Zone Abalone Industry Association	East Gippsland Estuarine Fishermen's Association
Eastern Victorian Rock Lobster Industry Association	Eastern Zone Abalone Industry Association
Port Franklin Fishermen's Association	Lakes Entrance Fishermen's Society Co-operative Limited (LEFCOL)
San Remo Fishing Cooperative	Seafood Industry Victoria (SIV)
South-east Fishing Trawl Industry Association (SETFIA)	Southern Rock Lobster Ltd
Southern Shark Industry Alliance	Sustainable Shark Fishing Inc. (SSF)
Victorian Recreational Fishers Association (VRFish)	Victorian Rock Lobster Association (VRLA)
Victorian Scallop Fisherman's Association	Victorian Fish & Food Marketing Association
Victorian Bays & Inlets Fisheries Association	
Oil spill preparedness and response agencies:	
Australian Marine Oil Spill Centre (AMOSC)	DEDJTR – Marine Pollution Branch
Parks Victoria	Department of Environment, Land, Water and Planning (DELWP) (Wildlife Emergencies)
NSW Environment Protection Authority (EPA)	Tasmanian Environment Protection Authority (EPA)
NSW Roads and Maritime Services (RMS)	Queensland Maritime Safety
NSW Port Authority	
Nearby Petroleum Titleholders:	
Bass Oil Limited	Esso Australia Resources Pty Ltd
Other entities:	
Aboriginal Affairs Victoria	Australian Oceanographic Services P/L
Native Title Services Victoria	Southern Cross Cables
Victorian Fish and Food Marketing Association	
Any other person or organisation that the Titleholder considers relevant	
Community interests:	
Scuba Divers Federation of Victoria (SDFV)	

9.1 Provision of Sufficient Information

9.1.1 Initial Consultation

2018 Offshore Drilling Campaign Brochure

A 2018 Offshore Campaign Stakeholder Information Brochure outlining upcoming Cooper Energy activities in the Otway and Gippsland Basins, including BMG abandonment activities, was

disseminated to stakeholders on the 19th September 2017. The brochure provides information concerning the location, timing and nature of the proposed activities, information on potential risks and impacts, and provides contact details should stakeholders wish to seek further information or have an objection.

Distribution of Survey Information via Fishing Associations

To ensure broader communications with new and existing commercial fishers; entities or individuals holding commercial fishing licences have been informed of the activities via government and private associations such as AFMA, SIV, VFA and SETFIA. State fisheries Departments in Victoria, NSW and Tasmania were also contacted and supplied with the September Offshore Campaign brochure.

Cooper Energy Website

The 2018 Offshore Campaign Stakeholder Information Brochure has been made available on the Cooper website (http://www.cooperenergy.com.au/) for all interested members of the public to access. Information prepared for future project milestones will also be made available on the website.

New Stakeholders

Based on a potential worst-case hydrocarbon spill, the following spill response agencies were contacted on 7th December 2017 via telephone to discuss potential review of the BMG OPEP:

- Queensland Maritime Safety
- NSW Port Authority
- NSW Roads and Maritime Services (RMS)
- NSW Environmental Protection Authority (EPA)
- Tasmanian EPA
- Victorian Marine Pollution Team (Ecodev)

9.1.2 Ongoing Consultation

Consultation with relevant stakeholders will be ongoing. Cooper Energy will comply with requests by stakeholders for additional information or updates during the activity itself. In addition, stakeholders will be notified of any changes to scope of the EP that may affect their interests or activities at a minimum two (2) weeks in advance of an activity to be undertaken under that change.

Approximately four (4) weeks prior to the BMG activities commencing, Cooper Energy will provide relevant stakeholder's further information including:

- Confirmation on the timing and duration;
- Name and call sign of any associated vessels (if known);
- A description of the activities which are being undertaken;
- A request to provide feedback on the activities;
- The opportunity for face-to-face meetings; and
- Contact details of where any claims, objection or concerns may be directed.

As part of this process, Cooper Energy shall check that identified stakeholders are still relevant and correct, and also identify new stakeholders (via organisational bodies such as AFMA, AMSA, SIV, SETFIA, lessons learnt etc.). Any claims or objections will be dealt with as outlined in Section 9.4.

Cooper Energy will follow-up with stakeholders providing notifications approximately five days prior to activity commencement (or as requested by the individual stakeholder) and a demobilisation notification within 10 days of completion of the activity (or at a period requested by stakeholder).

Activity notification may be a stand-alone notice or part of another Campaign Brochure (or equivalent).

9.2 Summary of Stakeholder Consultation

Stakeholder engagement has involved a combination of email exchanges and phone conversations.

A summary of stakeholder responses, Cooper Energy's assessment of any objections or claims and response or proposed response, are provided in **Table 9-2**. It should be noted that the majority of responses are generic and relate equally to other activities that may occur as part of Cooper Energy's 2018 Offshore Campaign.

Table 9-2: Stakeholder Feedback and Cooper Assessment of Claims/Objections

Stakeholder and relevance	Summary of Response	Assessment of Merits to Adverse Claim / Objection	Operators Response to each Claim / Objection
Aboriginal Affairs Victoria	Your message was received. Thank You.	No claims or objections to be assessed.	Not applicable
	Thanked COE for the information and that it will be passed on to our major projects senior officer (Dan Cummins) for consideration. If he determines a cause for response he will get back to you.	No claims or objections to be assessed.	Responded with thanks and offer of further information if required.
Australian Fisheries Management Authority	Brodie MacDonald replied with thanks	No claims or objections to be assessed.	Not Applicable
	Requested that all correspondence be via the generic etroleum@afma.gov.au address and it will then be disseminated to relevant managers.	No claims or objection to be assessed. All emails to only go via generic petroleum email address.	COE confirmed that the information was sent to the appropriate fishing industry contacts as outlined in the link. requested confirmation then that any information about upcoming activities only be emailed to the 'petroleum' address and not to individual Fishery Managers.
Australian Hydrographic Services	Requested to provide finalised information at least three weeks prior to commencement of any works to allow for publication of notices to mariners.	No claims or objections to be assessed.	COE confirmed information would be provided to AHS at least 3 weeks prior to activities commencing
Australian Maritime Safety Authority	22/9/2017: Thanked COE for providing information on PSZ, NtM and AUSCOAST warnings. Provided updated data traffic plots for Otway and Gippsland basins. Identified where greater traffic may be encountered. Noted that vessels entering and exiting the Traffic Separation Scheme (TSS) slightly encroach on BMG and Sole. Requested JRCC be contacted 24-48 hours before activity commences with vessel details etc to promulgate AUSCOAST warning. Requested AHS be contacted at least 4 weeks prior to activities for NtM (via hydro email) and to update charts (via datacentre email).	22/9/2017: No claims or objections to be assessed. COE acknowledge increased traffic in areas	23/9/2017: COE acknowledged increased traffic in the areas and that the TSS slightly encroaches on BMG and Sole. COE acknowledge the timeframes and requirements for notification to AMSA in relation to the Auscoast warnings and NtM as well as any petroleum safety zones. This information will be carried through into EP and future correspondence requirements.

Stakeholder and relevance	Summary of Response	Assessment of Merits to Adverse Claim / Objection	Operators Response to each Claim / Objection
AMOSC	19/9/2017: AMOSC does not distribute member information amongst the membership group. We will however, be very interested in receiving a draft copy of the OPEP to confirm with Cooper AMOSC's resources and processes and comment on the same.	20/9/2017: Cooper apologized for not removing the sentence regarding distribution from the covering email. No issue with comments provided	20/9: Responded stating that OPEP is being finalised and will be forwarded to AMOSC for review in the near future. 29/9: First Strike Plans were developed for Sole to supplement the already AMOSC reviewed OPEP. AMOSC reviewed the FSP and provided feedback 28/9 which has been incorporated. 3/10/2017: OPEP and First strike plans resent to AMOSC for their information only.
Australian Southern Bluefin Tuna Industry Association (ASBTIA)	27/10/2017: Confirmed that activities unlikely to impact SBT migration or fishing and ranching operations that mainly occur in central and eastern GAB but would like to keep receiving notices	No assessment required.	COE will continue to send ASBTIA notices
Department of Environment, Land Water and Planning (DELWP)	20/9/2017: Replied with thanks	20/9/2017: No claims or objections to be assessed.	No response required
	19/9/2017: Thanked COE for the update. Requested confirmation that the 'single point of contact' is for general communications rather than statutory reporting obligations, and that legal arrangements for the transfer of Victorian land based pipelines will continue as is and the current contacts will not be affected	19/9/2017: COE acknowledge confusion regarding point of contact and provided clarity as requested	19/9/2017: COE confirmed that the parties involved in reporting etc. will not change but If any changes do occur, DELWP will be notified immediately and amend and resubmit documentation as required.
Department of Defence	20/10/2017: Defence has reviewed the proposed activities and has no objections.	No assessment required	COE will continue to send DoD notices
Department of the Environment and Energy	19/9/2017 - Generic response: Requested all information be via NOPSEMA. Provided links to further guidance material.	COE acknowledge the advice from DOE.	19/9/2017: COE will no longer send information to DOE offshore petroleum email address. No response necessary as it's a generic response email from DOE. Remove from stakeholder register.
Geoscience Australia	19/9/2017: Out of office reply, but that she has access to emails	No claims or objections to be assessed.	No response required

Stakeholder and relevance	Summary of Response	Assessment of Merits to Adverse Claim / Objection	Operators Response to each Claim / Objection
Australian Oceanographic Services Pty Ltd (Dr Andrew Levings)	22/9/2017: Dr. Levings outlined his experience in O&G, fishing, energy transmission and provision of services and requested opportunity to talk that day. 23/9/2017: Agreed talks can wait. Dr. Levings talked with COE management and service boat owners regarding their vessels being used for future support activities. 5/10: Dr Levings discussed vessels he has available for possible work with COE management. 31/10: COE stakeholder liaison called Dr Levings to confirm conversation of 5/10/17. Confirmed he has 2 boats that are in survey with all appropriate systems in place and experienced personnel.	No adverse claim or objection to assess. COE acknowledge possible use of vessels	22/9/2017: COE acknowledged Dr. Levings but stated that the COE liaison would be out of the country until the 12th and requested that the discussion be delayed. 23/9/2017: COE agreed that use of fishing vessels where possible has merit as builds good relations. Confirmed will be in touch on return. 5/10/2017: COE stated they would consider the use of the vessels if they were appropriate. 31/10/2017: COE to assess the possibility and opportunity of using the local boats where possible. Dr Levings will be contacted if his services/ vessels are required.
Marine Border Control	10/10/2017: MBC confirmed that they are the catch all for oil and gas industry and will forward all information to the relevant parties within MBC	No assessment required	No action required 11/10/2017: COE replied with thanks
Department of Agriculture and Water Resources - MNCC	20/9/2017: Auto reply outlining requirements for vessels entering Australian waters to enter info in the the MARS system including: • Pre-Arrival Report (PAR) – 96 and 12 hours prior to arrival in Australia. • Ballast Water Report (BWR) – no later than 12 hours prior to arrival in Australia if the vessel is fitted with ballast tanks. Ballast water must be managed in accordance with the Australian Ballast Water Requirements. • Non First Point of Entry Application (NFP) submitted no less than 10 working days prior to arrival in Australia (if applicable). Changes in health of crew to be reported Links to information provided	No claims or objections to be assessed.	20/9/2017: No response required as automated reply. Information provided shall be included in subsequent EPs as necessary

Stakeholder and relevance	Summary of Response	Assessment of Merits to Adverse Claim / Objection	Operators Response to each Claim / Objection
National Native Title Tribunal	20/9/2017. email from Steve Edwards stating that there were no registered claims over the area of proposed activities. However, stated that for pipelines that crossed the coast that it may impacts on interests of two groups. Stated: The proposed activities will take place within the Representative Aboriginal Torres Strait Islander Body Area of the Native Title Services Victoria Ltd. You may wish to, if you have not already consult with that body. It is not appropriate for the Tribunal to comment further. 5/10/2017 - NNTT confirmed contact details for NTSV and also provided a link to geospatial maps outlining RATSIB areas	No claims or objections to be assessed. Unlikely to be affected by offshore drilling activities	5/10/2017: COE acknowledged that no registered native title claims or determined native title claims appear to overlap the proposed offshore areas and that where a new pipeline crosses the coast and becomes onshore that native title holders may be impacted. Confirmed that relevant parties will be contacted as required. Acknowledged that the Native Title Services Victoria Ltd have not been contacted and requested NNTT confirm the contact details for the group. COE also acknowledge that the Tribunal cannot comment any further on the activities. NTSV sent flyer on 9/10/17. 5/10/17 - COE thanked NNTT for the assistance and that the maps were reviewed.
NSW Environment Protection Agency (EPA)	NSW EPA front desk stated to please just send through the OPEP once completed to the generic email address: info@environment.nsw.gov.au	No claims or objections to be assessed	BMG OPEP, Rev OA, sent 4/1/2018
	5/1/2018 – EPA responded stating that as this was an incident that could occur in Vic waters, it is Victorian EPA that should be contacted not NSW EPA. NSW EPA contact details supplied	COE believe this is incorrect and NSW EPA should be consulted. NSW RMS will handle internal consultation.	5/1/5018- COE responded stating that they believe NSW EPA should be consulted as hydrocarbon could impact NSW waters and coastline.
NSW Road and Maritime Safety (RMS)	Spoke with S Durham who stated would try and find best person to speak to as it was not her. Sally sent through text with details for Alex Hamilton – Alex.Hamilton@rms.nsw.gov.au	No claims or objections to be assessed	Alex Hamilton contacted
	Out of office reply – not back until 3/1/2018	No claims or objections to be assessed	No response required
	4/1/2018 -RMS would like to receive copy of the OPEP. Supplied updated email address and asked that S. Wilde also be included in correspondence. Provided link to further information on RMS website	No claims or objections to be assessed	4/1/2018 – COE sent through copy of BMG OPEP to all email addresses as requested.

Stakeholder and relevance	Summary of Response	Assessment of Merits to Adverse Claim / Objection	Operators Response to each Claim / Objection
	4/1/2018 - stated should review the areas around Control Agency in Commonwealth Waters as there are some complexities between offshore facilities and shipping related pollution incidents. Accordingly, AMSA may not necessarily be the Control Agency unless you have some form of MOU with them. Queried who in EPA we spoke to re OPEP. Asked to review TRPs. Stated response should be 3 weeks. 5/1/2018- In respect to the Port Authority of NSW were you after the local contact at Eden, the Harbour Master? From your e-mail If I am correct with respect to the person (Brendan Wiseman) he is located in Sydney. Eden falls under the Port Kembla Port for management purposes. If you are looking to have their input also let me know. 12/1/2018- confirmed COEs interpretation of CA. Requested to review all TRPs. Advised that RMS will undertake necessary consultation and advice with EPA and Port Authority.	COE recognise the RMS and their input as a response agency and requirements to review OPEP and TRPs	4/1/2018- COE thanked RMS for confirming they were SA and sent through a copy of OPEP to all email addresses provided 4/1/2018 - COE stated thanks for the info and will ensure OPEP is updated as necessary based on their comments re CA. Outlined who was spoken to in EPA and requested if RMS had a better contact for EPA and Port Authority. Confirmed 3 weeks review is appreciated. 11/1/2018 - COE clarified that OPEP aligned with NatPlan and who relevant CAs were. Outlined what TRPs have been developed with Esso and AMOSC for NSW. Provided 1 TRP as an example. Indicated they are in draft and that we are keen for responders to review and comment, but looking to do in a collaborative way. Provided more clarity on who COE was trying to contact in Port Authority as all ports could be affected and requested if RMS knew of a single point of contact. 15/1/2018 - all TRPs provided to RMS. 13/02/2018 – COE queried how the RMS review was progressing and whether any further information was required

Stakeholder and relevance	Summary of Response	Assessment of Merits to Adverse Claim / Objection	Operators Response to each Claim / Objection
	21/02/2018: RMS briefly reviewed docs but will allocate more time next week. In regards to the notification number probably the easiest and simplest way for your Plan is to notify the RMS Maritime Division Marine Pollution Response Duty Officer on 02 9962 9074. This number will connect to a paging service and is monitored 24/7 by our marine pollution response unit who can then determine appropriate combat agency and send out all of the NSW notifications to regional areas, Ports VTS and supporting agencies. 5/3/2018: Confirmed that for any impact to NSW State waters on the NSW South Coast that RMS will still remain the combat agency regardless of the spill source. Depending on the incident the environmental priorities from a NSW State response will be determined in consultation with the NSW Environmental and Scientific Coordinator (ESC). TRPs are good but do not cover some key critical habitats such as Nadgee Lake (a high value wilderness area) and some other smaller estuarine systems along that stretch of coast line. So there should realistically be TRPs for all of the estuaries along that section of coastline as some of the systems not identified are recognised by NSW as being high protection priorities. The full list of estuarine systems can be located on p.59-60 of the NSW South Coast Marine Oil and Chemical Spill Contingency Plan	No claims or objections to be assessed. COE recognise that the RMS have identified priority areas. However, based on process outlined in OPEP, COE believe TRPs do not need to be developed up front for NSW regions but can be developed post spill. This to be outlined to RMS.	21/2/2018: Supplied information will be incorporated into OPEP 5/3/2018: COE will endure updated OPEP reflects the information provided about the RMS remaining the combat agency for spills along the south coast. Requested confirmation that RMS are also the CA for spills along the north coast up to the Queensland border? OPEP being revised and will include identifying priority areas and where we will need to develop TRPs or equivalent. COE will ensure the NSW South Coast Marine Oil and Chemical Spill Contingency Plan are checked for the priority areas and estuaries listed. Once finalised, the priority areas and revised OPEP will be supplied OPEP and explanation of priority area identification to be provided to RMS and to get their input on future process.
Parks Victoria	19/9/2017: automated response email	No claims or objections to be assessed.	No response required
South-East Trawl Fishing Industry Association	Project update provided. Indicative timing that pipelay will start after 1st Sept to avoid FIS. Confirmed use of SMS messaging for information dissemination. COE to provide contractor and vessel info to SETFIA. Drilling schedule discussed and likely commence circa Feb 2018 and that Cooper drilling be in touch. Campaign to use 8-pt mooring and 500 m exclusion zone and anchors out to 1.5km Discussed possibility of a person assisting with updating plotters with finalised Sole 3 location, but this is to be reviewed at a later date.	No claims or objections to be assessed.	COE provided contractor and vessel info to SETFIA as requested (see SETFIA-04a) as well as update on project Commitments made to continue to engage with SETFIA and LEFCOL keeping them in the loop and up to date with any key project decisions / changes. This is a part of the ongoing stakeholder consultation plan.

Stakeholder and relevance	Summary of Response	Assessment of Merits to Adverse Claim / Objection	Operators Response to each Claim / Objection
	No response received in relation to emailed brochure 26/9/2017: Generic email sent to all O&G stakeholders outlining the upcoming Fish Survey and request to not undertake any activities between Feb and mid-Sept 2018 and then again between Feb and mid-Sept 2018. Noted that an earlier request was sent out asking that no seismic be undertaken but that SETFIA has received 2 notices re non-seismic activities 28/9/2017: Confirmed may be available 9/10/2017: SETFIA stated the outcome was not what they were after. They will decide whether to proceed with the FIS shot(s) in question for that survey, but suspect not. Simon is concerned that he is unable to engage as he is now only part time and he can't think of an instance where the time SETFIA invests in oil/gas engagement has seen a proponent change plans.	Assessment of claims and objections is required as the activity will be within the 6 months prior to the FIS and in close proximity. Initial notice only asked that seismic not be undertaken. COE are not undertaking seismic activities. Cooper have assessed that the offshore activities will not negatively impact the FIS.	28/9/2017: COE acknowledged the email stating that an official response was being drafted. Requested confirmation of meeting date for the Mon or Tues 30/9/2017: Meeting invite sent 5/10/2017: Official response (SETFIA-05A) addressing claims and objections emailed. COE acknowledged: importance of FIS and potential impacts of seismic, but that our activities are not seismic and that any noise emissions would be similar to those currently generated by existing O&G operations or transiting vessels in the region. Provided supporting information on likely produced sound levels of the activities and that the noise from the vessels is greater than from drilling itself. Based on studies it is likely received levels will be less than 120dB within only 2-4 km from the activity, while seismic may only reach such levels 35 km away. As such, the activities cannot be compared to each other as stated in the SETFIA letter. It is anticipated that the drilling program will be completed before the FIS commences in August and pipelay activities will commence in nearshore waters adjacent to the Orbost Gas Plant between September and November 2018, and so likely not impact the FIS. 9/10/2017: Meeting confirmed for Tuesday 17th to discuss the issues raised 11/10/2017: COE replied with thanks and that the issues would be discussed in the meeting on the 17th.
	COE introduced new Stakeholder Liaison. SETFIA pleased that COE have single POC. Confirmed FIS July and Aug 2018. COE provided overview of offshore activities as outlined in Sept brochure and that small 1-day survey to occur in state waters. Overview of upcoming provided. COE again confirmed pipeline to be trawlable.	No claims or objections to be assessed.	17/10/2017: COE will continue to keep SETFIA informed of all activities and send SMS as required for notifications. COE requested information on possible co-funding research programs from SETFIA. No information provided to date.

Stakeholder and relevance	Summary of Response	Assessment of Merits to Adverse Claim / Objection	Operators Response to each Claim / Objection
	Discussion regarding SETFIA letter objecting to offshore campaign. SETFIA confirmed main concerns are seismic and not COE SoW and that they had no concerns with the proposed activities. SETFIA pleased that pipelay not to commence until after 1st Sept to be after FIS. Appreciated that FIS had been taken into account during planning. SETFIA queried possible IMS and COE confirmed appropriate controls will be in place. Communications still to be via SMS. Just needs simple specific info. Discussions regarding community involvement, jobs for local industry and possible research program co-funding. Queries if COE person to move to Lakes Entrance SETFIA and other fishers do not like open forums but prefer smaller, pointed discussions. Stated only complaint had been from D Barrett but that he was more upset from earlier negative engagement with Geoscience Australia (See Dallas Barret SOL004 this table) General discussion on quotas and costs etc.		COE will likely not have a person at Lakes Entrance, but regular visits will occur. This will be made known to SETFIA. Draft minutes of meeting sent to SETFIA.
Seafood Industry Victoria	19/9/2017: Out of office reply. Alternate email address being Johnathon Davey at johnd@siv.com.au in my absence.	email was already also sent to johnd and so not further action is required.	No action required
	19/9/2017: John Davey responded requesting when feedback is required as they would like to discuss this and sit down and work through an appropriate approach to consulting with the fishing industry of Victoria.	No assessment required	19/9/2017: COE responded stating first EP to be submitted within 1 month. Reminded SIV that consultation is ongoing and understood that they need time to discuss the approach with their members. 9/10/2017: Follow up email sent to see if SIV had any response or required a meeting 11/10/2017: Meeting organised for Monday 16th September

Stakeholder and relevance	Summary of Response	Assessment of Merits to Adverse Claim / Objection	Operators Response to each Claim / Objection
	16/10/17: Confirmed SIV represented all commercial fishers, including LEFCOL, in State and was the best means of contacting all fishers. COE can send out info via Quarterly Profish magazine for fee SIV always on road and may be opportunity for COE to join in meetings Discussion was held regarding ongoing consultation and the monitoring of feedback. Cooper stated that on a regular basis they could provide SIV with an overview of feedback (i.e. every quarter or whenever there was a change in impact etc) stated he would try and get an updated list of contacts for each fishing group they represented. One of SIVs concerns were exclusion zones that reduced a fisher's useable area. Requested whether it was possible to reach agreement in terms of what operations could occur within exclusion zones and/or petroleum safety zones. I.e. if there is infrastructure on the seabed, trawling may be precluded, but some non-trawl operations could occur. 30/10/17: Email with minutes and apology for tardiness. Provided overview of current activities. 31/10/2017 – SIV suggested changes to minutes and that updated contact list will be provided when complete	Cooper acknowledge that fishers would like to reduce exclusion zones and petroleum safety zones and will discuss internally. Cooper acknowledge that they must be more accountable for feedback and SIV would like to be made aware. 31/10/17 – COE acknowledge changes to minutes	Most discussion points addressed during meeting. COE to review the possibility of sending information in the Profish magazine For operations phase COE to review reducing exclusion zones, however for safety, integrity and to protect fishers, the 500 m PSZ is preferred. During construction, 500m is required for safety. Any changes will be recorded in relevant EP and made known to SIV. 31/10/17 – COE acknowledge changes to minutes and updated and resent minutes to SIV 03/04/2018 – COE provided further information to SIV outlining that infrastructure may remain on seabed for up to 7 years and in this time PSZ will remain. Outlined that for safety reasons PSZ will remain, particularly in light of recent incursion into BMG PSZ.
Southern Cross Cable Network	19/9/2017: Thank you for the information and notice, we will share this with our members in the Submarine Cable community and advise you of any issues or concerns.	no assessment required Unlikely to be affected by activities at Sole	20/9/2017: COE sent thanks and offer for more info if required.
Southern Shark Industry Alliance	20/9/2017: Auto reply	no assessment required	no action required SSIA members are contacted also via SETFIA and SIV
Department of Communications and the Arts Submarine Cables Team	10/10/2017: The department had no comments on the proposals noting that there are three submarine cables across Bass Strait connecting Victoria and Tasmania, but they do not appear to be in the vicinity of the activity areas	no assessment required	no action required 11/10/2017: COE replied with thanks and questioned whether the department still wanted to receive updates since their assets were not in the vicinity
Tasmanian Environment Protections	No response received	no assessment required	no action required

Stakeholder and relevance	Summary of Response	Assessment of Merits to Adverse Claim / Objection	Operators Response to each Claim / Objection
Authority (EPA)	4/1/2018: Out of office received	no assessment required	no action required
	9/1/2018: Thanked COE for information and stated that they did not have the time or resources to review the OPEP. Main requirements is that Tasmania control actions and response in Tasmanian waters. This doesn't take away from the responsibility of the company to provide resources and appropriate response actions, just ensures Tasmanian interests are maintained. In the case of wildlife for example, this means all effected wildlife in Tasmanian waters will be managed by our Natural & Cultural Heritage Wildlife management branch. I appreciate any response will also require Victoria State response requirements, so I am open to suggestions on how we implement a practical solution to a response across so many boundaries. For Tasmanian waters - it looks like the areas effected would be Flinders and the Kent Group for the most part? The contact number for any oil entering State waters needs notification to the 24 hours pollution Hotline 1800 005 171.	Cooper acknowledge Tas EPA as relevant party and requirements to ensure spill response are adequately covered as per the TasPlan and that relevant info is provided for in the OPEP.	9/1/2018- COE will ensure that Tasmanian interest and response requirements are captured as per your email (i.e. wildlife affected will be managed by and the Natural and Cultural Heritage Wildlife and the inclusion of the 24 hour pollution hotline number) and as per the TASPLAN. COE will discuss with Victorian response agency, the best way to tackle a response across multiple jurisdictions. Final copy of the OPEP will be supplied once completed.
Victorian Fishery Authority (VFA) DEDJTR	General discussion of project and fisheries in the region. Discussed privacy issues that FV have under the Act, that means FV cannot provide Santos with any information that might identify fishers. Agreement reached that FV could send out information (e.g. a letter and brochure) to the potentially affected licence holders on Santos' behalf.	No claims or objections to be assessed.	Information was sent to FV on 31/10/206 for dissemination to fishers (Summer 2016 Brochure)
	4/10/2017: Response to BMG notice. Stuart requested all info be sent to Bill Lussier. 10/10/2017: VFA confirmed that all correspondence to now go via Bill Lussier and that all VFA emails are now VFA and not ecodev	No claims or objections to be assessed.	4/10/2017: COE acknowledged request and will update database 9/10/2017: COE reverted back to VFA to request whether ALL correspondence now goes to Bill and whether they were using new email addresses. 10/102017: COE will ensure all correspondence goes to Bill Lussier and that the VFA emails will be used.

Stakeholder and relevance	Summary of Response	Assessment of Merits to Adverse Claim / Objection	Operators Response to each Claim / Objection
Victorian Marine Pollution Team (MPT)(ECODEV)	telephone call outlining BMG activities, oil spill potential and offer of OPEP review. MPT will need approx. 2 weeks to provide feedback. Linda stated that COE could come and do a briefing/ presentation to their department and working group which includes fisheries department, resources etc.	No claims or objections to be assessed.	COE to supply BMG OPEP when ready. COE to discuss if briefing is required once MPT have received OPEP
	Out of office reply until 8/1/2018 9/1/2018: Linda stated that she has given her group until Friday next week to supply responses	No claims or objections to be assessed.	No response required Friday next week to supply responses 9/1/2-18: COE stated next Friday for response was great.
	24/1/2018: MPT pleased to see correct referenced used in OPEP. Stated link to VicPlan doesn't work as currently using Emergency Management Victoria's EMCop to store out plans. Link provided. MPT would have would also have an investigation functional role and an intelligence functional role under the latest version of AIIMS when we set up a L2/3 response. Queried whether to include some references as to how a vessel casualty would be managed in the plans. Fluids properties (Physical Characteristics/ Properties of Basker Crude and Diesel) should have been included prior to the Section 3 or in the Section 3.	COE recognise the comments made by MPT. Casualties are not covered as part of OPEP which only deals with spill response, but are covered under Cooper ER plans.	24/1/2018: COE thanked MPT for their review and comments and would revert back with any queries. Responses provided as part of meeting and email dated 03/04/2018.
	21/03/2018 – MPT supplied copy of IAP and list of assets at each location for information only 03/04/2018: Minutes of meeting emailed to MPT. See MPT-005 att for summary.	No claims or objections to be assessed.	COE to supply OPEP, TRP template and information on pre-operational NEBA.

10 References

Addison, R.F., Brodie, P.F. 1984. Characterization of ethoxyresirufin O-deethylase in grey seal Halichoerus grypus. Comp. Biochem. Physiol. C79, 261-263

Addison, R.F., P.F. Brodie, A. Edwards and M.C. Sadler. 1986. Mixed function oxidase activity in the harbour seal (Phoca vitulina) from Sable Is., N.S. Comp. Biochem. Physiol. 85C (1): 121-124.

Anzon, 2005. Basker Manta Project Full Field Development. Summary Environment Plan.

Barton, Jan, Pope, Adam and Howe, Steffan 2012, Marine protected areas of the Flinders and Twofold Shelf bioregions Parks Victoria, Melbourne, Vic available at http://hdl.handle.net/10536/DRO/DU:30047221

BirdLife International. 2012. Light pollution has a negative impact on many seabirds including several globally threatened species. Presented as part of the BirdLife State of the world's birds website. Available online at: http://www.birdlife.org/datazone/sowb/casestudy/488 [Accessed 13 January 2017]

Black, K.P., Brand, G.W., Grynberg, H., Gwyther, D., Hammond, L.S., Mourtikas, S., Richardson, B.J. and Wardrop, J.A. 1994. Production facilities. In: Environmental implications of offshore oil and gas development in Australia – the findings of an independent scientific review.

BP. 2013. Shah Deniz 2 Project. Environmental & Socio-Economic Impact Assessment. BP Development Pty Ltd.

Commonwealth of Australia, 2003. Australia's South-east Marine Region: A user's guide to Identifying Candidate Areas for a Regional Representative System of Marine Protected Areas available at https://www.environment.gov.au/resource/australias-south-east-marine-regiona-users-guide-identifying-candidate-areas-aregional

Connell, D.W., Miller, G.J. and Farrington, J.W., 1981. Petroleum hydrocarbons in aquatic ecosystems—behavior and effects of sublethal concentrations: Part 2. *Critical Reviews in Environmental Science and Technology*, *11*(2), pp.105-162.

Currie, D.R. and Isaacs, L.R. 2005. Impact of exploratory offshore drilling on benthic communities in the Minerva gas field, Port Campbell, Australia. Marine Environmental Research 59, 217-233.

DAWR, 2017. Australian Ballast Water Requirements. Department of Agriculture and Water Resources, version 7. http://www.agriculture.gov.au/SiteCollectionDocuments/biosecurity/avm/vessels/ballast/australian-ballast-water-management-requirements.pdf [Accessed November 2017]

de Campos, L. F., Paiva, P.M., Rodrigues, P.P. G.W., Ferreira, M.I.P, and Junior, J.L. 2017. Disposal of waste from cementing operation from offshore oil and gas wells building. Ciencia e Natura, Santa Maria, Vol. 39(2), pp. 413-422.

Dean, T.A., Stekoll, M.S., Jewett, S.C., Smith, R.O. and Hose, J.E. 1998. Eelgrass (Zostera marina L.) in Prince William Sound, Alaska: Effects of the Exxon Valdez oil spill. Marine Pollution Bulletin 36:201–210.

den Hartog, C. and Jacobs, R.P.W.M. 1980. Effects of the Amoco Cadiz oil spill on an eelgrass community at Roscoff (France) with special reference to the mobile benthic fauna. Helgolaender Meeresuntersuchungen 33:182–191.

DoE, 2017 Recovery Plan Marine Turtles, Department of Environment http://www.environment.gov.au/marine/publications/recovery-plan-marine-turtles-australia-2017

DoE. 2015b. Conservation Management Plan for the Blue Whale; A Recovery Plan under the Environment Protection and Biodiversity Conservation Act 1999. Department of Environment. Commonwealth of Australia.

DoE. 2018. *Balaenoptera musculus* in Species Profile and Threats Database. Department of the Environment, Canberra. Available from: http://www.environment.gov.au/sprat. Accessed 5 Jan 2018.

DoEE, 2017. Conservation Values atlas. Search for HDD activity area Undertaken on the 6th of January 201 at http://www.environment.gov.au/webgis-framework/apps/ncva/ncva.jsf

DSE, 2004 – Controlling the Northern Pacific Seastar (*Asterias Amurensis*) in Australia – Final Report for the Australian Government of Environment and Heritage available at https://www.environment.gov.au/system/files/resources/1b962183-8a66-4874-9ddd-7e9654e1c7dd/files/pacific-seastar.pdf

Engelhardt, F. 1983. Petroleum effects on marine mammals. *Aquatic Toxicology*, 4: 199–217.

French McCay, D.P. 2004. Oil spill impact modeling: Development and validation. Environmental Toxicology and Chemistry 23(10):2441–2456.

Harvey JT, Dahlheim ME (1994) Cetaceans in oil. In: Loughlin TR (ed) Marine mammals and the 'Exxon Valdez'. Academic Press, San Diego, CA, 257–26

Hewitt, C.L., Martin, R.B., Sliwa, C., McEnnulty, F.R., Murphy, N.E., Jones, T. and Cooper, S. (eds). 2002. National introduced marine pest information system. Available online http://www.marinepests.gov.au/Pages/default.aspx Accessed 04 May 2017

Hinwood, J.B., Potts, A.E., Dennis, L.R., Carey, J.M., Houridis, H., Bell, R.J., Thomson, J.R., Boudreau, P. and Ayling, A.M. 1994. 'Drilling Activities'. In: Environmental Implications of Offshore Oil and Gas Developments in Australia – the Findings of an Independent Scientific Review. Edited by Swan J.M., Neff J.M. and Young P.C. Australian Petroleum Exploration Association. Sydney.

Hook, S. van de Kamp, J. Williams, A., Tanner, J. Bodrossy, L 2016. Spatial distribution and diversity in hydrocarbon degrading microbes in the Great Australian Bight I: Functional Gene Distribution. Great Australian Bight Research Program.

Howard, R.K. and Edgar, G.J. 1994. Seagrass meadows. In: Hammond, L.S. and Synnot, R.N. (eds) Marine Biology. Longman Cheshire, Melbourne.

IMCRA Technical Group. 1998. Interim Marine and Coastal Regionalisation for Australia: an ecosystem-based classification for marine and coastal environments. Version 3.3. Interim Marine and Coastal Regionalisation for Australia Technical Group. Environment Australia, Commonwealth Department of the Environment. Australia.

International Tanker Owners Pollution Federation [ITOPF]. 2011. Effects of oil pollution on the Marine Environment. Technical Information Paper: No. 13. Viewed online http://www.itopf.com/fileadmin/data/Documents/TIPS%20TAPS/TIP13EffectsofOilPollutiononthe MarineEnvironment.pdf

ITOPF, 2010 - Technical Information Paper No 11: Effects of Oil Pollution on Fisheries and Mariculture (2010) downloaded on 15th May 2013 at http://www.itopf.com/informationservices/publications/documents/TIP11EffectsofOilPollutiononF isheriesandMariculture.pdf

International Tanker Owners Pollution Federation [ITOPF]. 2011. Effects of oil pollution on the Marine Environment. Technical Information Paper: No. 13. Viewed online http://www.itopf.com/fileadmin/data/Documents/TIPS%20TAPS/TIP13EffectsofOilPollutiononthe MarineEnvironment.pdf

Jenkins G.P. and McKinnon L. 2006. Channel Deepening Supplementary Environment Effects Statement – Aquaculture and Fisheries. Primary Industries Research, Victoria.

Laist, D.W., Knowlton, A.R., Mead, J.G., Collet, A.S., & Podesta, M. 2001. Collisions between Ships and Whales. Marine Mammal Science, Vol. 17, Issue 1, pp 35-75.

Langford, T.E.L. 1990. Ecological effects of thermal discharges, xi, 468p. Elsevier.

Lewis, M. and Pryor, R. 2013. Toxicities of oils, dispersants and dispersed oils to algae and aquatic plants: Review and database value to resource sustainability. Environmental Pollution 180:345–367.

Marquenie, J., Donners, M., Poot, H., Steckel, W. and de Wit, B. (2008). Adapting the spectral composition of artificial lighting to safeguard the environment. Petroleum and Chemical Industry Conference Europe -Electrical and Instrumentation Applications, pp 1-6.

Matkin CO, Saulitis EL, Ellis GM, Olesiuk P and Rice SD (2008) Ongoing population-level impacts on killer whales Orcinus orca following the 'Exxon Valdez' oil spill in Prince William Sound, Alaska. Marine Ecology Progress Series 356:269–281

McCauley, R.D., Fewtrell, J. and Popper, A.N., 2003. High intensity anthropogenic sound damages fish ears. *The journal of the acoustical society of America*, *113*(1), pp.638-642.

McGurk, M.D. 1986. Natural mortality of marine pelagic fish eggs and larvas: role of spatial patchiness. Mar. Ecol. Prog. Ser. Vol. 34:227–242, 20985. Available from: http://hcrs.co/wp-content/uploads/Hay%20Egg%20Loss%20Folder/McGurk%201986.pdf

McIntyre, A.D. and Johnson, R. 1975. Effects of nutrient enrichment from sewage in the sea. In: ALH Gameson, ed. Discharge of sewage from sea outfalls. New York, Pergamon Press. pp. 131–141

Neff, J.M. 2005. Composition, Environmental Fates, and Biological Effect of Water Based Drilling Muds and Cuttings Discharged to the Marine Environment: A Synthesis and Annotated Bibliography. Prepared for Petroleum Environmental Research Forum (PERF) and American Petroleum Institute. Battelle. USA.

Neff, J.M. 2010. Fates and Effects of Water Based Drilling Muds and Cuttings in Cold-Water Environments. Prepared by Neff & Associates LLC for Shell Exploration and Production Company. A WWW document accessed at https://s08.static-shell.com/content/dam/shell-new/local/country/usa/downloads/alaska/neff-final-draftgs072010.pdf.

Neuparth, T., Costa, F. O., & Costa, M. H. (2002). Effects of temperature and salinity on life history of the marine amphipod Gammarus locusta. Implications for ecotoxicological testing. Ecotoxicology, 11, 61–73.

NOAA. 2002. Environmental Sensitivity Index Guidelines. Version 3. March 2002. National Oceanic and Atmospheric Administration. Washington

NOAA. 2010. *Oil spills in coral reefs: planning and response considerations*, US Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Service, Office of Response and Restoration.

NOO. 2002. Sea Country – an Indigenous Perspective; The South-east Regional Marine Plan Assessment Reports. National Oceans Office. Commonwealth of Australia.

NRDA. 2012. April 2012 Status Update for the Deepwater Horizon Oil Spill. A WWW publication accessed at: http://www.gulfspillrestoration.noaa.gov. Natural Resource Damage Assessment.

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

Pendoley, K. 2000. The influence of gas flares on the orientation of green turtle hatchlings at Thevenard Island, Western Australia. Second ASEAN Symposium and Workshop on Sea Turtle biology and Conservation, Kota Kinabalu, Borneo, ASEAN Academic Press

Popper and Hastings (2009) The effects of anthropogenic sources of sound on fish. Journal of Fish Biology (2009) 75, 455–489

Popper, A. N., Hawkins, A. D., Fay, R. R., Mann, D., Bartol, S., Carlson, T., Coombs, S., Ellison, W. T., Gentry, R., Halvorsen, M. B., Løkkeborg, S., Rogers, P., Southall, B. L., Zeddies, D., and Tavolga, W. N. (2014). "Sound Exposure Guidelines for Fishes and Sea Turtles: A Technical Report," ASA S3/SC1.4 TR-201.4 prepared by ANSI Accredited Standards Committee

Ramboll Danmark, 2008. Offshore pipeline through the Baltic Sea. Release of sediments from anchor operations. Memo 4.3A-9.

Richardson, W. J., Greene, C. R., Maime, C. I. and Thomson, D. H. 1995. Marine Mammals and Noise. Academic Press, San Diego, California.

Rodrıguez A, Burgan G, Dann P, Jessop R, Negro JJ, et al. (2014) Fatal Attraction of Short-Tailed Shearwaters to Artificial Lights. PLoS ONE 9(10): e110114. doi:10.1371/journal.pone.0110114

RPS-APASA. 2017. *BMG Well Abandonment Program, Gippsland Basin – Quantitative Oil Spill Modelling Study*. Prepared for Cooper Energy. RPS Australia West Pty Ltd.

Shell. 2010. Prelude Floating LNG Project EIS Supplement-Response to Submissions

Shigenaka, G. 2001. *Toxicity of oil to reef building corals: a spill response perspective.* National Oceanic and Atmospheric Administration (NOAA) Technical Memorandum, National Ocean Service, Office of Research and Restoration 8, Seattle, USA.Simmonds, M.P., Dolman, S.J. and Weilgart, L. (eds). 2004. Oceans of Noise. AWDCS Science Report Published by the Whale and Dolphin Conservation Society. Available online at: http://www.wdcs.org/submissions_bin/OceansofNoise.pdf [Accessed 22 February 2017]

Simmonds, M., Dolman, S. and Weilgart, L. 2004. Oceans of Noise. Whale and Dolphin Conservation Society. Wiltshire.

SINTEF. 2013. Offshore Blowout Database. Proprietary, www.sintef.no. March 2013.

Southall, B.L., Bowles, A.E., Ellison, W.T., Finneran, J.J., Gentry, R.L., Greene Jr C.R., Kastak, D., Ketten, D.R., Miller, J.H., Nachtigall, P.E., Richardson, W.J., Thomas, J.A and Tyack, P.L. 2007. Marine Mammal Noise Exposure Criteria: Initial Scientific Recommendations. Aquatic Mammals. 33 (4):411–414.

United Nations Environment Programme, (UNEP). 1985. GESAMP: Thermal discharges in the marine environment. UNEP Regional Seas Reports and Studies No. 45.

Walker, D.I. and McComb, A.J. 1990. Salinity response of the seagrass Amphibolis antarctica (Labill.) Sonder et Aschers: an experimental validation of field results. Aquat Bot. 36:359–366.

Wiese, F. K., Montevecci, W. A., Davoren, G. K., Huettmann, F., Diamond, A. W. and Linke, J. 2001. Seabirds at risk around off shore oil platforms in the northwest Atlantic. Marine Pollution Bulletin. 42:1285-1290.

WEL (Woodside Energy Ltd.) 2014. Browse FLNG Development, Draft Environmental Impact Statement. EPBC 2013/7079. November 2014. Woodside Energy, Perth WA.

Whale and Dolphin Conservation Society (WDCS), 2003 - Oceans of Noise. [Online]. Available from: http://ww.wdcs.org/stop/pollution/index.php

Zieman, J.C., Orth, R., Phillips, R.C., Thayer, G.W. and Thorhaug, A. 1984. The effects of oil on seagrass ecosystems. In: Cairns J, J., Buikema J, A.L. (eds) Restoration of Habitats Impacted by Oil Spills. Butterworth, London.