WA-8-L PRODUCTION EQUIPMENT ABANDONMENT

ENVIRONMENT PLAN SUMMARY

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ACRONYMS & ABBREVIATIONS

Acronym / Abbreviation	Meaning
%	percent
~	approximately
‘	minutes
“	seconds
º	degrees
ºC	degrees Centigrade
A$	Australian dollars
AFMA	Australian Fisheries Management Authority
AFZ	Australian Fishing Zone
AHV	Anchor Handling Vessel
ALARP	As Low As Reasonably Practicable
AMP	Australian Marine Park
AMSA	Australian Maritime Safety Authority
APPEA	Australian Petroleum Production and Exploration Association
bar	atmospheric air pressure
bbl	barrels
BIA	Biologically Important Area
BoM	Bureau of Meteorology (Australia)
BPEO	Best Practicable Environmental Option
CALM	Catenary Anchor Leg Mooring system
cm	centimetres

Acronym / Abbreviation	Meaning
COLREGS	International Regulations for Preventing Collisions at Sea
DASETT	Department of Arts, Sports, Environment, Trade and Tourism (Commonwealth), now DoEE
DEWHA	Department of Environment, Water, Heritage and the Arts (Commonwealth), now DoEE
dia	diameter
DIIS	Department of Industry, Innovation and Science (Commonwealth)
DME	Department of Minerals and Energy (WA), now DMIRS
DMIRS	Department of Mines, Industry Regulation and Safety (WA)
DNP	Director of National Parks (Commonwealth)
DoD	Department of Defence (Commonwealth)
DoEE	Department of the Environment and Energy (Commonwealth)
DP	Dynamically Positioned
DPIRD	Department of Primary Industries and Regional Development (WA)
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities (Commonwealth), now DoEE
E	East
e.g.	exempli gratia (for example)
EHS	Environment, Health and Safety
EMBA	Environment that May Be Affected
EP	Environment Plan
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
et al.	et alia (and others)
FPSO	Floating Production Storage and Offtake
GN	Guidance Note
H&S	Health and Safety
i.e.	id est (in other words)
IMS	Introduced Marine Species
in	inch
in situ	"on site" or "in position"
IUCN	International Union for the Conservation of Nature
KEF	Key Ecological Feature
kg/m	kilograms per metre
km	kilometres
km^2	square kilometres
m	metres
MARPOL	International Convention for the Prevention of Pollution from Ships
MBC	Marine Border Command
mm	millimetres
MMF	Mackerel Managed Fishery (WA)
MNES	Matters of National Environmental Significance
MO	Marine Orders
MoC	Management of Change
NBPMF	Nickol Bay Prawn Managed Fishery (WA)
nm	nautical miles
NOAA	National Oceanic and Atmospheric Administration (US)

Acronym / Abbreviation	Meaning
NOPIMS	National Offshore Petroleum Information Management System (Australia)
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
NORMs	Naturally Occurring Radioactive Materials
NT	Northern Territory
NTM	Notice to Mariners
NWMR	North-west Marine Region
OGUK	Oil & Gas UK
OPEP	Oil Pollution Emergency Plan
OPGGS (E) Regulations	Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009
OPGGS Act	*Offshore Petroleum and Greenhouse Gas Storage Act 2006*
PFTIMF	Pilbara Fish Trawl Interim Managed Fishery
PLF	Pilbara Line Fishery
PM	Protected Matters
POMF	Pearl Oyster Managed Fishery
psi	pound per square inch
psu	practical salinity unit
PTMF	Pilbara Trawl Managed Fishery
Rev	Revision
ROV	Remotely Operated Vehicle
S	South
SBTF	Southern Bluefin Tuna Fishery (Commonwealth)
SMS	Santos Management System
U3	special heat treated steel
UKOOA	United Kingdom Offshore Operators Association
UV	ultra violet
VOCs	Volatile Organic Compounds
WA	Western Australia
WGS84	World Geodetic System 1984
WSTF	Western Skipjack Tuna Fishery (Commonwealth)
WTBF	Western Tuna and Billfish Fishery (Commonwealth)

1 INTRODUCTION

1.1 Background

This Environment Plan (EP) summary relates to abandonment of production equipment that is currently *in situ* on the seabed in the WA-8-L Production Licence area, where it has been since the decommissioning of the Talisman production facility in 1992.

The Talisman project was a joint venture between Marathon Petroleum Australia Ltd (52.63%), Santos Ltd (27.37%), Lasmo Oil (Australia) Ltd (10%) and Ampolex Ltd (10%). Following the termination of production operations in July 1992, the Talisman No.1 (T-1) and No. 7 (T-7) wells were plugged and abandoned, and the wellheads were recovered over two stages from September to November 1992. During the decommissioning all locatable items were recovered from the Talisman field, with the exception of the T-7 flowline and control umbilical line, an anchor and length of chain, and a tyre weight. The flowline and umbilical were clamped together at the time of decommissioning and, together with the other items that could not be recovered, are hereinafter collectively referred to as the 'production equipment.' The production equipment has remained on the seabed to date.

The current titleholders of Production Licence WA-8-L are:

- Santos Limited;
- Tap (Shelfal) Pty Ltd; and
- Kufpec (Perth) Pty Ltd.

Santos Limited (Santos) is the Operator of Production Licence WA-8-L and hence the designated petroleum titleholder for the purposes of this EP.

The EP has been prepared in accordance with the requirements of the *Offshore Petroleum and Greenhouse Gas Storage Act 2006* (OPGGS Act) and associated Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (OPGGS (E) Regulations). It has also been prepared with reference to the Environment Plan Content Requirements Guidance Note (Rev 3, April 2016) produced by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA).

1.2 Defining the Petroleum Activity

The EP includes a comparative assessment of two potential petroleum activities within WA-8-L:

- Base case – complete removal of the production equipment; and
- Option A – leave the production equipment *in situ* in perpetuity.

The comparative assessment process has determined that abandonment option A is the "best practicable environmental option" (BPEO). Therefore, the defined petroleum activity to be undertaken for WA-8-L involves no operations and comprises of leaving the production equipment *in situ* in perpetuity. This is defined as a petroleum activity in Regulation 4 of the OPGGS (E) Regulations. As such, an EP is required to be prepared and submitted to NOPSEMA.

The defined activity ends upon acceptance of the EP by NOPSEMA, and on submission and acceptance of the notifications as required under Regulation 29 (end of activity) and Regulation 25A (end of operation of EP) of the OPGGS (E) Regulations.

1.3 Scope of the Environment Plan

The scope of the EP covers an assessment of two potential abandonment options for the production equipment remaining on the seabed within WA-8-L from the 1992 Talisman decommissioning. As the proposed activity relates to the abandonment of the equipment in 2019 and in perpetuity, the EP has been prepared in the context of the existing environment at the time of submission. The EP identifies impacts to the existing environment and demonstrates potential impacts and risks are maintained to as low as reasonably practicable (ALARP) and acceptable levels, as required by the relevant legislation and guidelines (Section 2). This activity will involve no operations within WA-8-L, as described in Section 3.

1.4 Titleholder

Table 1-1 provides details of the WA-8-L titleholders and the titleholders' nominated liaison person.

Table 1-1 Titleholder and nominated liaison person

Titleholder Details	Liaison Person Details
Production Licence WA-8-L Name: Santos Limited (Operator) 60 Flinders Street, Adelaide, SA 5000 Telephone number: 08 8116 5000 ABN: 80 007 550 923 Name: Tap (Shelfal) Pty Ltd Name : Kufpec Australia Pty Ltd	Name: Nick Fox Role: Head of Environment and Access, EHS & Governance Santos Limited 60 Flinders St, Adelaide, SA, 5000 08 8116 5151 Email: Nick.Fox@santos.com

2 ENVIRONMENT REQUIREMENTS

This section provides information on the requirements that apply to the activity and how they apply to the activity. Requirements include relevant laws, codes, other approvals and conditions, standards, agreements, treaties, conventions or practices (in whole or part) that apply to jurisdiction that the activity takes place in.

The abandonment of the production equipment in WA-8-L will take place within Commonwealth waters. The impact assessment undertaken and documented in Section 7 did not identify any impacts or risks to State waters of Western Australia (WA).

Table 2-1 provides a summary of requirements that apply to the activity and are relevant to the activity's environmental management.

Under subsection 572(3) of the OPGGS Act, a titleholder must remove all equipment and other property in their title area that is neither used, nor to be used, for operations authorised by their title. This obligation is ongoing, and covers both the removal of property at the end of production and the removal of disused infrastructure at appropriate points throughout the life of a project (see Table 2-1).

The complete removal of infrastructure and the plugging and abandonment of wells is the "base case" – i.e. the default decommissioning requirement under the OPGGS Act. This is consistent with Australia's international obligations, primarily under the United Nations Convention on the Law of the Sea (UNCLOS) and the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Convention) and associated Protocol, to remove disused installations and structures and to preserve and protect the marine environment.

2.1 Other Environmental Approvals

In early 1992 Marathon Petroleum Australia (then operator of Production Licence WA-8-L) submitting three separate applications for Sea Dumping Permits under the *Environment Protection (Sea Dumping) Act 1981* to the Commonwealth Department of Arts, Sports, Environment, Trade and Tourism (DASETT). These applications covered onsite abandonment of infrastructure within WA-8-L, and offsite abandonment at two locations (nearby deep water location and inshore, shallow water location near Bare Rock in the Dampier Archipelago). In July 1992, Marathon was informed that DASETT had rejected both onsite and offsite abandonment options, with the rejection not being based on the materials being detrimental to the natural environment, but rather at the request of the trawling industry.

Platforms are defined in the Sea Dumping Act as "*platform includes any man-made structure at sea, whether floating or fixed to the seabed, but does not include a vessel*". It is not clear whether the production equipment left *in situ* in 1992 would be defined as a 'platform' under the Sea Dumping Act. Consultation with the Sea Dumping team at the Department of the Environment and Energy (DoEE) (refer Section 4) during preparation of the EP indicated that the flowline/umbilical and anchor/chain left *in situ* would probably be covered under the definition of "platform" under the Sea Dumping Act (whereas wellheads are not), so therefore a Sea Dumping Permit may be required. However, there may be a possibility of seeking an exception under Section 15 of the Act.

Santos has provided relevant information to the Sea Dumping team at the DoEE, and is awaiting their response (refer Section 4).

Table 2-1 Summary of requirements relevant to the activity and its environmental management

Requirements and Guidance	Scope	How it Applies to the Activity or Activity's Environmental Management	Administering Authority
Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) Environment Protection and Biodiversity Conservation Regulations 2000	The EPBC Act aims to protect the environment, particularly matters of national environmental significance for which Australia has made international agreements. The Act streamlines national environmental assessment and approval processes, and promotes ecologically sustainable development and conservation of biodiversity. It also provides for a cooperative approach to the management of natural, cultural, social and economic aspects of ecosystems, communities and resources.	Petroleum activities are excluded from within the boundaries of a World Heritage Area (Sub regulation 10A(f). *WA-8-L is not within the boundaries of a World Heritage Area.* The EP must describe matters protected under Part 3 of the EPBC Act and assess any impacts and risks to these. *Section 5 describes matters protected under Part 3 of the EPBC Act.* *Section 7 provide an assessment of any impacts and risks to matters protected under Part 3 of the EPBC Act.*	Department of the Environment and Energy (DoEE)
EPBC Act	Section 3A of the Act defines the principles of ecological sustainable development. The following principles are principles of ecologically sustainable development : (a) decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations; (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; (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; (d) the conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making; (e) improved valuation, pricing and incentive mechanisms should be promoted.	Petroleum activities must be carried out in a manner consistent with the principles of ecological sustainable development set out in Section 3A of the EPBC Act. *Section 6 outlines the risk assessment methodology, including residual risks needing to show that ALARP is demonstrated and the principles of ecologically sustainable development have been met.*	DoEE
Navigation Act 2012 Navigation Regulation 2013	Regulates international ship and seafarer safety, shipping aspects of protecting the marine environment and the actions of seafarers in Australian waters.	Several Marine Orders (MO) are enacted under this Act relating to offshore petroleum activities, including: MO 21—Safety of navigation and emergency arrangements MO 30—Prevention of collisions	Australian Maritime Safety Authority (AMSA)

Requirements and Guidance	Scope	How it Applies to the Activity or Activity's Environmental Management	Administering Authority
	It gives effect to the relevant international conventions (MARPOL 73/78, COLREGS 1972) relating to maritime issues to which Australia is a signatory. The Act also has subordinate legislation contained in Regulations and Marine Orders.	MO 91—Marine pollution prevention—oil MO 95—Marine pollution prevention—garbage MO 96—Marine pollution prevention—sewage MO 97—Marine pollution prevention—air pollution MO 98—Marine pollution prevention—anti-fouling systems	
Offshore Petroleum and Greenhouse Gas Storage Act 2006	Addresses all licensing, health, safety, environmental and royalty issues for offshore petroleum exploration and development operations extending beyond the three nautical mile limit.	Under subsection 572(3) of the OPGGS Act, a titleholder must remove all equipment and other property in their title area that is neither used, nor to be used, for operations authorised by their title. This obligation is ongoing, and covers both the removal of property at the end of production and the removal of disused infrastructure at appropriate points throughout the life of a project. The complete removal of infrastructure and the plugging and abandonment of wells is the "base case" – i.e. the default decommissioning requirement under the OPGGS Act. This is consistent with Australia's international obligations, primarily under the United Nations Convention on the Law of the Sea (UNCLOS) and the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Convention) and associated Protocol, to remove disused installations and structures and to preserve and protect the marine environment. The property removal, maintenance and repair obligations are subject to other provisions of the OPGGS Act, the regulations, directions given by NOPSEMA or the responsible Commonwealth Minister, and other applicable laws. The obligations therefore do not substitute for or override other provisions of, or arrangements made under, the OPGGS Act or regulations.	Department of Industry, Innovation and Science (DIIS) NOPTA NOPSEMA
Offshore Petroleum and Greenhouse Gas Storage Act 2006 Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009	Addresses all licensing, health, safety, environmental and royalty issues for offshore petroleum exploration and development operations extending beyond the three nautical mile limit. Ensures that petroleum activities are undertaken in an ecologically sustainable manner and in accordance with an approved EP.	A titleholder must have an in force EP prior to the commencement of any petroleum activity. *This requirement is met by submission and acceptance of this EP.* A significant modification, change or new stage of an existing activity that is not included in an in force EP requires a revision of the EP to be submitted to NOPSEMA for acceptance. *Section 8.4 details this requirement.* Titleholders are required to maintain financial assurance sufficient to give the titleholder carrying out the petroleum activity, the capacity to meet the costs, expenses and liabilities that may result in connection with carrying out the petroleum activity; doing any other thing for the purpose of the petroleum activity; or complying (or failing to comply) with a requirement under the OPGGS Act in relation to the petroleum activity. *This requirement is required to be met by the titleholder before NOPSEMA can accept the EP.*	NOPSEMA
Offshore Petroleum and Greenhouse Gas Storage (Regulatory Levies) Act 2003	An Act to impose levies relating to the regulation of offshore petroleum activities and greenhouse gas storage activities.	Requires that EP levies are imposed on EP submissions, including revisions, where the activities to which the EP relates are authorised by one or more Commonwealth titles. *This requirement applies once the EP is accepted.*	NOPSEMA

Requirements and Guidance	Scope	How it Applies to the Activity or Activity's Environmental Management	Administering Authority
Offshore Petroleum and Greenhouse Gas Storage (Regulatory Levies) Regulations 2004			
Offshore Petroleum and Greenhouse Gas Activities: Consultation with Australian Government agencies with responsibilities in the Commonwealth Marine Area	Under the OPGGS (E) Regulations, a titleholder is required to consult with each Department or agency of the Commonwealth to which the activities to be carried out under the environment plan may be relevant. The Australian Government has developed guidance for titleholders to assist in determining which agencies may be relevant for consultation purposes in developing or revising environment submissions.	Provides guidance as to which Commonwealth Departments or agencies are potentially relevant stakeholders and how to consult with. The guidance document also details reporting requirements to Commonwealth Departments or agencies. *Section 4 describes the Commonwealth Departments or agencies identified as potential relevant stakeholders using this guidance.*	Department of Industry, Innovation and Science (DIIS)
Environment Protection (Sea Dumping) Act 1981 (the Sea Dumping Act) Environment Protection (Sea Dumping) Regulations 1983	The Sea Dumping Act regulates all ocean disposal activities. The Act fulfils Australia's international obligations under the London Protocol to prevent marine pollution caused by dumping.	Aims to prevent the deliberate disposal of wastes (loading, dumping and incineration) at sea from vessels, aircraft and platforms. Platforms are defined in the Act as "*platform includes any man-made structure at sea, whether floating or fixed to the seabed, but does not include a vessel*." Where a titleholder proposes to dispose of or abandon *in situ* infrastructure at sea, the titleholder will be required to apply for a permit under the Sea Dumping Act.	DoEE
Offshore Petroleum Decommissioning Guideline, January 2018	To assist titleholders with the regulatory approvals required and understand decision makers' expectations.	A non-compulsory but recommended approach to guide the decommissioning process.	DIIS
Offshore Oil and Gas Decommissioning Decision-making Guidelines, July 2016	Summarises the considerations when determining the scope for decommissioning offshore oil and gas facilities.	A non-compulsory but recommended approach to guide the decommissioning process.	Australian Petroleum Production and Exploration Association (APPEA)
ALARP Guidance Note (GN0166)	Provides guidance on the ALARP concept	Provides consistency in the ALARP approach when assessing environmental impacts.	NOPSEMA

3 DESCRIPTION OF THE ACTIVITY

3.1 Background

This EP relates to abandonment of infrastructure that is currently *in situ* on the seabed in WA-8-L, where it has been since the decommissioning of the Talisman production facility in 1992.

Following the termination of production operations in July 1992, the Talisman No.1 (T-1) and No. 7 (T-7) wells were plugged and abandoned and the wellheads were recovered, over two stages from September to November 1992. During the decommissioning all locatable items were recovered from the Talisman field, with the exception of the T-7 flowline and control umbilical line, an anchor and length of chain, and a tyre weight. The flowline and umbilical were clamped together at the time of decommissioning and, together with the other items that could not be recovered, are hereinafter collectively referred to as the 'production equipment.' The production equipment has remained on the seabed to date.

For the purposes of this EP, the defined petroleum activity is leaving the production equipment remaining from the 1992 Talisman field decommissioning on the seabed within WA-8-L.

3.2 Location

Production Licence WA-8-L is located 127 km north of Dampier, WA in the northern Carnarvon Basin, and covers two graticular blocks, containing the Talisman and Amulet fields. The production licence area covers 161 km^2 across a water depth range of 79-89 metres (m). WA-8-L is surrounded by adjacent exploration permit areas WA-191-P, WA-352-P and WA-1-P. The Talisman field contains seven plugged and abandoned wells, as identified in the WA-8-L Abandonment and Decommissioning Report (Marathon 1992). The locations of the wells and production licence area are provided in Figure 3-1. Geographical coordinates for the assumed position of the production equipment, based on the known locations for the T-7 wellhead and Talisman CALM Buoy / FPSO, are provided in Table 3-1.

For the purposes of this EP a 'production equipment abandonment area' has been defined, based on a 1 km radius around the coordinates provided in Table 3-1. Water depths in the production equipment abandonment area range from 79 to 84 m.

Table 3-1 Geographic coordinates for assumed position of production equipment in WA-8-L

Equipment	Coordinates (WGS84)	
	Latitude	Longitude
T-7 Wellhead	19º 29' 47.066" S	116º 55' 53.516" E
Flowline and umbilical (start point)	19º 29' 47.066" S	116º 55' 53.516" E
Flowline and umbilical (end point)	19º 29' 52.85" S	116º 55' 25.940" E
Anchor and chain*	-	-
Tyre weight*	-	-

* Position unknown – assumed to be within the production equipment abandonment area.

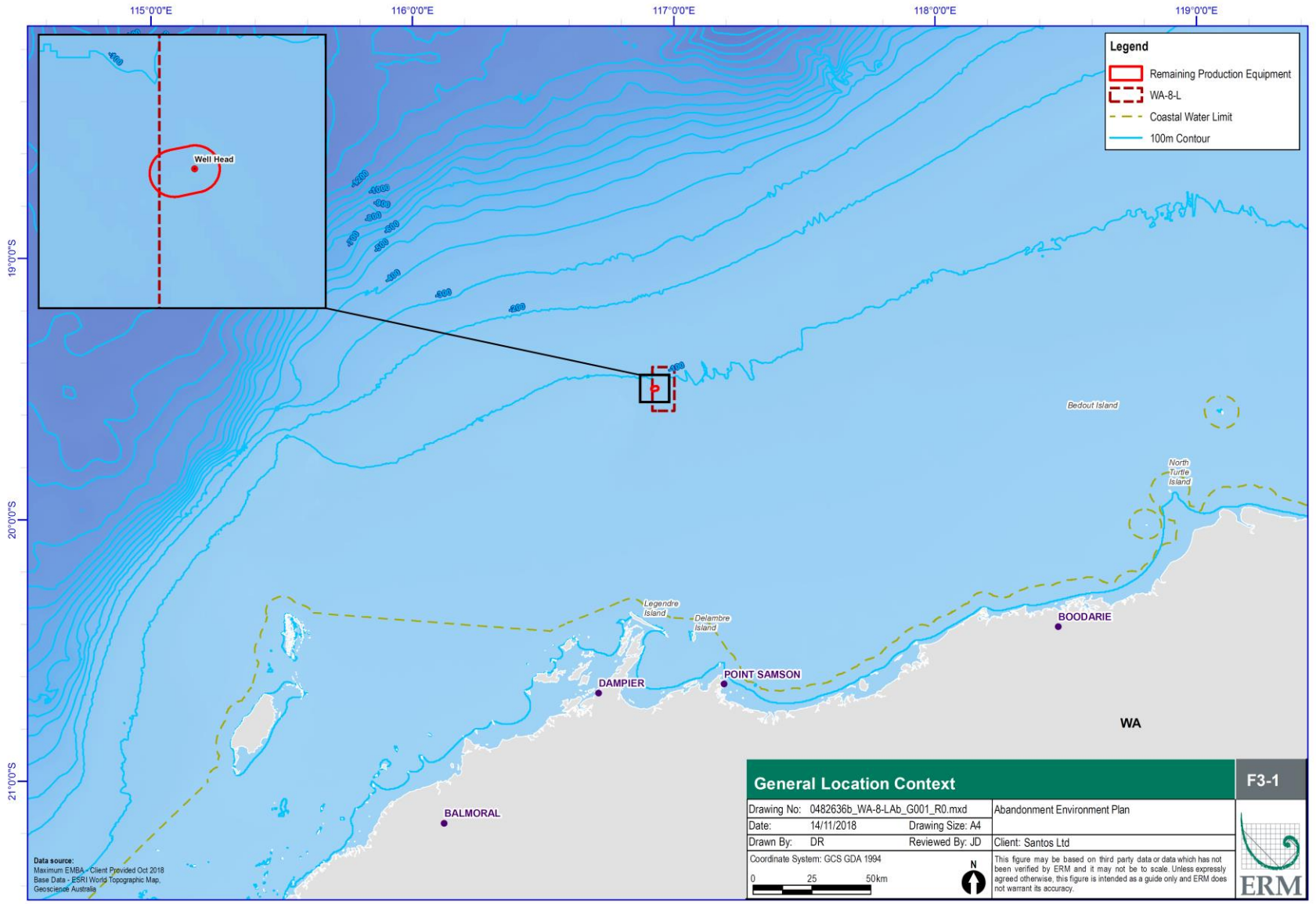

Figure 3-1 Location of WA-8-L and production equipment

3.3 Overview of Previous WA-8-L Production and Decommissioning Activities

The Talisman field produced 7.7 million bbl of high quality light crude oil between June 1989 and September 1992 at two production wells (Talisman No. 1 [T-1] and Talisman No. 7 [T-7]). T-1 was the first production well, producing oil between 1989 and 1992. The T-7 well produced oil between 1990 and 1992. The oil was processed on an FPSO (the *Acqua Blu*), connected to the wells with subsea trees, flowlines and umbilicals.

Following the termination of production operations in the Talisman field on 20th July 1992, the two production wells were killed, plugged and abandoned in September – October 1992 using a semi-submersible drilling rig (*Southern Cross*) and support vessels. Decommissioning was completed in two stages. First, with the drilling rig on location, the CALM anchor chains were cut beneath the buoy; and the buoy towed from the licence area. The rig then recovered the T-1 flowline (Figure 3-2), control umbilicals, mid-water buoyancy tank and associated clump weight and chain before repositioning and recovering the T-7 mid-water buoyancy tank, clump weigh and chain. The T-7 flowline and control umbilical were lifted off the buoyancy tank and laid on the seabed. The rig then pulled anchors and was towed out of the licence area for demobilisation (Marathon 1992).

Figure 3-2 Recovery of T-1 flowline and umbilical through the rig moonpool

For the second stage of decommissioning, the AHV *Lady Elizabeth*, complete with ROV spread, was used for the removal of the remaining CALM anchors and chains, recovery of a launch frame and the final site survey. All locatable items were recovered from the Talisman field, with the exception of the T-7 flowline and umbilical, an anchor and length of chain, and a tyre weight (Marathon 1992).

Thus, all subsea infrastructure was removed from the Talisman field, with the exception of the T-7 flowline / umbilical, an anchor / chain, and the tyre weight. There were multiple attempts to retrieve these items between 19th October and 6th November 1992 including (Marathon 1992):

- 19th Oct 1992: lifting from the semi-submersible rig was attempted; however, the lifting clamps used to retrieve the T-1 flowline were too small to fit on the T-7 flowline.

- 19th Oct 1992: an alternative lifting method using a wrap-around strop and repair sleeve was then attempted, with the padeye of the repair sleeve failing and the flowline lowered to the seabed.
- 30th and 31st Oct 1992: further attempts were made from a support vessel but the T-7 flowline and umbilical were not able to be reached due to strong variable currents and light variable winds.
- 2nd Nov 1992: the support vessel returned to the site of the T-7 flowline and umbilical following a return to port, but was unable to locate it using the ROV.
- 4th Nov 1992: the ROV located the T-7 flowline and umbilical and followed them to the launch frame. Due to technical problems with the ROV the operation was aborted.
- 5th Nov 1992: Caught and lifted the T-7 control line before putting it back on the seabed. Grapple on tow line failed to catch the frame. ROV mechanical arm dislocated during attempt to use a sling to retrieve the frame, and ROV was retrieved for repair.
- 6th Nov 1992: ROV survey of the flowline, now detached from the CALM buoy and other possible debris did not observe any retrievable items. The flowline was observed to be 2 m clear of the seabed 50 to 60 m from the CALM (east end), potentially due to unintentional grappling during lifting operations on 5th Nov 1992.

The AHV left the site of the Talisman field on 6th November 1992. The estimated location of the T-7 flowline and umbilical is shown in Figure 3-1.

Items recovered are listed in Table 3-2, and items left *in situ* are listed in Table 3-3.

Table 3-2 Items recovered during decommissioning activity

Item	Dimensions (m)	Weight (tons)
Flowline	230 x 0.16 dia	8
Umbilical	230 x 0.09 dia	2.8
Clump weights	10 x 1.5 x 1.5 5 x 3 x 2.5	25 47
Buoyancy tanks x 2	7.5 x 2 x 3 7.5 x 5 x 4	Unknown 21
CALM anchor x 2	Not known	32.5
CALM anchors x 2	5 x 2 x 2 each 50 m of chain each	122
CALM anchor chains x 4	1,675 m total of U3 quality 3.25 in chain	Not known
AQB mooring hawser	50 x 0.2 dia	Not known
Chain-through buoy	2 x 1.8 dia	Not known
Clump weight chain	27	Not known
Gravity box launch frame	6 x 3 x 1	4.5

Table 3-3 Items left *in situ* during decommissioning activity (T-7)

Item	Dimensions (m)	Weight (tons)	Observations from Marathon (1992)
Flowline	1,010 x 0.23 dia	87	Located. Could not be lifted. Wellstream/ Coflexip.
Control umbilical	1,047 x 0.11	15.7	Located. Could not be lifted. Clamped to flowline. Combined weight of flowline and umbilical is ~100 kg per metre length.
Anchor and chain	1.2 x 1 x 1 anchor* 90 m x 50 mm chain	5	Could not be located with ROV.
Tyre weight	0.15 x 0.6 dia	0.4	Could not be located with ROV.

Note: * Assumed to be a 1.2 x 1 x 1 m cube of concrete.

Figure 3-3 shows a cross section of a cut section of the T-1 flowline. Whilst the T-7 flowline is slightly larger in diameter (0.23 m vs. 0.16 m diameter) it is assumed that the flowline construction and materials are the same. Figure 3-4 shows the T-7 flowline and umbilical being lifted off the mid-water buoyancy tank.

Figure 3-3 Cross section of a cut section of the T-1 flowline

Figure 3-4 Decoupling of the T-7 flowline and umbilical from the buoyancy tank

3.4 Flowline and Umbilical Materials and Construction

In the absence of any information in the WA-8-L Abandonment and Decommissioning Report (Marathon 1992) it has to be assumed that the T-7 flowline (indicated as being Wellstream / Coflexip – refer Table 3-3) would have similar materials and construction to Coflexip high pressure flexible pipe used in the 1980s – 1990s. Coflexip flexible pipe hose has an articulated carcass of spiral-wound stainless steel covered by an outer thermoplastic (high-grade polyamide nylon) sheath (refer Figure 3-3). The inner carcass flexes but will not kink or collapse, ensuring the internal diameter is maintained. The outer thermoplastic sheath is extruded over the pipe, making it completely leak-proof and resistant to most chemicals. Thus, Coflexip flowlines are made of very stable, non-biodegradable materials and are expected to have a service life of many decades, with design parameters of 70ºC and 172 bar (~2,500 psi).

3.5 Residual Fluids in Flowline and Umbilical

No information is available from the WA-8-L Abandonment and Decommissioning Report (Marathon 1992) as to whether the T-1 or T-7 flowlines and umbilicals were flushed with water prior to attempted recovery. During decommissioning operations it is standard practice for flowlines to be purged of hydrocarbons (via pigging) and then flushed with large volumes of water before being either left *in situ* or recovered.

It is assumed that, even if deliberate flushing of the T-7 flowline and umbilical did not occur, a degree of unintentional flushing would have occurred during the recovery attempts, particularly as they were open at both ends. Hence, it is unlikely that there would have been any significant quantity of hydrocarbons, treatment chemicals or hydraulic fluids in either the flowline or umbilical when they were left on the seabed.

3.6 Other Contaminants in Flowline

During production operations in the Talisman field there is the possibility that there may have been some scale build up in the flowlines, with the scale potentially including NORMs (normally occurring radioactive materials). However, it would have been routine practice to use scale inhibitors, which would have limited scale build up, and as shown in Figure 3-3 there doesn't appear to have been any scale deposition in the T-1 flowline when recovered. It is likely that the same would have been the case for the T-7 flowline, particularly given the short duration of production operations from the T-7 well (~3 years).

It is possible that the flowline may have contained some residual produced sand that was not flushed out during the recovery attempts. Any remnant produced sand is unlikely to contain contaminants, such as heavy metals or hydrocarbons, especially after a period of 26 years on the seabed.

3.7 Abandonment Activity

The subject of this EP is the permanent abandonment of items left *in situ* during decommissioning of the Talisman field infrastructure in 1992, as described in Section 3.3 above. As the T-1 and T-7 production wells were plugged and abandoned and all retrievable infrastructure was removed in 1992, it is proposed the production equipment that has been on the seabed within WA-8-L since 1992 (as outlined in Table 3-3), remain *in situ* in perpetuity.

There are no additional proposed activities associated with abandonment of the T-7 infrastructure. The options analysis (ALARP assessment) to assess the suitable abandonment approach for the *in situ* production equipment is described below in Section 3.8, and in Section 7.

3.8 Comparative Assessment of Abandonment Options

The assessment of the preferred options for abandonment of the WA-8-L production equipment has been carried out through a two part process. The first step was to conduct a comparative assessment of credible options to identify the BPEO, which considered two potential abandonment options:

- Base case – complete removal of the production equipment; and
- Option A – leave production equipment *in situ*.

The purpose of the comparative assessment process is to establish the option(s) that provides the most benefits or the least damage to the environment, as a whole, at acceptable cost, in the long term as

well as in the short term. The comparative assessment process assesses identified decommissioning options against a range of generic criteria and specific sub-criteria as outlined in Table 3-4.

Table 3-4 - Assessment criteria for comparison of abandonment options

Criteria	Sub-criteria	Description
Technical Feasibility	Technical Feasibility	Assessment of the technical feasibility of each option, including consideration of: • The ability to recover from unplanned excursions and complete the planned abandonment option. • The extent to which the option requires the use of proven technology.
Health and Safety	Risk to project personnel offshore	Safety risk to project personnel offshore.
	Residual risk to other marine users	Safety risk to commercial vessels (fishing and shipping).
Environment	Water quality and sediment impacts	Assessment of water quality and potential impacts to sediment, including potential for short term and long term contamination.
	Ecological services	Assessment of potential biodiversity and habitat impacts due to physical presence/seabed disturbance as a result of the activity.
	Emissions	Emissions as a result of operations. CO_2 emissions (tonnes).
	Waste	Volume of waste due to offshore operations and potential impact on end points (e.g. landfill, recycle).
Social	Commercial impact on fisheries	Impacts of both the operations and the endpoints on the present commercial fisheries in and around WA-8-L.
	Socio-economic impacts on communities, recreational fishing, shipping	Impacts on recreational marine users and local communities.
	Common practice	Is the decommissioning technique common practice in the industry and associated\ social perception.
Economic	Total project cost	Total capital expenditure (CAPEX).

Table 3-5 provides the outcomes of the comparative assessment for the base case and option A abandonment options considered. The findings against each assessment criteria were ranked as either High, Medium or Low Risk.

For the base case abandonment option (complete removal), attempting to locate and remove the production equipment has been assessed as having the potential for significant H&S risks to people during attempted removal activities, potential loss of habitat (hard substrate), and environmental and socio-economic impacts associated with vessels/equipment required for removal activities (i.e. planned and unplanned emissions from vessels; associated air, water and sediment quality impacts; underwater noise emissions; and temporary exclusion of commercial fishers). There are also potential challenges with technical feasibility of located and removing the production equipment—related to the likely partial or full burial of the flowline and umbilical over the course of the past 26 years, presence of marine growth (biofouling) and potential issues with structural integrity after such a long period on the seabed. There is also significant cost associated with mobilising vessels to WA-8-L for location and removal of equipment, and this cost is considered clearly disproportionate to any environmental benefit gained.

In contrast, option A (leave *in situ*) would have no H&S risk (due to no operational activities being required), minimal impact to the surrounding environment, and no associated project costs.

Therefore, the comparative assessment concluded that leaving the production equipment *in situ* is the BPEO as it results in no H&S risk to personnel, no cost and has a minimal environmental impact/risk when compared to the base case. Option A has therefore been defined as the Petroleum Activity for the purposes of this EP (see Section 1.2).

The second part of the process was comprised of an assessment of the environmental impacts and risks of both abandonment options (Section 7.1), and ALARP and Acceptability demonstrations for both options (Section 7.2).

Table 3-5 Comparative assessment of base case and option A for abandonment of WA-8-L production equipment

Abandonment Options	Comparative Assessment	Risk Ranking
Base case – complete removal of equipment	**Technical Feasibility:** The location of the tyre weight, anchor and chain are unknown as they could not be located by ROV at the time of decommissioning of the Talisman field in 1992. It is unlikely that this production equipment would be easily located after 26 years *in situ* and could be partially or fully buried. The location of the T-7 flowline and umbilical was documented by ROV survey in 1992. Attempts were made on several occasions during the decommissioning of the Talisman field to retrieve the T-7 flowline and umbilical (refer to Section 3.3). Due to various technical issues it was not possible to retrieve the equipment and it was left *in situ* on the seabed. It is possible that a further attempt to retrieve the flowline and umbilical could be successful. However, after 26 years *in situ* it is expected that the equipment may be partially or fully buried with typically only the upper 10-25% of the flowline/umbilical exposed at the surface, if at all. Several processes will have acted on the production equipment to cause embedment in the underlying sediment. An assessment of sedimentation induced burial of marine pipelines in the North-west Marine Region was conducted by Leckie *et al.* (2015, 2016). The study found that physical action of currents and internal waves acting on the substrate provides a mechanism for sedimentation against pipelines. The study also observed further embedment through biological activity such as tunnelling under the equipment by crustaceans and demersal fishes of the subfamily Epinephelinae (groupers), as well as dispersal of sediment by rapid fish movement. The study showed, based on seven years of field survey measurements of a subsea pipeline obtained using sonar profilers and underwater video, that significant lowering of the pipeline into the seabed resulted from sediment mobility and scour. The majority of the lowering occurred within two years of pipeline laying and appeared to result from sustained ambient tidal and soliton currents as opposed to large storms (Leckie *et al.* 2015). The following variables were taken into account when considering the potential embedment of the T-7 flowline and umbilical in the underlying sediment: • A relatively mobile substrate, as described in Section 5.4; • Strong seasonal currents and internal waves, as described in Section 5.4; • Regional presence of species displaying behaviours that can contribute to embedment; • Significant timescale of events; and • Relatively narrow diameter of flowline/umbilical (combined diameter of 34 cm) and significant weight (combined approximately 100 kg/m). Based on this information, it is likely that partial, if not total burial of the T-7 flowline and umbilical has occurred. For any lengths of the pipeline or umbilical that remain on the surface of the seabed, significant marine growth is expected due to the presence of hard substrate in a habitat that is otherwise dominated by soft sediments. Given the length of time the production equipment has been left on the seabed it may have been subject to corrosion, resulting in issues with structural integrity. An attempt to remove the production equipment could result in break-up of the flowline and umbilical. The challenges of partial or full burial of the flowline and umbilical, presence of marine growth and structural integrity of the production equipment would provide considerable technical challenges for retrieval.	**Medium**
	Health and Safety: H&S risks to personnel associated with removal of the production equipment are considerably greater than leaving *in situ* due to the requirement for operational activities undertaken in field. Potential risks include exposure of personnel during flowline/umbilical lifting activities, including exposure to any residual contaminants (if present).	**High**

Abandonment Options	Comparative Assessment	Risk Ranking
	Environment: Pros: Removal of the production equipment would remove the risk of localised contamination resulting from deterioration of materials over time if left *in situ*. Cons: The removal of the production equipment would represent an environmental disturbance and potential loss of ecological habitat. The equipment has been *in situ* for over 26 years, and any sections of the flowline and umbilical (~1 km in length) that are not buried will provide habitat for benthic invertebrate fauna and fish (Pradella *et al*. 2014; McLean *et al*. 2017). Removal of the flowline and umbilical could result in break up due to issues with structural integrity, making it difficult to retrieve the equipment. This could result in a wider area of potential disturbance to the surrounding environment than leaving the production equipment *in situ*. Any residual fluids remaining in the flowline and umbilical (if present) would be released to the marine environment during retrieval resulting in localised impacts after the removal. This is compared to a more gradual release as a result of deterioration of the production equipment over time if left *in situ*. There would be impacts and risks to the environment from vessel and ROV activities (planned and unplanned discharges to the marine environment). Any production equipment retrieved would require disposal onshore, including potential handling and disposal of contaminated materials.	**High**
	Social: Retrieval of the production equipment could remove ecological habitat supporting locally enhanced fish populations for sections of the flowline and umbilical that remain unburied. Removal of the production equipment could also result in a temporary exclusion of commercial fishers from an area where they normally fish.	**Medium**
	Project Cost: There will be considerable cost to mobilise vessels to undertake retrieval of the production equipment. Estimated costs in the order of at least A$300,000 to A$450,000 for two vessels (geotechnical survey vessel plus PSV or construction vessel) for 10-15 days to locate and retrieve the production equipment.	**High**
Option A - leave production equipment *in situ*	**Technical Feasibility:** There are no technical challenges associated with leaving the production equipment *in situ*.	**Low**
	Health and Safety: There are no health and safety risks associated with leaving the production equipment *in situ*, as no operations are proposed to be undertaken.	**Low**
	Environment: Pros: Any sections of the flowline and umbilical (~1 km in length) that remain unburied may provide ecological habitat and localised fish aggregation due to the presence of hard substrate (and associated biofouling) in a habitat that is otherwise dominated by soft sediments (Pradella *et al*. 2014; McLean *et al*. 2017). Cons: There is potential for localised contamination from deterioration of the production equipment over time, should this occur.	**Medium**
	Social: Potential social impacts relate to other marine users, particularly commercial fishing activities. Pros: For any lengths of the flowline or umbilical (~1 km in length) that remain on surface of the seabed, significant marine growth (biofouling) is expected due to the presence of hard substrate in a habitat that is otherwise dominated by soft sediments. The ecological habitat provided by the production equipment may locally enhance fish populations, which could be of some limited benefit to commercial fishing (e.g. Pilbara Trap and Line Fishery) in the area. Cons: There is a potential snag risk from the production equipment remaining on the seabed (to trawling activities within the Pilbara Trawl Fishery). However, this risk is low given the low profile of the equipment and the likelihood that the equipment is partially or fully buried after 26 years on the seabed (see description of potential burial below). These impacts / risks are expected to continue in perpetuity and not to change substantially in either magnitude or significance.	**Low**
	Project Cost: There is no cost associated with this option as no operations are proposed to be undertaken.	**Low**

4 CONSULTATION

The principal objectives of consultation undertaken for the WA-8-L Production Equipment Abandonment EP is:

- Identify relevant stakeholders;
- Initiate and maintain open communications between relevant stakeholders and Santos;
- Identify, establish and implement stakeholder engagement tools for initial and on-going communications;
- Establish an open and transparent process for input;
- Proactively seek agreement with relevant stakeholders on recommended strategies to minimise negative impacts and maximise positive impacts of the activity; and
- Provide a means for recording initiatives in which communication and/or consultation is undertaken, issues raised and responses recorded.

Stakeholder consultation has been guided by the following:

- NOPSEMA Decision-Making Guideline – Criterion-10A(g) Consultation Requirements;
- APPEA Stakeholder Consultation and Engagement Principles and Methodology – Draft;
- AFMA's Guidelines for Petroleum Industry Consultation with AFMA; and
- The Western Australian Department of Fisheries' Guidance Statement for oil and gas industry consultation with the Department of Fisheries (DoF 2013).

4.1 Relevant Stakeholders

For the consultation process Santos has used the requirements in the OPGGS (E) Regulations in regards to a relevant person (Table 4-1):

- Each Department or agency of the Commonwealth to which the activities to be carried out under the environment plan, or the revision of the environment plan, may be relevant;
- Each Department or agency of a State or the Northern Territory to which the activities to be carried out under the environment plan, or the revision of the environment plan, may be relevant;
- The Department of the responsible State Minister, or the responsible Northern Territory Minister;
- Person or organisation whose functions, interests or activities may be affected by the activities to be carried out under the environment plan, or the revision of the environment plan;
- Any other person or organisation that the titleholder considers relevant.

4.2 Consultation Method

All stakeholders that have been identified as relevant for the purposes of this EP have been contacted by either email, postal letter or phone call. Initial correspondence provided information regarding the activity including the history, location, details of the equipment. A detailed map was also provided to all relevant stakeholders.

Table 4-1 Assessment of stakeholders

Stakeholder	Relevant to WA-8-L Abandonment EP	Reasoning
Department or agency of the Commonwealth to which the activities to be carried out under the environment plan, or the revision of the environment plan, may be relevant		
Australian Fishing Management Authority (AFMA)	X	Manage Commonwealth fisheries. No activity in WA-8-L area or surrounding waters (see below for SBTF, WSTF and WTBF
Australian Maritime Safety Authority (AMSA)	X	The proposed activity has no discernible impact on marine safety.
Australian Hydrographic Service (AHS)	X	Responsible for Notice to Mariners (NTM). Titleholder required to notify AHS a minimum of three weeks prior to commencement of activities. No activities proposed to take place within WA-8-L. Not considered a relevant stakeholder as the activity (leaving the production equipment *in situ*) does not represent a hazard to commercial shipping or fishers. The presence of this equipment is not currently marked on nautical charts, and it is not expected that this will be necessary, given the low risk it presents to other marine users.
Marine Border Command (MBC)	X	Responsible for coordinating offshore maritime security. The proposed activity does not impact MBC interests.
Department of Defence (DoD)	X	Environment that may be affected (EMBA) is not located within, or adjacent to any restricted defence areas.
Department of the Environment and Energy (DoEE)	✓	As the DoEE's functions, interests and activities include administration of the Sea Dumping Act, they are considered to be a relevant stakeholder.
Director of National Parks (DNP)	X	The DNP is not a relevant stakeholder as the activity is not within, or adjacent to, the boundaries of a proclaimed Australian Marine Park (AMP).
National Offshore Petroleum Safety Environment Management Authority (NOPSEMA)	✓	Statutory authority for offshore petroleum activities. Consultation prior to EP submission is not required.
Department or agency of the State or the Territory to which the activities to be carried out under the environment plan, or the revision of the environment plan, may be relevant and the Department of the responsible State Minister		
Department of Primary Industries and Regional Development (DPIRD)	✓	Responsible for managing WA State fisheries. Considered to be a relevant stakeholder and engaged as part of the consultation process.
Department of Mines, Industry Regulation and Safety (DMIRS)	✓	The regulatory body at the time of decommissioning was the Department of Minerals and Energy (DME). This department has since become the Department of Mines, Industry Regulation and Safety. Engaged as part of the consultation process. Not in WA State waters and no potential to impact State waters.

Stakeholder	Relevant to WA-8-L Abandonment EP	Reasoning
Person or organisation whose functions, interests or activities may be affected by the activities to be carried out under the environment plan, or the revision of the environment plan		
Mackerel Managed Fishery (MMF)	✓	EMBA overlaps fishery and effort occurs within, or near the EMBA.
Pilbara Fish Trawl (Interim) Managed Fishery (PFTIMF)	✓	EMBA overlaps fishery and effort occurs within, or near the EMBA.
Pilbara Trap Managed Fishery (PTMF)	✓	EMBA overlaps fishery and effort occurs within, or near the EMBA.
Pilbara Line Fishery (PLF)	✓	EMBA overlaps fishery and effort occurs within, or near the EMBA.
Aquarium Fishery	X	EMBA overlaps fishery, however no effort occurs within the EMBA.
Pearl Oyster Managed Fishery (POMF)	X	EMBA overlaps fishery, however no effort occurs within the EMBA.
Southern Bluefin Tuna Fishery (SBTF)	X	EMBA overlaps fishery, however no effort occurs within the EMBA.
Western Skipjack Tuna Fishery (WSTF)	X	EMBA overlaps fishery, however no effort occurs within the EMBA.
Western Tuna and Billfish Fishery (WTBF)	X	EMBA overlaps fishery, however no effort occurs within the EMBA.
Any other person or organisation that the titleholder considers relevant.		
None identified		

4.3 Consultation Results

A summary of consultation records is provided in Table 4-2.

Table 4-2 Summary of consultation between 9/11/2018 and 13/12/2018

Stakeholder	Date	Type	Correspondence Summary	Attachment	Assessment of Merit
Department of Primary Industries and Regional Development (Fisheries) (DPIRD)	9/11/2018	Email to stakeholder	Email sent to DPIRD (Fisheries) providing notification that they have been identified as a potential stakeholder. The email advised that Santos is currently preparing an EP for the abandonment of the production activity relating to a decommissioning in 1992. Included in the email was an explanation of the activity, the historical context and the equipment description, dimensions and location. The email provided contact details for further information, comments, claims or objections. Santos requested all feedback be received by 3 December 2018. A map of the production equipment location was attached for reference.	Yes: Map of Production Equipment Location	N/A
	3/12/2018	Email from stakeholder	Advised that the following advice is preliminary and will be reconsidered once the EP is submitted to NOPSEMA. Advised that at this stage DPIRD does not oppose the production equipment remaining *in situ*.	No	N/A - Advice / request for further information only. No objection or claim made.
Department of Mines, Industry Regulation and Safety (DMIRS)	9/11/2018	Email to stakeholder	Email sent to DMIRS providing notification that they have been identified as a potential stakeholder. The email advised that Santos is currently preparing an EP for the abandonment of the production activity relating to a decommissioning in 1992. Included in the email was an explanation of the activity, the historical context and the equipment description, dimensions and location. The email provided contact details for further information, comments, claims or objections. Santos requested all feedback be received by 3 December 2018. A map of the production equipment location was attached for reference.	Yes: Map of Production Equipment Location	N/A
	28/11/2018	Email from stakeholder	Email advising that DMIRS has reviewed the information and does not have any comments to make. Requests that if the EP is accepted, a notification be sent to DMIRS.	No	N/A - Advice / request for further information only. No objection or claim made.

Stakeholder	Date	Type	Correspondence Summary	Attachment	Assessment of Merit
Pilbara Trap Managed Fishery (PTMF) Pilbara Line Fishery (PLF)	9/11/2018	Letter to stakeholder	Letter sent to all licence holders in the PTMF and PLF providing notification that they have been identified as a potential stakeholder. The letter advised that Santos is currently preparing an EP for the abandonment of the production activity relating to a decommissioning in 1992. Included in the letter was an explanation of the activity, the historical context and the equipment description, dimensions and location. The letter provided contact details for further information, comments, claims or objections. Santos requested all feedback be received by 3 December 2018. A map of the production equipment location was attached for reference.	Yes: Map of Production Equipment Location	N/A No responses received
Pilbara Fish Trawl Interim Managed Fishery (PFTIMF)	9/11/2018	Letter to stakeholder	Letter sent to all licence holders in the PFTIMF providing notification that they have been identified as a potential stakeholder. The letter advised that Santos is currently preparing an EP for the abandonment of the production activity relating to a decommissioning in 1992. Included in the letter was an explanation of the activity, the historical context and the equipment description, dimensions and location. The letter provided contact details for further information, comments, claims or objections. Santos requested all feedback be received by 3 December 2018. A map of the production equipment location was attached for reference.	Yes: Map of Production Equipment Location	N/A No responses received
Mackerel Managed Fishery (MMF)	9/11/2018	Letter to stakeholder	Letter sent to all licence holders in the MMF providing notification that they have been identified as a potential stakeholder. The letter advised that Santos is currently preparing an EP for the abandonment of the production activity relating to a decommissioning in 1992. Included in the letter was an explanation of the activity, the historical context and the equipment description, dimensions and location. The letter provided contact details for further information, comments, claims or objections. Santos requested all feedback be received by 3 December 2018. A map of the production equipment location was attached for reference.	Yes: Map of Production Equipment Location	N/A No responses received

Stakeholder	Date	Type	Correspondence Summary	Attachment	Assessment of Merit
Western Australian Fisheries Industry Association (WAFIC)	9/11/2018	Email to stakeholder	Email sent to WAFIC providing notification that they have been identified as a potential stakeholder. The email advised that Santos is currently preparing an EP for the abandonment of the production activity relating to a decommissioning in 1992. Included in the email was an explanation of the activity, the historical context and the equipment description, dimensions and location. The email provided contact details for further information, comments, claims or objections. Santos requested all feedback be received by 3 December 2018. A map of the production equipment location was attached for reference.	Yes: Map of Production Equipment Location	N/A
	9/11/2018	Email from stakeholder	Email received from WAFIC with request for further information on the following topics: • Which commercial fishers have been engaged in the activity • Whether leaving the production equipment in-situ will produce a trawl hazard • Asked if the EMBA overlaps the Pilbara Trawl Fishery • Asked if FishCube data indicates the Nickol Bay Prawn Managed Fishery is active in the EMBA • Asked if there is any visuals of the site in its current condition • Asked whether there will be a safety exclusion zone applied • Asked about the safety of the production equipment - i.e. whether it was secure Stakeholder also requested a more personal avenue of consultation	No	N/A - Advice / request for further information only. No objection or claim made.

Stakeholder	Date	Type	Correspondence Summary	Attachment	Assessment of Merit
	12/11/2018	Email to stakeholder	Email response to WAFIC advised the following: • Mackerel Managed Fishery, Pilbara Trap and Pilbara line were identified and contacted • The exposed areas of the flowline and umbilical will potentially support certain marine species. This is something that will be investigated as part of the impact assessment part of the EP • The equipment is unlikely to represent a trawl hazard. The impact assessment section of the EP will include an evaluation of whether the flowline/umbilical, and anchor and chain, potentially represent a trawl hazard • The location of the equipment is within Area 2 – Zone 2, which is currently open to trawling for the Pilbara Trawl fishery • The Nickol Bay Prawn Managed Fishery has not been included as a stakeholder • No visuals have been recorded and there are currently no plans for visual assessment • No safety exclusion zone is currently in place, and there are no plans to request implementation of one for this equipment Contacts of personnel managing stakeholder consultation also provided.	No	N/A
	23/11/2018	Email to stakeholder	Follow up email to WAFIC. Offering face-to-face meeting if required, alternatively can send further questions via email/phone call.	No	N/A
	26/112018	Email from stakeholder	Email response from WAFIC, advised that they are satisfied as long as there are: • No safety issues • No snag issues • No exclusion zones • Commercial fishers operating in the area have been consulted and have no issues	No	N/A - Advice / request for further information only. No objection or claim made.

Stakeholder	Date	Type	Correspondence Summary	Attachment	Assessment of Merit
	29/11/2018	Email to stakeholder	Confirmation that no credible safety risks had been identified. Advised that the most likely scenario involves significant embedment in the underlying sediment and leaving the equipment *in situ* is not expected to increase the trawl risk above what already occurs in the surrounding trawl area. Advised that no exclusion zones will be applied. Confirmed no issues had been raised by commercial fishers.	No	N/A
Department of the Environment and Energy (DoEE)	29/11/2018	Phone call to stakeholder	Phone conversation with member of the DoEE Sea Dumping team. Indicated that the flowline/umbilical and anchor/chain left *in situ* would probably be covered under the definition of "platform" under the Sea Dumping Act (whereas wellheads are not), so therefore a Sea Dumping Permit may be required. However, in their view, given the length of time this equipment has been in place, it is likely that there would be more environmental harm caused by trying to locate and recover it rather than leaving it permanently *in situ*. They indicated that there is the possibility of seeking an exception under Section 15 of the Act re. securing the "safety of human life" (the Act does not allow for exemptions). Next step is for Santos to send an email DoEE providing more detailed information for the Sea Dumping team to consider.	No	N/A - Advice / request for further information only. No objection or claim made.
	3/12/2018	Email / letter to stakeholder	Follow up email to Sea Dumping team, seeking advice as to whether a permit would be required for the action of leaving the production equipment in place within production licence WA-8-L. Provided copy of activity description from the draft EP, which includes an analysis examining the options of leaving the equipment in situ vs. removal, based on a range of criteria: technical feasibility; health & safety; environment; social and project cost. Requested a response prior to 14 December 2018.	Yes: Activity description from the draft EP	N/A
	13/12/2018	Email from stakeholder	Email received from Sea Dumping team, advising that they have not been able to ascertain within the requested timeframe whether a permit would be required for the activity. They advised that they would endeavour to provide Santos with their advice as soon as possible. Advised that their endorsed approach would be for Santos to submit the EP to NOPSEMA noting that Santos has sought their advice, and are awaiting a response.	No	N/A

5 DESCRIPTION OF EXISTING ENVIRONMENT

This section describes the physical, biological, cultural and socio-economic environment and identifies any relevant values and sensitivities of the environment that may be affected by the activity (EMBA). During the Talisman production phase, the flowline and umbilical cable ran west from the T-7 wellhead for approximately 1 km to the CALM Buoy and production facility (FPSO *Acqua Blu*). The approximate location of production equipment is between point 19°29'47.07" S 116°55'53.52" E and 19°29'52.85" S 116°55'25.94" E (refer Table 3-1). For the purposes of this EP, the EMBA has been defined by a 1 km radius around the presumed location of the production equipment, as shown in Figure 3-1.

Using Santos' and publicly available information and the results from the Protected Matters (PM) Search a review of biological, cultural and socio-economic environment was undertaken to identify the environmental values and / or sensitivities that can reasonably be expected to occur within the EMBA. Table 5-1 provides a summary of these

5.1 Regional Environment

The WA-8-L Production Equipment Abandonment EMBA is within the North-west Marine Region (NWMR) and the North West Shelf Mesoscale Bioregion. The Marine Bioregional Plan for the North-west Marine Region (DSEWPaC 2012) has been used in conjunction with other relevant management plans and studies to inform this description of the environment.

The NWMR comprises Commonwealth waters and extends from the Western Australian-Northern Territory (WA-NT) border to Kalbarri, south of Shark Bay. The NWMR is a shallow-water tropical marine ecosystem with high species richness. It is generally low productivity, with boom and bust cycles driven by monsoonal seasonality, with some locations exhibiting predictably higher productivity (DSEWPaC, 2012).

5.2 Matters of National Environment Significance

A search of the DoEE PM database was undertaken covering a 1 km radius around the presumed location of the production equipment. The Matters of National Environmental Significance (MNES) identified by the search are summarised in Table 5-1.

Table 5-1 Protected Matters database search summary

Matter of National Environmental Significance	Search Findings
World Heritage Property	Nil
National Heritage Place	Nil
Wetlands of Importance	Nil
Listed Threatened Ecological Communities	Nil
Listed Threatened Species	14
Listed Migratory Species	30
Other Matters Protected by the EPBC Act	**Search Findings**
Commonwealth Heritage Places	None
Listed Marine Species	55
Whales and Other Cetaceans	13
Critical Habitats	Nil
Commonwealth Reserves Marine	Nil
Extra Information	**Search Findings**
State and Territory Reserves	Nil
Invasive Species	Nil
Nationally Important Wetlands	Nil
Key Ecological Features (Marine)	Nil

5.3 Key Ecological Features

Key ecological features (KEFs) are elements of the Commonwealth marine environment that, based on current scientific understanding, are considered to be of regional importance for either the region's biodiversity or ecosystem function and integrity. The EMBA is in close proximity to two KEFs, the Ancient Coastline at 125 m Depth Contour and the Glomar Shoals.

5.3.1 Ancient Coastline at 125 m Depth Contour

The Ancient Coastline KEF is a geomorphic feature stretching along the North West Shelf and Sahul Shelf at a depth of 125 m. The KEF provides a hard substrate in an area otherwise dominated by soft sediment and therefore may provide sites for higher diversity and enhanced species richness (DSEWPaC 2012). The KEF has also been identified as a migration pathway for the humpback whale. At its closest point, the KEF lies ~8 km north of the T-7 wellhead location (Figure 5-1).

5.3.2 Glomar Shoals

The Glomar Shoals KEF are a submerged littoral feature located ~150 km north of Dampier and 12 km south-west of the T-7 wellhead location (Figure 5-1). The total area of the KEF is ~767 km^2. The KEF is likely to be an area of high productivity and supports populations of commercially important fish species including Rankin cod, brown striped snapper, red emperor, crimson snapper, bream and yellow-spotted triggerfish (Falkner *et al.* 2009; Fletcher & Santoro 2009). The Glomar Shoals are therefore utilised by commercial fisheries, including the PFTIMF, the PTMF and the PLF (known collectively as the Pilbara Demersal Scalefish Fisheries).

5.4 Physical Environment

5.4.1 Climate

The main drivers of ecosystem function in the NWMR are strong surface currents, a monsoonal climate, cyclones and tides (DSEWPaC 2012). The summer and winter seasons fall into the periods October-April and May-September, respectively. Weather is largely controlled by the seasonal oscillation of an anti-cyclonic belt. Winters are characterised by clear skies, fine weather and predominantly strong east to south-east winds and infrequent rain. Summer winds are more variable, but west to south-west predominates. Three to four cyclones per year can be expected, primarily in the December to March period, though cyclones have been recorded as late as April in the Pilbara region (Pearce *et al.* 2003).

5.4.2 Oceanic Conditions

Short period waves within the North West Shelf region are generated by local synoptic winds and are typically the largest during winter months when the south-easterly trade winds dominate. Surface water temperatures vary seasonally and are influenced by the Indonesian Throughflow. Monthly sea temperature and salinity profiles of the water column near WA-8-L were obtained from the World Ocean Atlas 2013 (NOAA 2013a, 2013b). The annual average sea surface temperature is 26.4°C. The annual average surface salinity values average 35 psu and remain relatively stable throughout the year.

The NWMR is characterised by highly variable tidal regimes. The Indonesian Throughflow is the major circulation feature affecting the NWMR and transports warm, low-salinity and low-nutrient water the western Pacific Ocean through the Indonesian archipelago to the Indian Ocean (DSEWPAC 2012). The Leeuwin Current will also affect the EMBA. The influence of these two current systems weaken in the dry season from April to September.

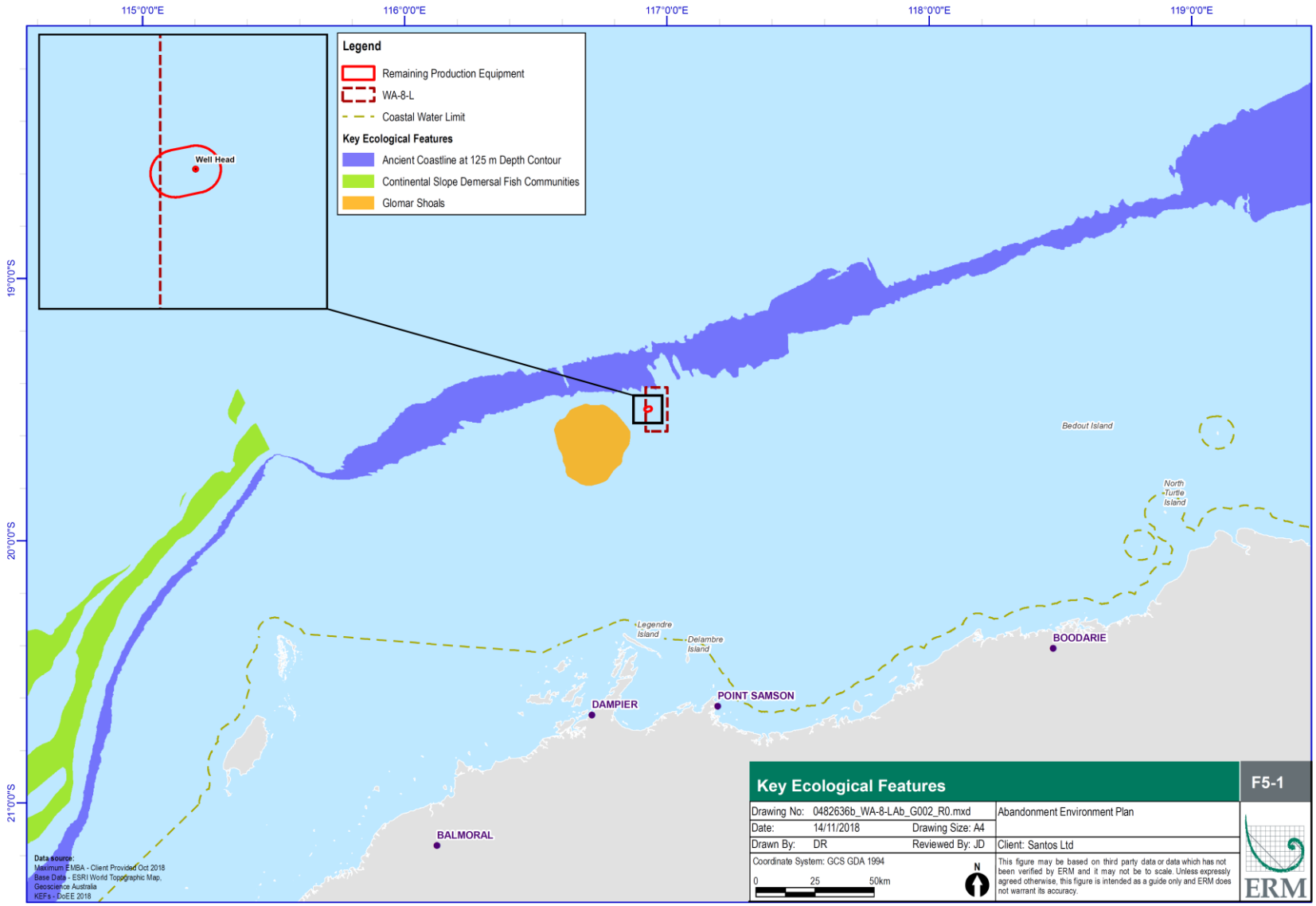

Figure 5-1 Key Ecological Features within the NWMR

5.4.3 Bathymetry and Geomorphology

Water depths in the EMBA range from 79 to 84 m. WA-8-L is situated in an area characterised by a gently seaward-sloping Pleistocene limestone plain that is relatively flat and dipping gently to the north-west. It consists predominantly of limestone with a sandy covering of varying thickness that rises more or less randomly to form the bases of many cays and islands in the region.

The seabed topography within the bulk of WA-8-L is expected to be smooth and flat, with a thin layer of silty sand to a maximum of ~2 m thick. The sandy seabed is smooth and featureless.

5.5 Biological Environment

The NWMR can be divided into three large scale ecological systems based on the influence of primary ecological drivers such as ocean currents, seafloor features and eco-physical processes (Brewer *et al*. 2007). These systems are the Ningaloo-Leeuwin, Pilbara and Kimberley systems.

The WA-8-L Production Licence is located within the mid shelf (60-100 m water depths) sub-system of the Pilbara System.

5.5.1 Benthic Environment

Faunal diversity associated with the EMBA probably shares similarities with the nearby Ancient Coastline KEF, with the any hard substrates supporting sponges, corals, crinoids, molluscs, echinoderms and other benthic invertebrates representative of hard substrate fauna in the North West Shelf bioregion. However, as described above, the majority of seabed substrates within WA-8-L are expected to be comprised of soft, silty sand, which will be characterised by sediment infaunal communities and sparsely distributed epibenthic fauna.

Rhodolith beds are known to occur in the mid shelf sub-system in the Pilbara to depths of 90 m and Glomar Shoals are also believed to be a site of higher productivity, as evident in high catches of commercial fisheries in this area (Brewer *et al.* 2007). Internal waves provide some inflow of nutrients into this system, with increased productivity resulting from enhanced vertical mixing. Benthic species would include foraminifera, bryozoans, molluscs and holothurians.

5.5.2 Pelagic Environment

Pelagic species feeding in the mid shelf sub-system include turtles, cetaceans, sharks and rays as well as fish species such as red emperor, rock cod, sweetlips, goatfish, trigger fish and threadfin bream. Humpback whales on their southern migration would frequently traverse this sub-system (Brewer *et al.* 2007).

A search of the DoEE PM database was undertaken for the EMBA. Table 5-2 details fauna identified by the PM Search and any applicable management plans.

Table 5-2 Threatened and migratory species that may occur within EMBA

Common Name	Scientific Name	EPBC Act Status	Management Plan / Recovery Plan / Approved Conservation Advice	Species Description
Sharks				
White Shark	*Carcharodon carcharias*	Vulnerable, Migratory	—	The white shark if found in all oceans in offshore and coastal environments, however in Australia the majority of great white shark movements occur between the coast and the 100 m depth contour (Bruce *et al.* 2006). Due to the habitat preference of the white shark, the species may be present near the EMBA.
Green Sawfish	*Pristis zijsron*	Vulnerable, Migratory	Conservation Advice for Green Sawfish *not a Recovery Plan	The green sawfish inhabits muddy bottom habitats, and has been recorded in inshore marine waters, estuaries, river mouths, embankments, and along sandy / muddy beaches. The green sawfish has been reported as bycatch by vessels fishing in the PFTIMF (Newman *et al.* 2017). Due to the distribution and reports from fishing vessels in the area, the green sawfish may be present in the EMBA in very low numbers.
Narrow Sawfish	*Anoxypristis cuspidata*	Migratory	—	The narrow sawfish inhabits inshore and estuarine areas to offshore habitat of up to 100 m depth (IUCN 2017a). The narrow sawfish has been reported as bycatch by vessels fishing in the PFTIMF (Newman *et al.* 2017). Due to the distribution and reports from fishing vessels in the area, the green sawfish may be present in the EMBA in very low numbers.
Whale Shark	*Rhincodon typus*	Vulnerable, Migratory	Conservation Advice *Rhincodon typus* (whale shark).* *not a Recovery Plan	Whale sharks have a broad distribution in tropical oceanic and coastal waters. A BIA for whale shark foraging occurs off the north west coast of Australia and intersects with the EMBA. From May and June individuals migrate northward along the 200 m isobath from Ningaloo as far north as Ashmore and Scott Reefs. Tagged whale sharks spend at least 50% of their time in depths of less than 30 m (Wilson *et al.* 2006).
Shortfin Mako	*Isurus oxyrinchus*	Migratory	—	The shortfin mako is found offshore in temperate and tropical waters. The species is usually found at depths of 5 – 80 m and is capable of large-scale movements (Rogers *et al.* 2009). Transient individuals may be present within the EMBA.

Common Name	Scientific Name	EPBC Act Status	Management Plan / Recovery Plan / Approved Conservation Advice	Species Description
Longfin Mako	*Isurus paucus*	Migratory	—	The longfin mako is found in tropical and warm waters
Rays				
Reef Manta Ray	*Manta alfredi*	Migratory	—	The reef manta ray has a circum-tropical and semi-temperate distribution within the Pacific, Atlantic and Indian oceans, however populations are highly fragmented (IUCN 2017b). The species is resident to productive near-shore environments and may be present in EMBA.
Giant Manta Ray	*Manta birostris*	Migratory	—	The giant manta ray has a circum-tropical and semi-temperate but highly fragmented distribution throughout the world's major oceans. They are capable of migrating over large distances and are generally solidary, aggregating to feed, mate or clean. Giant manta rays may be present in the EMBA.
Reptiles				
Loggerhead Turtle	*Caretta caretta*	Endangered, Migratory	Recovery Plan for Marine Turtles in Australia 2017 - 2027	Loggerhead turtles are found in tropical, subtropical and temperate waters throughout the world. They inhabit waters of coral and rocky reefs, seagrass beds and muddy bays throughout eastern, northern and western Australia. Loggerhead turtles primarily feed on benthic invertebrates from nearshore to depths of 55 m. No loggerhead turtle BIAs or habitat critical to the survival of the species occurs in the EMBA.
Green Turtle	*Chelonia mydas*	Vulnerable, Migratory		Green turtles are found in tropical and subtropical waters throughout the world. The first 5-20 years of life are spent in a pelagic phase drifting on ocean currents before settling as adults in shallow benthic foraging habitats. No green turtle BIAs or habitat critical to the survival of the species occurs in the EMBA.
Leatherback Turtle	*Dermochelys coriacea*	Endangered, Migratory		Leatherback turtles have a global tropical and temperate distribution. It is a highly pelagic species and is capable of diving to several hundred meters. In Australia, leatherback turtles forage year-round in continental shelf waters. feeding mainly on pelagic, soft-bodied fauna such as jellyfish and

Common Name	Scientific Name	EPBC Act Status	Management Plan / Recovery Plan / Approved Conservation Advice	Species Description
				tunicates. No leatherback turtle BIAs or habitat critical to the survival of the species occurs in the EMBA.
Hawksbill Turtle	*Eretmochelys imbricata*	Vulnerable, Migratory		Hawksbill turtles are found in tropical, subtropical and temperate waters in all oceans. Hawksbill turtles spend their first 5 – 10 years drifting on ocean currents, foraging on plankton, before returning to reef habitats as adults, and are occasionally found in seagrass habitats and deeper habitats utilised by trawl fisheries. No green turtle BIAs or habitat critical to the survival of the species occurs in the EMBA. Due to the known distribution and habitat preference of the hawksbill turtle, the species may be present in the EMBA in low numbers.
Flatback Turtle	*Natator depressus*	Vulnerable, Migratory		The flatback turtle is found only in the tropical waters of northern Australia, Papua New Guinea and Irian Jaya. Post-hatchlings and juveniles inhabit the continental shelf of northern Australia. Little is still known about the foraging habits of the flatback turtle, but due to the known distribution of the species and location of the production equipment, the species may be present within the EMBA in low numbers.
Mammals				
Sei Whale	*Balaenoptera borealis*	Vulnerable, Migratory	Conservation Advice *Balaenoptera borealis* (sei whale) *not a Recovery Plan	Sei whales are a cosmopolitan species, however they are found infrequently in Australian waters. Sei whales show well-defined migratory movements along longitude lines between polar, temperate and tropical waters. The species may be present in low numbers within the EMBA.
Blue Whale	*Balaenoptera musculus*	Endangered, Migratory	Conservation Management Plan for the Blue Whale 2015-2025	Two sub-species of blue whale occur within Australian waters, the Antarctic blue whale (*B. m. intermedia*) and pygmy blue whale (*B. m. brevicauda*). The BIA for pygmy blue whale migration runs north from the Perth Canyon to Indonesian waters within the 500 m and 100 m isobaths. At its closest point, the production equipment lies 60 km south of the BIA. Given the location of the production equipment in respect to the pygmy whale migration BIA, the species is may to be found within the EMBA during migration months from April to August (northern migration) and October to late December (southern migration).

Common Name	Scientific Name	EPBC Act Status	Management Plan / Recovery Plan / Approved Conservation Advice	Species Description
Fin Whale	*Balaenoptera physalus*	Vulnerable, Migratory	Conservation Advice *Balaenoptera physalus* (fin whale) *not a Recovery Plan	Fin whales are a cosmopolitan species that occur from polar to tropical waters. They can be found in Australian waters but are rarely sighted in inshore waters. No known breeding or calving areas have been identified in Australian waters. Based on the distribution of the species, fin whales may be present in the EMBA in low numbers.
Humpback Whale	*Megaptera novaeangliae*	Vulnerable, Migratory	Conservation Advice for *Megaptera novaeangliae* (humpback whale) *not a Recovery Plan	The BIA for humpback whale migration runs north from the Perth Canyon to breeding grounds in the Kimberley marine region. The BIA extends 100 km from the mainland coastline. At its closest point, the production equipment lies 30 km north of the BIA. Given the location of the production equipment in respect to the BIA, the species is may to be found within the EMBA during migration months from late July to September (northern migration) and September to mid-November (southern migration).
Bryde's Whale	*Balaenoptera edeni*	Migratory	—	Bryde's whales are found year-round in tropical and warm temperate waters, both oceanic and inshore.
Killer Whale	*Orcinus orca*	Migratory	—	Killer whales have a cosmopolitan distribution and may be seen in any marine region. Within Australian waters, killer whales are most often seen along the continental slope and on the shelf. This species may occur in low numbers within the EMBA.

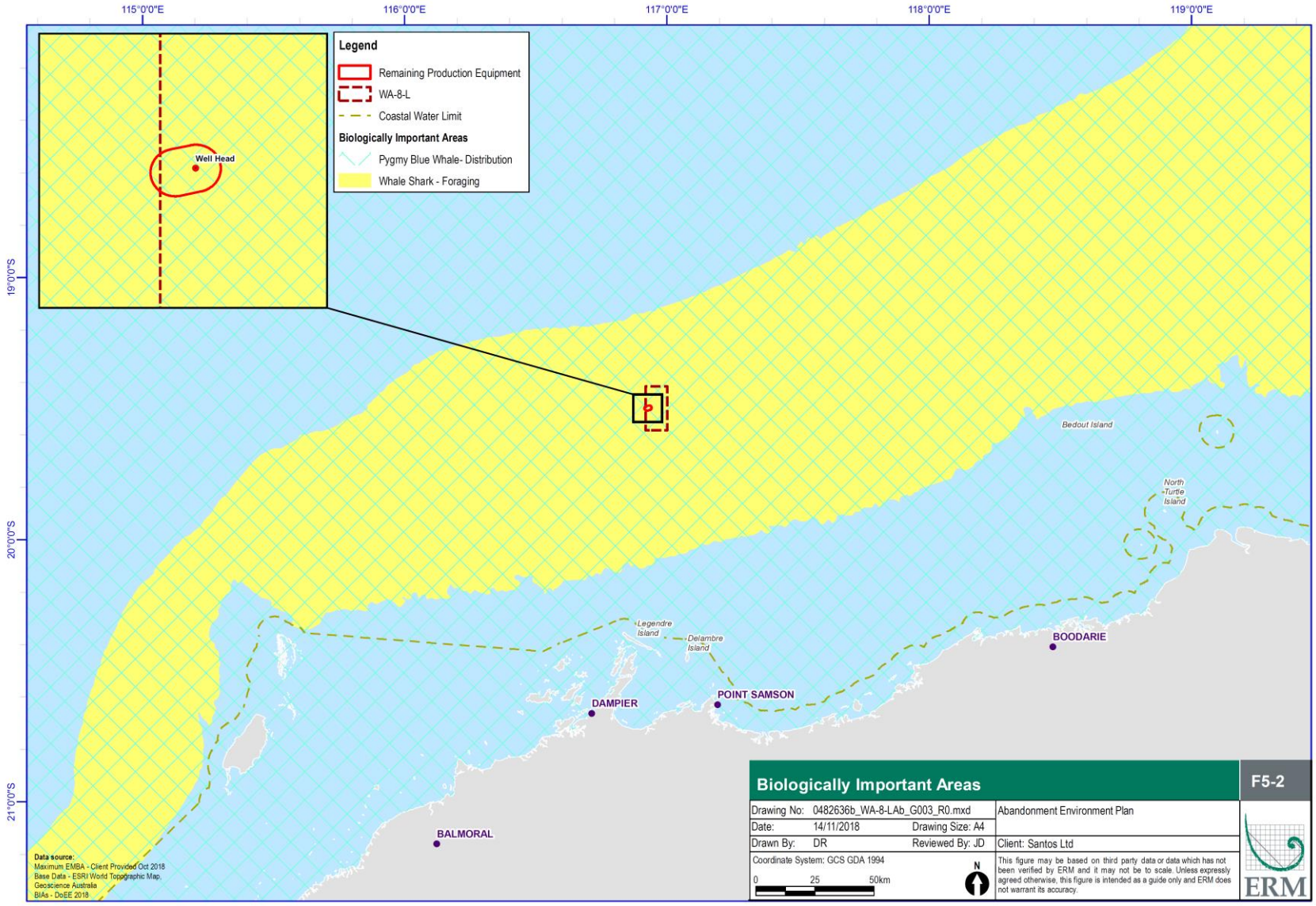

Figure 5-2 BIAs overlapping WA-8-L and the EMBA

5.5.3 Biologically Important Areas

The EMBA overlaps two biologically important areas (BIAs) for listed threatened marine species within the NWMR (Figure 5-2):

- Distribution BIA for pygmy blue whales; and
- Foraging BIA for whale sharks.

5.5.4 Fish

The EMBA is not located within any known area of high productivity. Fish species that occur within the EMBA are expected to be representative of the wider NWMR. Common species include Lutjanidae (snappers), Lethrinidae (emperors), Gobiidae (gobies), Mullidae (goatfishes), Serranidae (groupers). Demersal fishes such as Paralichthyidae (sand flounders) and Platycephalidae (flathead) may also be present. Based on known distributions, the species that are within the EMBA are likely to be well represented throughout the NWMR and are not considered endemic or unique.

Any areas of the production equipment that are exposed above the seabed are highly likely to have attracted encrusting marine invertebrates (biofouling), and have resulted in a minor localised increase of fish activity from species that feed on these organisms (Pradella *et al*. 2014; McLean *et al*. 2017). Depending on the species, some fish may be site-attached and have limited capacity to relocate if disturbed. Accumulation of benthic flora along exposed areas of the flowline and umbilical is possible, however, it is unlikely that the habitat has increased to a point where a significant increase in fish assemblages has occurred, primarily because it is likely that the flowline and umbilical will be partially or fully buried in the seabed sediments.

5.6 Socio-economic Environment

5.6.1 Commonwealth Managed Fisheries

Commonwealth fisheries are managed by the Australian Fisheries Management Authority (AFMA) under the *Fisheries Management Act 1991* (Commonwealth). AFMA's jurisdiction covers the area of ocean from 3 nm from the coast out to the 200 nm limit (the extent of the Australian Fishing Zone - AFZ). Commonwealth managed fisheries with jurisdictions to fish within the EMBA are described in Table 5-3.

Table 5-3 Commonwealth managed fisheries within the EMBA

Fishery	Actual Catch & Effort within EMBA	Comments
Southern Bluefin Tuna Fishery (SBTF)	No	The SBTF extends over all waters within the AFZ, however since 1992 southern bluefin tuna have been targeted in the Great Australian Bight and waters off South Australia. Spawning occurs in offshore waters between the north west coast and the Java sea, outside WA-8-L.
Western Skipjack Tuna Fishery (WSTF)	No	This fishery has been inactive since the 2008-2009 fishing season.
Western Tuna and Billfish Fishery (WTBF)	No	Efforts have been concentrated off south-west WA over recent years.

5.6.2 State Managed Fisheries

WA fisheries are managed by the Department of Primary Industries and Regional Development (DPIRD). State managed fisheries with jurisdictions to fish within the EMBA are described in Table 5-4 and are shown in Figure 5-3.

Table 5-4 WA managed fisheries licenced to fish within the EMBA

Fishery	Actual Catch & Effort within EMBA	Comments
Pilbara Fish Trawl (Interim) Managed Fishery (PFTIMF)	Yes	The fishery uses trawl nets to target tropical demersal fish species between 116° E and 120° E. Trawling is only permitted in Zone 2 of this fishery. The production equipment lies within Zone 2 (Area 2) of the PFTIMF.
Pilbara Trap Managed Fishery (PTMF) and Pilbara Line Fishery (PLF)	Yes	In the 2016-17 season these fisheries reported a total catch of 621 tonnes, with 495 tonnes from the PTMF and 126 tonnes from the PLF.
Mackerel Managed Fishery (MMF)	Yes	The MMF targets Spanish mackerel, which are a pelagic species with a wide distribution within the region. The fishery uses near-surface trolling gear to land an average of 300 tonnes of Spanish mackerel annually. Effort is likely to occur within or near the EMBA.
Nickol Bay Prawn Managed Fishery (NBPMF)	No	While the location of the production equipment is within the boundaries of the NBPMF, effort for this fishery is concentrated in coastal waters (see Figure 5-4; Sporer *et al*. 2015).
Pearl Oyster Managed Fishery (POMF)	No	The POMF licence area extends from the high water mark to the outer limit of the AFZ. While the location of the production equipment lies within Zone 1 of the POMF, fishing efforts are restricted to water depths less than 35 m and all oysters are harvested by hand. Deeper oysters are relied on as broodstock to support recruitment and prevent over-fishing.

Data on catch and effort in the PTIMF, PTMF, PLF, NBPMF and the MMF were sourced from DPIRD's FishCube database, for the period 2012-2017. The WA-8-L production licence area overlaps two 60 x 60 nm blocks in FishCube - 19160 and 19170. In summary, the data for these two blocks shows that:

- three vessels from the PTIMF were active in block 19160 until 2014, catching between 147 and 211 tonnes annually. Since then, less than three vessels have been active;
- in 2016, the PTMF had three vessels active in block 19160, catching 132 tonnes total. There were also three active in 2012, when they caught 56 tonnes;
- there was no activity from NBPMF vessels within blocks 19160 and 19170 within that 5-year period;
- less than three vessels have been active in the MMF in both blocks across the timeframe; and
- generally, fishing effort was higher in block 19160 than block 19170.

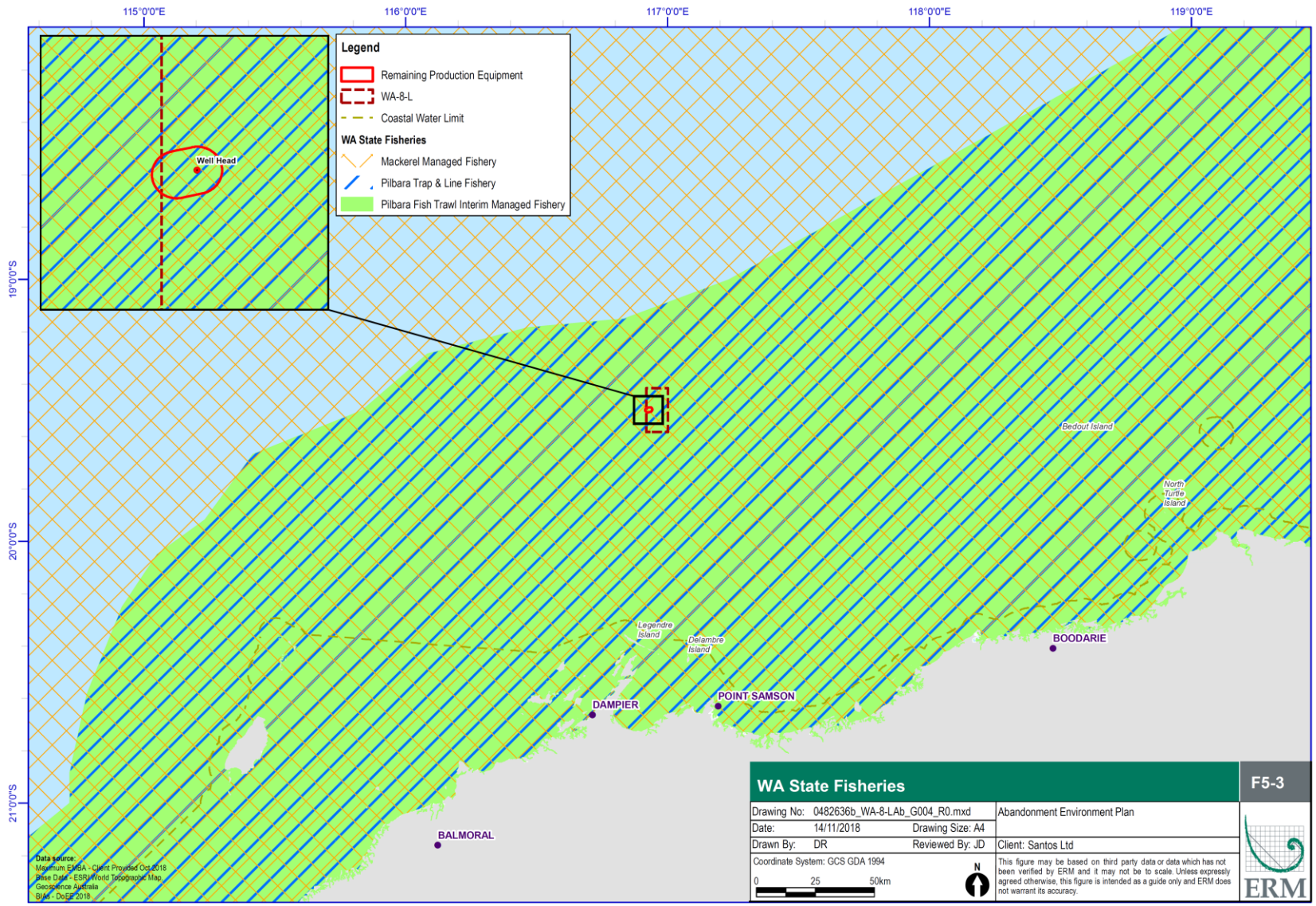

Figure 5-3 WA managed fisheries overlapping WA-8-L and the EMBA

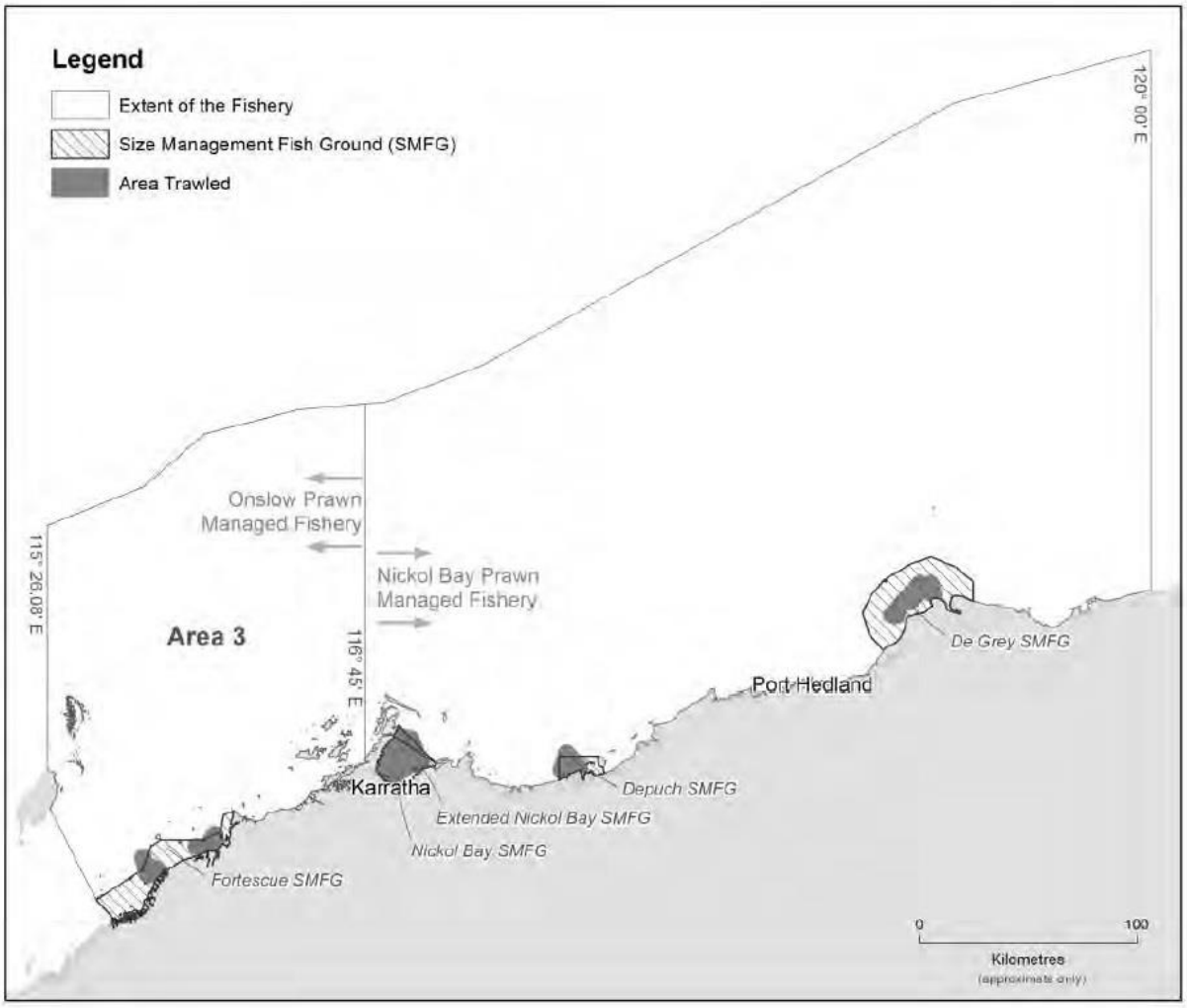

Figure 5-4 Areas trawled within the NBPMF in 2014 (Sporer *et al*. 2015)

5.6.3 Recreational Activities

The EMBA is located in water depths of 79-84 m in an area of relatively featureless benthic habitat and is not utilised for recreational activities, such as fishing. The nearby Glomar Shoals and Ancient coastline at 125 m depth contour KEFs support higher productivity than the surrounding marine environment and could potentially attract recreational fishers, however the distance offshore probably precludes this activity.

5.6.4 Oil and Gas Activities

There is no ongoing or scheduled oil and gas activities occurring within WA-8-L or within adjacent blocks WA-458-P and WA-191-P. Similarly, there is no petroleum infrastructure (producing or decommissioned) within either WA-458-P or WA-191-P.

5.6.5 Shipping

The NWMR supports a significant commercial shipping industry with vessels transiting from several regional ports to domestic and international locations. The EMBA is situated ~4 km east of a corridor of moderate-high intensity shipping from vessels transiting between Dampier Port and international locations.

5.6.6 Defence Activities

WA-8-L is not located within any defence training areas. The closest restricted defence area is the Yampi Sound Training Area.

5.6.7 Indigenous and European Heritage

A search of the Australian Heritage Database did not identify any indigenous heritage areas within the EMBA (DoEE 2018a). The closest Indigenous Listed Place is the Dampier Archipelago, which is located ~87 km south of WA-8-L. The closest Native Title Determination is located ~71 km south of WA-8-L and belongs to the Yaburara & Mardudhunera People.

5.6.8 Maritime Heritage

Historic shipwrecks are recognised and protected under the *Historic Shipwrecks Act 1976* that protects historic wrecks and associated relics. Under the Act, all wrecks more than 75 years old are protected, together with their associated relics regardless of whether their actual locations are known.

A search of the National Shipwreck and Relic database did not identify any shipwrecks or relics within the EMBA (DoEE 2018b). The nearest known shipwreck is the *Zelma*, located ~90 km south of WA-8-L.

5.6.9 Commonwealth Protected Areas

The DoEE PM Search (Section 5.2) identified that the EMBA does not occur within any Australian Marine Parks (AMPs). The EMBA does not overlap any World Heritage Properties, National Heritage Properties, Ramsar wetlands, State Marine Parks, or Indigenous Heritage Sites. The closest AMP is the Dampier Marine Park, located ~88 km south of the EMBA.

5.6.10 State Protected Areas

The closest WA Marine Park to the EMBA is the Montebello Islands Marine Park, located ~160 km south-west of WA-8-L.

6 RISK ASSESSMENT METHODOLOGY

The environmental risk assessment process undertaken for the activity comprised of the following components that are discussed further in the following sections:

1. Identification of environmental hazards
2. Identification of the area that may be effected
3. Description of the environment that may be affected
4. Identification of the particular values and sensitivities
5. Identification and evaluation of potential environmental impacts
6. Control measure identification and ALARP decision framework
7. Determine severity of consequence
8. Determine likelihood
9. Determine residual risk ranking
10. Determination of Acceptability

The outcome of the risk assessment process is detailed in the Section 7 (Environmental Risk Assessment).

6.1 Identification of Environmental Hazards (Aspects)

Environmental hazards or aspects are those elements of the activity that can interact with the environment. Environmental hazards were identified for operations and emergency conditions. An assessment of each component of the activity was undertaken and the environmental hazards (aspects) identified.

6.2 Identification of the EMBA

Following the identification of environmental hazards, the likely extent of each hazard, the environment that may be affected (EMBA) was determined. For the purposes of this EP the EMBA represents the 'production equipment abandonment area', defined by a 1 km radius around the assumed position of the flowline and umbilical on the seabed within WA-8-L. Section 5 describes the existing environment within this area including any relevant physical, biological, and socio-economic aspects.

6.3 Identification of Particular Values and Sensitivities

Based on Santos' and publicly available information a review of the existing environment (Section 5) was undertaken to identify the environmental values and / or sensitivities with the potential to occur within the EMBA. These were used to inform the risk assessment.

6.4 Identification and Evaluation of Potential Environmental Impacts

Based on Santos' and publicly available information, the known and potential impacts to the identified receptors were identified. These were then evaluated and specifically considered on the basis of:

- receptor sensitivity to identified hazard; and
- extent and duration of the potential impact.

6.5 Control Measure Identification and ALARP Decision Framework

Based upon the identified assessment technique used to demonstrate ALARP, control measures were identified in accordance with the defined environmental performance outcomes, to eliminate, prevent, reduce or mitigate consequences associated with each of the identified environmental impacts.

6.5.1 ALARP Decision Framework

In alignment with NOPSEMA's ALARP Guidance Note (GN0166), Santos have adapted the approach developed by Oil and Gas UK (OGUK 2014) (formerly UKOOA) for use in an environmental context to determine the assessment technique required to demonstrate that potential impacts and risks are ALARP (Figure 6-1). Specifically, the framework considers impact severity and several guiding factors:

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

This framework provides appropriate tools, commensurate to the level of uncertainty or novelty associated with the impact or risk (referred to as the Decision Type A, B or C). Decision types and methodologies to establish ALARP are outlined in Table 6-1.

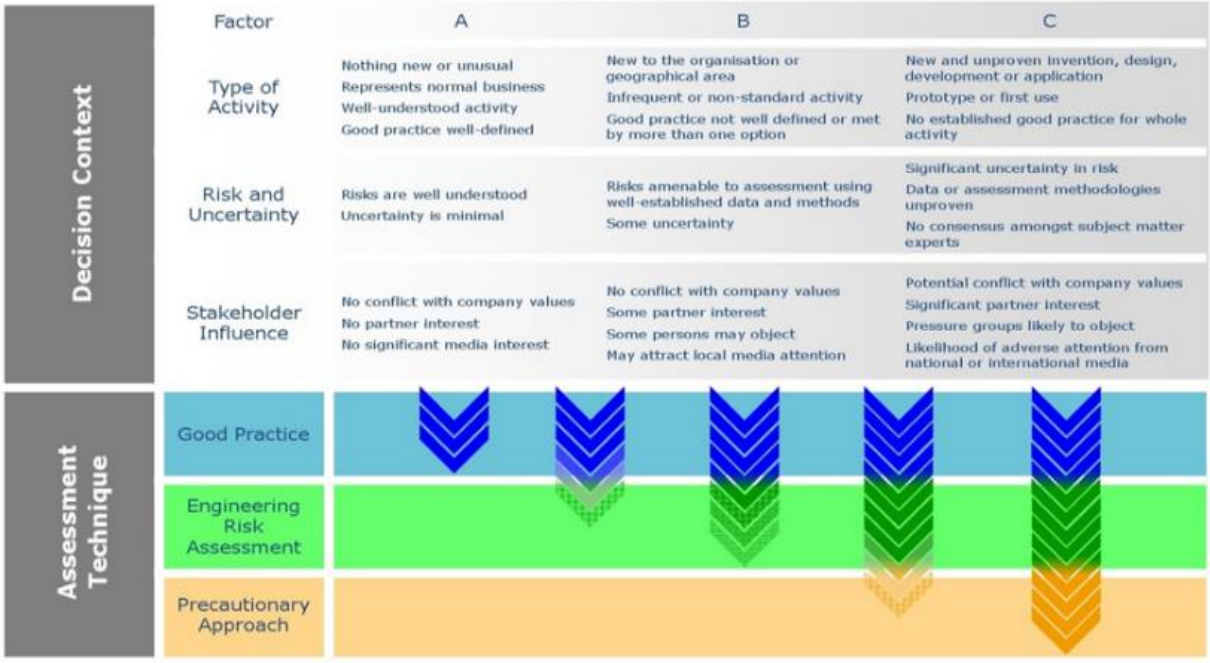

Figure 6-1 Impact and risk 'uncertainty' decision making framework

Table 6-1 ALARP decision making based upon level of uncertainty

Decision Type	Description	Decision Making Tools
A	Risks classified as a Decision Type A are well-understood and established practice	Good Practice Control Measures are considered to be: Legislation, codes and standards: Identifies the requirements of legislation, codes and standards that are to be complied with for the activity. Good Industry Practice: Identifies further engineering control standards and guidelines that may be applied over and above that required to meet the legislation, codes and standards. Professional Judgement: Uses relevant personnel with the knowledge and experience to identify alternative controls. When formulating control measures for each environmental impact or risk, the 'Hierarchy of Controls' philosophy, which is a system used in the industry to identify effective controls to minimise or eliminate exposure to impacts or risks, is applied.
B	Risks classified as a Decision Type B are typically in areas of increased environmental sensitivity with some stakeholder concerns.	Risk-based tools such as cost based analysis or modelling: Assesses the results of probabilistic analyses such as modelling, quantitative risk assessment and/or cost benefit analysis to support the selection of control measures identified during the risk assessment process.
C	Risks classified as a Decision Type C will typically involve sufficient complexity, high potential impact, uncertainty or stakeholder interest	Precautionary Approach: OGUK (2014) state that if the assessment, taking account of all available engineering and scientific evidence, is insufficient, inconclusive or uncertain, then a precautionary approach to hazard management is needed. A precautionary approach will mean that uncertain analysis is replaced by conservative assumptions that will result in control measures being more likely to be implemented.

6.5.2 Control Measure Identification

Control measures were identified for each hazard with the aim of eliminating the hazard, or if this is not reasonably practicable, to minimise the risk to as low as reasonably practicable (ALARP). The process of identifying control measures is an iterative process of:

- Identifying a risk control
- Assessing the risk control
- Deciding whether residual risk levels are tolerable
- If not tolerable, identifying a new risk control
- Assessing the effectiveness of that control

Santos uses a Hierarchy of Control (Table 6-2) where you start at the top of the list and ask, "Is there any reasonably practicable way that we can eliminate the hazard?" If the answer is yes, then this is the most effective way of managing the hazard. If the answer is no, then you move down to the next option in the list. This process of working down the list is repeated until a control measure/s can be found.

Once the control measures were determined performance outcomes, performance standards and measurement criteria were established. Terms used for measuring the environmental performance for each hazard are defined as:

- *Control measure* – a system, an item of equipment, a person or a procedure that is used as a basis for managing environmental impacts and risks.
- *Performance outcome* – a statement of the measurable level of performance required for the management if environmental aspects of an activity to ensure that the environmental impacts and risks will be of an acceptable level.
- *Performance standard* – performance required of a control measure.
- *Measurement criteria* – defines how environmental performance will be measured and determine whether the outcomes and standards have been met.

Table 6-2 Santos Hierarchy of Control

Control	Effectiveness	Example
Eliminate		*Removal of the risk.*
Substitute		*Change the risk for a lower one.*
Engineering		*Engineer out the risk.*
Isolation		*Isolate people or the environment from the risk.*
Administrative		*Provide instructions or training to people to lower the risk.*
Protective		*Use of protective equipment.*

6.6 Determination of Severity of Consequence

Once the potential hazards and receptors were identified the potential level of impact (consequence) was assessed and assigned. Consequence is defined using the Santos Environmental Consequence Classification (Table 6-3) from the Santos Operational Risk Matrix. The consequence level for each hazard is documented in the impact / risk assessment table in Section 7.

Table 6-3 Santos Environmental Consequence Classification

Level	Environment
VI	Regional and long term impact on an area of significant environmental or social value. Destruction of an important population of plants and animals with recognised conservation value. Complete remediation impossible. Complete loss of trust by affected community leading to long-term social unrest and outrage.
V	Destruction of an important population of plants or animals or of an area of significant environmental or social value. Complete remediation not practical or possible. Prolonged community outrage that impacts the viability of the business.
IV	Extensive and medium term or localised and long term impact to an area, plants or animals of recognised environmental or social value. Remediation possible but may be difficult or expensive. High potential for complaints from interested parties.
III	Localised and medium term or extensive and short term impact to areas, plants or animals of significant environmental or social value. Remediation may be difficult or expensive. Immaterial effect on community.
II	Localised and short term impact to an area, plants or animals of environmental or social value. Readily treated. One off community protest requiring intervention and management.
I	Localised and short term environmental or community impact – readily dealt with.

Definitions	
Duration of Potential Impact	**Extent of Potential Impact**
Short term: Days or weeks	**Localised**: Within the EMBA
Medium term: Less than 12 months	**Extensive**: Within WA-8-L
Long term: Greater than 12 months	**Regional**: Outside of WA-8-L

6.7 Determination of Likelihood

Likelihood is defined as the likelihood of the consequence occurring, this includes the likelihood of the event occurring and the subsequent likelihood of the consequence occurring. Likelihood is defined using the Santos Likelihood Descriptors (Table 6-4) from the Santos Operational Risk Matrix.

Table 6-4 Santos Likelihood Descriptors

Level		Criteria
Almost Certain	**f**	Occurs in almost all circumstances or could occur within days to weeks
Likely	**e**	Occurs in most circumstances or could occur within weeks to months
Occasional	**d**	Has occurred before in Santos or could occur within months to years
Possible	**c**	Has occurred before in the industry or could occur within the next few years
Unlikely	**b**	Has occurred elsewhere or could occur within decades
Remote	**a**	Requires exceptional circumstances and is unlikely even in the long term or only occurs as a “100 year event”

6.8 Residual Risk Ranking

Risk is expressed in terms of a combination of the consequence of an impact and the likelihood of the impact occurring. Santos uses a Corporate Risk Matrix (Table 6-5) to plot the consequence and likelihood to determine the level of risk.

Once the level of risk is determined Santos uses a Risk Significance Rating (Table 6-6) to determine the magnitude of the risk and if further action is required to reduce the level of risk using the process described in Section 6.6.

Table 6-5 Santos Risk Matrix

	I	II	III	IV	V	VI
f	2	3	4	5	5	5
e	2	3	4	4	5	5
d	2	2	3	4	4	5
c	1	2	2	3	4	5
b	1	1	2	2	3	4
a	1	1	1	2	3	3

Table 6-6 Santos Risk Significance Rating

RISK LEVEL	MITIGATION / INVESTIGATION FOCUS (ADD ADDITIONAL BUSINESS UNIT SPECIFIC REQUIREMENTS WHERE REQUIRED)
5	- Intolerable risk level - Following verification of the residual risk at level 5, activity must stop - Activity cannot recommence until controls implemented to reduce residual risk to level 4 or lower - Dedicated multi-disciplinary incident investigation team - Management involvement in the investigation
4	- Assess risk to determine if ALARP - If ALARP, activities related to maintenance of controls/ barriers prioritised & managed - If not ALARP, improve existing controls and/or implement new control/s - Dedicated multi disciplinary incident investigation team
3	- Assess risk to determine if ALARP - If ALARP, activities related to maintenance of controls/ barriers prioritised & managed - If not ALARP, improve existing controls and/or implement new control/s - Full incident investigation
2	- Assess risk to determine if ALARP - If ALARP, activities related to maintenance of controls/ barriers prioritised & managed - If not ALARP, improve existing controls and/or implement new control/s - Incident investigations using simple tools
1	- Managed as stipulated by the related work processes - No incident investigation required

6.9 Determination of Impact and Risk Acceptability

The model Santos used for determining acceptance of residual risk is detailed in Figure 6-2. In summary:

- A Level 5 residual risk is intolerable, and Risks will require further investigation and mitigation to reduce the risk to a lower and more acceptable level. If after further investigation the risk remains in the severe category, the risk must not be accepted or approved by Management.
- A Level 2 – 4 residual risk is acceptable provided that ALARP has been achieved and demonstrated.
- A level 1 residual risk is acceptable, and it is assumed that ALARP has been achieved.

In addition to the requirements detailed above, for the purposes of offshore petroleum activities, impacts and risk to the environment are considered broadly acceptable if:

- The residual risk is determined to be 1 (and ALARP Decision Type A selected and good practice control measures applied), or
- The residual risk is determined between 2 and 4 and ALARP can be demonstrated; and
- The following have been met:
  - Principles of ecologically sustainable development;
  - Legal and other requirements;
  - Santos policies and standards; and
  - Stakeholder expectations.

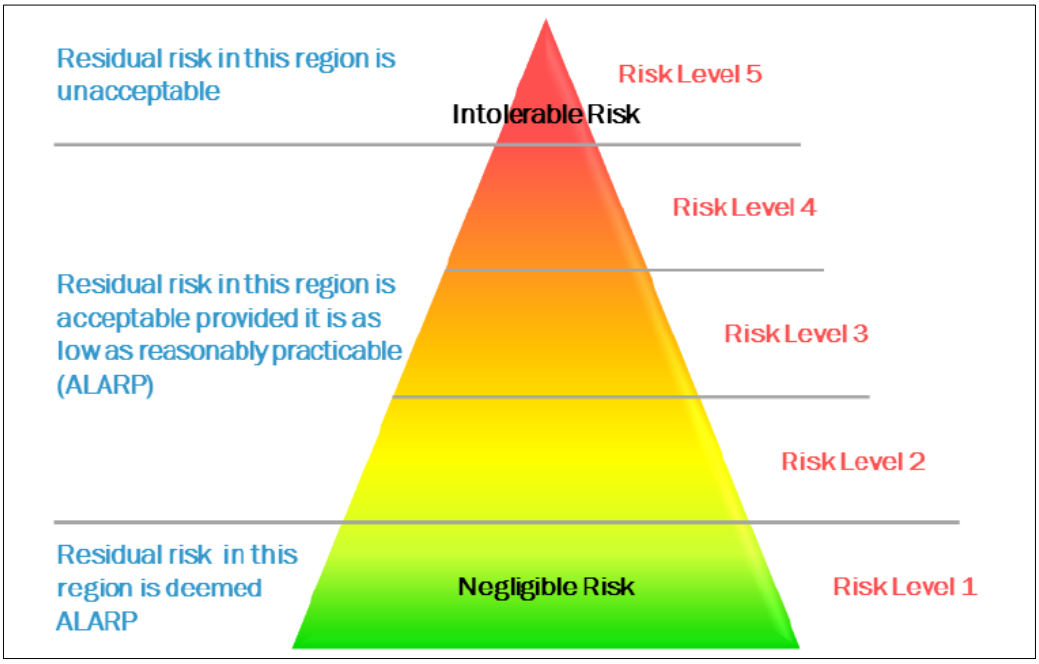

Figure 6-2 Santos Residual Risk Acceptance Model

7 ENVIRONMENTAL RISK ASSESSMENT

7.1 Assessment of Impacts and Risks

An assessment has been undertaken of the environmental impact and risks associated with the base case abandonment option (location and complete removal of equipment) versus the BPEO identified from the comparative assessment process described in Section 3.8 (leaving the production equipment permanently *in situ*).

Table 7-1 provides the outcome of this assessment, which examined:

- Routine emissions and discharges:
  - Underwater noise emissions;
  - Light emissions;
  - Atmospheric emissions; and
  - Wastewater discharges.

- Physical and biological disturbance:
  - Physical disturbance;
  - Biological disturbance; and
  - Marine fauna interactions.

- Interactions with other marine users:
  - Disturbance to commercial fisheries;
  - Disturbance to shipping;
  - Disturbance to oil and gas activities; and
  - Other marine user interactions.

- Unplanned events:
  - Introduction of invasive marine species;
  - Hydrocarbon contamination and spills;
  - Chemical contamination and spills; and
  - Solid wastes and dropped objects.

Table 7-1 Assessment of impacts / risks for base case and option A abandonment options

Impact / Risk	Base Case: Impact / Risk from Complete Removal of Production Equipment	Option A: Impact / Risk from Leaving Production Equipment *in situ*
Routine Emissions & Discharges		
Underwater noise emissions	The retrieval activity will incur standard vessel noise associated with one retrieval vessel (at minimum 60-70 m in length) and at least one survey / support vessel. This includes engine noise, thruster and propeller noise from dynamic positioning, and noise from on-deck machinery used in the retrieval. The duration of exposure will depend on the period required to first locate and then remove the production equipment.	No vessels will be used when leaving the production equipment *in situ* and therefore the impact is not applicable to the activity.
Light emissions	This activity will incur light emissions associated with the operation of the retrieval vessel (at minimum 60-70 m in length), survey / support vessel and remotely operated vehicles (ROVs). To maintain a safe work environment lighting is required as per the *Navigation Act 2012*. The duration of exposure will depend on the period required to first locate and then remove the production equipment.	No vessels will be used when leaving the production equipment *in situ* and therefore the impact is not applicable to the activity.
Atmospheric emissions	The retrieval activity will incur standard emissions associated with the operation of one retrieval vessel (at minimum 60-70 m in length) and at least one support vessel. Depending on the vessel specifications, emissions will most likely compose of carbon dioxide and volatile organic compounds (VOCs), and minor quantities of sulphur oxide. The total emissions will depend on the duration of the activity, which depends on the rate at which the production equipment can be located and removed.	No vessels will be used when leaving the production equipment *in situ* and therefore the impact is not applicable to the activity.
Wastewater discharges	A retrieval activity will incur standard wastewater discharge associated with the operation of one retrieval vessel (at minimum 60-70 m in length) and at least one survey / support vessel. Wastewater, including treated sewage and greywater, will need to be routinely discharged for the duration of the activity. Wastewater will temporarily impact local water quality and marine fauna behaviour. The total wastewater discharge will depend on the duration of the activity, which will depend on the period required to first locate and then remove the production equipment.	No vessels will be used when leaving the production equipment *in situ* and therefore the impact is not applicable to the activity.

Impact / Risk	Base Case: Impact / Risk from Complete Removal of Production Equipment	Option A: Impact / Risk from Leaving Production Equipment *in situ*
Physical & Biological Disturbance		
Physical disturbance	Removal of the production equipment will require disturbance to the seabed and will occur in the form of dispersal of sediment and organic debris into the water column. The disturbance footprint will span the full 1.05 km length of the flowline/umbilical and will be proportional to the state of embedment. Sediment within the EMBA is most likely a combination of calcareous gravel, sand and silt, and the dispersal will contain organic detritus, microorganisms and macrobenthos such as sponges, polychaete worms, bivalves and echinoderms. Resuspension of this material into the water column can result in increased nutrient availability for plankton and may result in temporary aggregations of marine life as organisms at different levels of the trophic level take advantage of the feeding opportunity. The flowline outer thermoplastic sheath is comprised of a high grade polyamide nylon (polymer), which is a very stable, non-biodegradable material that is expected to have a service life of many decades. Degradation of polymers within the flowline and umbilical is over the last 26 years is possible, but is considered unlikely. Any such degradation will lower the structural integrity of the equipment and increase the likelihood of the flowline/umbilical breaking on retrieval. If embedment is significant, the weight of the overlying sediment will increase the chance of the flowline/umbilical breaking. In a scenario where this does occur and the equipment falls back to the seabed, the disturbance footprint will be increased. No anchoring of vessels will occur during the activity unless in emergency situations. The vessels will maintain position using dynamic positioning (DP) systems.	The specifications of the production equipment and known conditions within the existing environment suggest there is a strong likelihood of progressed embedment of the equipment in the underlying sediment. An assessment of sedimentation-induced burial of marine pipelines in the NWMR was conducted by Leckie *et al.* (2015, 2016). The assessment found that physical action of currents and internal waves acting on the substrate provides a mechanism for sedimentation against a pipeline. Leckie *et al.* (2016) also observed further embedment through biological activity such as tunnelling under the equipment by crustaceans and Epinphelidaes (groupers), as well as dispersal of sediment by rapid fish movement. The study showed, based on seven years of field survey measurements of a subsea pipeline obtained using sonar profilers and underwater video, that significant lowering of the pipeline into the seabed resulted from sediment mobility and scour. The majority of the lowering occurred within two years of pipeline laying and appeared to result from sustained ambient tidal and soliton currents as opposed to large storms (Leckie *et al*. 2015). The following variables contribute to the embedment of the flowline and umbilical in the underlying sediment: • A relatively mobile substrate, as described in Section 5.4; • Strong seasonal currents and internal waves, as described in Section 5.4; • Regional presence of species displaying behaviours that can contribute to embedment; • Significant timescale of events; and • Relatively narrow diameter of flowline/umbilical (combined diameter of 34 cm) and significant weight (combined approximately 100 kg/m). Based on this information, it is likely that partial, if not total burial of the T-7 flowline and umbilical has occurred, and the likelihood of the equipment damaging the surrounding environment from movement is negligible. The production equipment is not fixed to the seabed and although technically free to move, it is highly unlikely to move at a rate that would result in significant seabed disturbance. The mass of the flowline and umbilical (approximately 100 kg/m) provides a relatively

Impact / Risk	Base Case: Impact / Risk from Complete Removal of Production Equipment	Option A: Impact / Risk from Leaving Production Equipment *in situ*
		high inertia. This is also applicable to the anchor and chain, which have a combined weight of 5 tonnes. These impacts / risks are expected to continue in perpetuity and not to change substantially in either magnitude or significance.
Biological Disturbance	Negative impact via removal of any biofouling communities that inhabit any exposed areas of the flowline/umbilical, anchor/chain and tyre weight, and consequent impacts on associated fish assemblages (Pradella *et al*. 2014; McLean *et al.* 2017).	Negligible negative risks – low risk of equipment movement (see above). Potential positive impact along any exposed areas from colonisation of sessile organisms and encrusting marine invertebrates (biofouling), and a potential positive impact for marine species that feed these organisms. These impacts / risks are expected to continue in perpetuity and not to change substantially in either magnitude or significance.
Marine fauna interactions	Disturbance through ROV use locating the equipment. Interactions with the retrieval and survey / support vessels. The production equipment is located within the boundaries of the whale shark foraging BIA and pygmy blue whale distribution BIA (Figure 5-2). These BIAs are associated with seasonal migrations, within which species transit the area in greater densities. The risk of interaction and vessel collision is therefore higher during these periods. Collisions with marine fauna are most likely to occur when the vessels are transiting between the location of the production equipment and port of operation. Attraction of plankton to the artificial light source can result in an aggregation of marine life near the operating vessels (Becker *et al.* 2013). Such aggregations increase the likelihood of marina fauna colliding with the retrieval vessel, equipment and survey / support vessel. A variety of migratory avifauna species may traverse the area. Migratory birds are attracted to artificial light within a radius of 3–5 km from the light source (Marquenie *et al.* 2008).	No vessels will be used when leaving the production *in situ* and therefore the impact is not applicable to the activity. At no point will the flowline and umbilical protrude above seabed higher than the combined diameter of 34 cm. At no point will the anchor protrude above the seabed at its tallest point of 1.2 m. Therefore, the impact of leaving the production equipment *in situ* has on marine fauna is considered negligible. These impacts / risks are expected to continue in perpetuity and not to change substantially in either magnitude or significance.
Interactions with Marine Users		
Disturbance to commercial fisheries	No vessels will be used when leaving the production equipment *in situ* and fishers will not be impacted by operational safety exclusion zones. Trawl gear is unlikely to be affected by the flowline and umbilical due to its cylindrical shape and partial or total burial in the underlying sediment. As described in Section 3, the anchor is assumed to be a 1.2 m x 1 m x 1 m concrete cube. Trawling gear that comes into	A NTM will need to be issued and the process of location and retrieval of the production equipment would need to include establishment of safety exclusion zone around the activity. The activity will restrict the movements of the PFTIMF, PTMF, PLF and MMF for the duration of the activity. The duration of exclusion will depend on the period required to first locate and then remove the production equipment.

Impact / Risk	Base Case: Impact / Risk from Complete Removal of Production Equipment	Option A: Impact / Risk from Leaving Production Equipment *in situ*
	contact with the anchor may temporarily snag, however entanglement is considered a low risk. Potential for minor positive impact due to localised increase in marine productivity introduced via biofouling communities and attraction of fish to the area. These impacts / risks are expected to continue in perpetuity and not to change substantially in either magnitude or significance.	Removal of the production equipment may negatively impact catch levels in commercial fisheries, via removal of habitat for demersal fish species that are targeted by the Pilbara Demersal Scalefish Fisheries, albeit at a small scale (Pradella *et al*. 2014; McLean *et al*. 2017).
Disturbance to shipping	No vessels will be used when leaving the production equipment *in situ* and the equipment lies in water depths of 79-84 m. Therefore, there is no risk to shipping and the impact is not considered relevant to the activity.	A NTM will need to be issued and the process of location and retrieval of the production equipment would need to include establishment of safety exclusion zone around the activity. The production equipment lies ~4 km east of a commercial shipping corridor (Section 5.6.5). The duration of exclusion will depend on the period required to first locate and then remove the production equipment.
Disturbance to oil & gas activities	There are no current or scheduled exploration or production activities within production WA-8-L.	There are no current or scheduled exploration or production activities within production licence WA-8-L.
Other marine user interactions	No credible scenarios have been identified for this activity where the remaining production equipment could impact other marine users. The production equipment is not located within an area that is obviously utilised by recreational divers and therefore there is no impact to visual amenity. The depth at the location of the production equipment is outside of usual anchoring depths for recreational fishing vessels and therefore the risk of entanglement with production gear is considered negligible.	A safety exclusion zone would have to be applied around the activity and this would affect any recreational marine users that may be transiting the area. The production equipment is located in a relatively remote area and the impact on other marine users is considered minimal due to the lack of activity in the area. The duration of exclusion will depend on the period required to first locate and then remove the production equipment.
Unplanned Events		
Introduction of invasive marine species (IMS)	No vessels will be used when leaving the production equipment *in situ* and therefore the impact is not applicable to the activity.	There is the potential for survey / support vessel and the main retrieval vessel to transfer IMS from Australian waters into the production equipment EMBA and for them to establish in the surrounding areas. The vessels used in retrieval operation will need to undergo usual procedures to minimise the risk of transferring IMS. If the vessels are sourced from overseas, there is a higher risk of introduction of IMS.
Hydrocarbon contamination and spills	Documentation available on NOPIMS suggests the Talisman field produced oil, most likely a light crude. A review of available documentation on the 1992 decommissioning provided no clear indication whether the flowline and umbilical were flushed during the decommissioning activity. However, the T-7 flowline and umbilical were brought to the surface at one stage of the decommissioning and are assumed to be flooded. In the scenario where the flowline was not	There is the potential for hydrocarbon contamination and spills from the vessels used for the location and retrieval operation, which could result in toxic effects to the marine environment including marine fauna. Removing the flowline/umbilical may potentially rupture the flowline and release any residual hydrocarbons into the environment. However

Impact / Risk	Base Case: Impact / Risk from Complete Removal of Production Equipment	Option A: Impact / Risk from Leaving Production Equipment *in situ*
	flushed, there may be residual hydrocarbons within the flowline cavity. Any residual hydrocarbons will remain contained until the flowline cavity is ruptured. If residual hydrocarbons are present they will be diluted and not present in significant quantities. The impact of a hydrocarbon release in this scenario are considered to be negligible. In the scenario where the flowline was flushed, the potential for hydrocarbon release is not considered as a credible risk. These impacts / risks are expected to continue in perpetuity and not to change substantially in either magnitude or significance.	these hydrocarbons, if present, will be highly diluted and the impact on the environment in this scenario is considered to be negligible. In the scenario where the pipeline was flushed, the potential for hydrocarbon release from the production equipment is not considered as a credible risk.
Chemical contamination and spills	A review of available documentation on the 1992 decommissioning provided no clear indication whether the flowline and umbilical were flushed during the decommissioning activity. There is a possibility that residual chemicals may be present in the flowline and umbilical cavities. The flowline was made by Coflexip and was most likely constructed of steel and polymer layers. The production equipment was designed to operate under high pressure in a marine environment and therefore has inherent capacity to resist chemical weathering from seawater (including sodium chloride and magnesium sulphate), acidizing liquids and fracturing solutions. However, some degradation of the equipment is possible due to the timescale and marine conditions. Degradation forces acting on the polymer include minor chemical and ultra violet (UV) weathering at any exposed areas, and physical weathering from extended contact with the surrounding substrate. Most polymer degradation will occur as surface erosion, a process in which the polymer will degrade from the exterior surface inward. Due to the materials used in manufacturing of flowline and umbilical the release of polymers into the surrounding environment is expected to be relatively slow, however the total loss of material from the polymer bulk since the decommissioning activity in 1992 is unknown. These impacts / risks are expected to continue in perpetuity and not to change substantially in either magnitude or significance.	A review of available documentation on the 1992 decommissioning provided no clear indication whether the flowline and umbilical were flushed during the decommissioning activity. There is a possibility that residual chemicals are present in the flowline and umbilical cavities. The structural integrity of the pipeline after 26 years in a marine environment is not considered optimal. Successful execution of this activity will prevent any remaining polymer material from degrading into the environment.
Solid waste and dropped objects	No vessels will be used when leaving the production equipment *in situ* and therefore the impact is not applicable to the activity.	Common waste items that may be generated aboard vessels used for this activity include paper, rope, cardboard, sacking, timbers, domestic packaging, plastic and food and drink containers. If lost overboard, these items pollute the marine environment and have the potential to kill or injure marine fauna through ingestion and entanglement.

7.2 ALARP and Acceptability Demonstration

A comparative assessment has been conducted to assess the suitable abandonment approach for the production equipment that is *in situ* in WA-8-L. This comparative assessment process considered two potential abandonment options:

- Base case – complete removal of the production equipment; and
- Option A – leave production equipment *in situ*.

The purpose of the comparative assessment process is to establish the option(s) that provides the most benefits or the least damage to the environment, as a whole, at acceptable cost, in the long term as well as in the short term. The comparative assessment process assesses identified decommissioning options against a range of generic criteria and specific sub-criteria as outlined in Table 3-4.

For the base case abandonment option (complete removal), attempting to remove the production equipment has been assessed as having the potential for significant H&S risks to people during attempted removal activities, potential loss of habitat (hard substrate), and environmental and socio-economic impacts associated with vessels/equipment required for removal activities (i.e. planned and unplanned emissions from vessels; associated air, water and sediment quality impacts; underwater noise emissions; and temporary exclusion of commercial fishers). There are also potential challenges with technical feasibility of located and removing the production equipment—related to the likely partial or full burial of the flowline and umbilical over the course of the past 26 years, presence of marine growth (biofouling) and potential issues with structural integrity after such a long period on the seabed. There is also significant cost associated with mobilising vessels to WA-8-L for location and removal of equipment, and this cost is considered clearly disproportionate to any environmental benefit gained.

In contrast, option A (leave *in situ*) would have no H&S risk (due to no operational activities being required), minimal impact to the surrounding environment, and no associated project costs.

Therefore, the comparative assessment concluded that leaving the production equipment *in situ* is the 'best practicable environmental option' (BPEO) as it results in no H&S risk to personnel, no cost and has a minimal environmental impact/risk when compared to the base case.

Tables 7-2 and 7-3 summarise the ALARP and Acceptability demonstrations for the base case and option A abandonment options, respectively. These are based on the comparative assessment of abandonment options (Table 3-5) and the assessment of impacts and risks in Table 7-1.

Table 7-2 Base case - ALARP and Acceptability demonstration

ALARP Decision Context			
Decision Context	**Justification**		
B	The Decision Context in relation to the base case abandonment option (location and complete removal of the production equipment) is deemed to be 'B' on the basis of: • Type of Activity: - New to the organisation or geographical area - Infrequent or non-standard activity - Good practice not well-defined or met by more than one option • Risk and Uncertainty: - Risks amenable to assessment using well-established data and methods - Some uncertainty • Stakeholder Influence: - No conflict with company values - Some partner interest - Some persons may object - May attract local media attention		
Control Measure Identification			
Good Practice Control Measure	**Cost**	**Benefit**	**Applied**
Complete removal of production equipment from seabed within WA-8-L	There is significant cost associated with mobilising vessels to WA-8-L for location and removal of equipment, which has been estimated to be in the order of at least A$300,000 to A$450,000 for two vessels.	This cost is considered clearly disproportionate to any environmental benefit gained. Attempting to locate and remove the production equipment has been assessed as having the potential for significant H&S risks to people, potential loss of habitat (hard substrate), and environmental and socio-economic impacts associated with vessels/equipment required for removal activities (i.e. planned and unplanned emissions from vessels; associated air, water and sediment quality impacts; underwater noise emissions; and temporary exclusion of commercial fishers).	No

Residual Risk Ranking			
Potential Impact	**Consequence**	**Likelihood (of Consequence)**	**Residual Risk**
Physical disturbance	III	Likely (e)	**4**
Biological disturbance	II	Occasional (d)	**2**
Marine fauna interactions	II	Possible (c)	**2**
Disturbance to commercial fisheries	II	Possible (c)	**2**
Other marine user interactions	I	Possible (c)	**1**
Hydrocarbon contamination	II	Occasional (d)	**2**
Chemical contamination	I	Occasional (d)	**2**

EPO, EPS & MC		
Performance Outcome	**Control Measure & Performance Standard**	**Measurement Criteria**
Not Applicable - as Option A has been determined as BPEO and is being implemented rather than the Base Case		

Demonstration of Acceptability	
Is residual risk determined to be 1 and the ALARP Decision Framework A applied?	No. The risk assessment has determined that the impacts and risks resulting from location and complete removal of the production equipment represents residual risks ranked from very low (1) to moderate (4). The base case option has the potential for H&S risks to people during attempted removal activities, potential loss of habitat (hard substrate), and environmental and socio-economic impacts associated with vessels/equipment required for removal activities (i.e. planned and unplanned emissions from vessels; associated air, water and sediment quality impacts; underwater noise emissions; and temporary exclusion of commercial fishers).

Table 7-3 Option A - ALARP and Acceptability demonstration

ALARP Decision Context	
Decision Context	**Justification**
A	The Decision Context in relation to the Activity (leaving the production equipment permanently in situ on the seabed within WA-8-L is deemed to be 'A' on the basis of: • Type of Activity: - Nothing new or unusual - Represents normal business - Well understood activity - Good practice well-defined • Risk and Uncertainty: - Risks are well understood - Uncertainty is minimal • Stakeholder Influence: - No conflict with company values - No partner interest - No significant media interest

Control Measure Identification			
Good Practice Control Measure	**Cost**	**Benefit**	**Applied**
Abandonment of the production equipment – leave *in situ* permanently on the seabed within WA-8-L determined to be BPEO	There is no cost associated with this control measure as no operations are proposed to be undertaken	No H&S risk (due to no operational activities being required), minimal impact to the surrounding environment	Yes

Residual Risk Ranking			
Potential Impact	**Consequence**	**Likelihood (of Consequence)**	**Residual Risk**
Physical disturbance	II	Unlikely (b)	Very Low (1)
Biological disturbance	I	Unlikely (b)	Very Low (1)
Marine fauna interactions	I	Unlikely (b)	Very Low (1)
Disturbance to commercial fisheries	II	Unlikely (b)	Very Low (1)
Other marine user interactions	I	Unlikely (b)	Very Low (1)

Hydrocarbon contamination	I	Unlikely (b)	Very Low (1)
Chemical contamination	I	Unlikely (b)	Very Low (1)

EPO, EPS & MC		
Performance Outcome	**Control Measure & Performance Standard**	**Measurement Criteria**
No impacts to sediments, benthic communities and commercial fishers resulting from location and removal of the production equipment	Abandonment of the production equipment – leave *in situ* permanently on the seabed within WA-8-L	Notification to stakeholders that the production equipment will be remaining *in situ* permanently, following acceptance of the EP
All legislative requirements that apply to the activity, and are relevant to the environmental management of the activity, are being met	Application for a Sea Dumping Permit from the DoEE, if required; or Granting of an exception by the DoEE, under Section 15 of the Sea Dumping Act	Lodgement of Sea Dumping Permit application with the DoEE, if required Granting of an exception under Section 15 of the Act Notification to NOPSEMA that a Sea Dumping permit has been applied for, or that an exception has been granted
Demonstration of Acceptability		
Is residual risk determined to be 1 and the ALARP Decision Framework A applied?		Yes. The risk assessment has determined that the impacts and risks resulting from leaving the production equipment *in situ* permanently within WA-8-L represents a very low (1) residual risks that may result in localised impacts to sediments, benthic communities and commercial fishers. Therefore, Santos considers the impacts and risks of option A to be broadly acceptable.

8 IMPLEMENTATION STRATEGY

8.1 Environmental Performance Reporting

The defined activity ends upon acceptance of the EP by NOPSEMA, and on submission and acceptance of the notifications as required under Regulation 29 (end of activity) and Regulation 25A (end of operation of EP) of the OPGGS (E) Regulations (refer Section 1.2).

Upon acceptance of the EP Santos will submit Regulation 29 and 25A notifications to NOPSEMA. As required under Regulation 26C, Santos will also submit an environmental performance report at the same time that the Regulation 29 and 25A forms are submitted.

8.2 Santos EHS Management System

Santos manages the environmental impacts and risks of its activities through the implementation of the Santos Management System (SMS). The SMS provides a formal and consistent framework for all activities of Santos employees and contractors.

The framework for the SMS is provided in Figure 8-1 and includes:

- Constitution, Board Charters, Delegation of Authority - These documents define the purpose and authorities of the Santos Limited Board, Board Committees.
- Code of Conduct and Policies – outline the key requirements and behaviours expected of anyone who works for Santos. The Policies are set and approved by the Board.
- Management Standards - prescribe the minimum performance requirements and expectations in relation to the way we work at Santos (the 'What').
- Processes, procedures and tools - support implementation of the Management Standard and Policy requirements by providing detail of 'How' to achieve performance requirements.

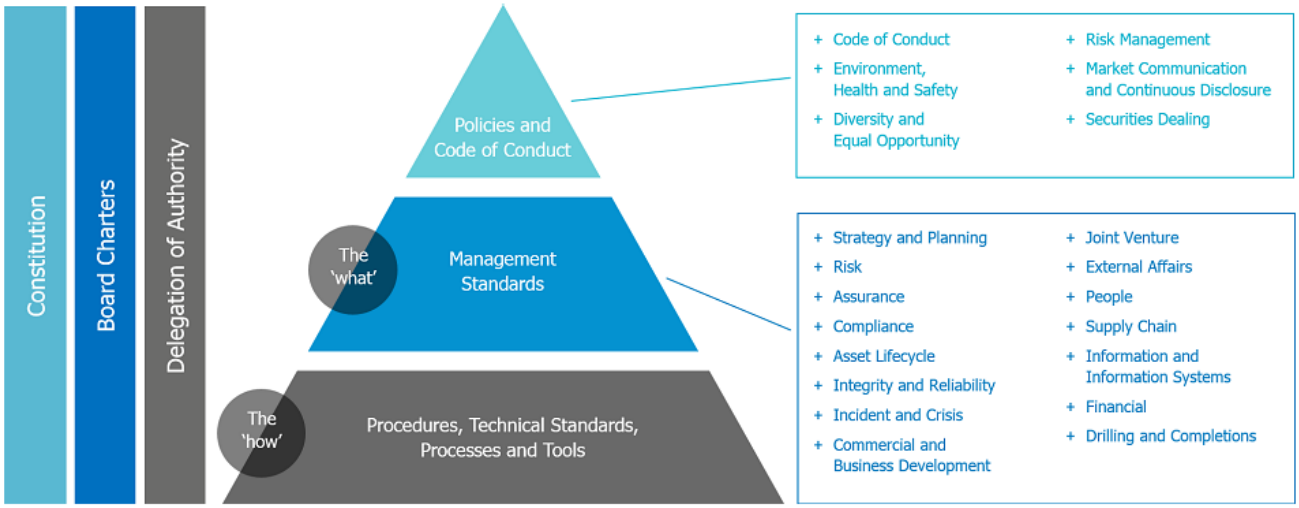

Figure 8-1 Santos Management System Framework

8.3 Management of Change

The SMS establishes the processes required to ensure that when changes are made to a project, control systems, an organisational structure or to personnel, the EHS risks and other impacts of such changes are identified and appropriately managed.

The SMS requires that all environmentally relevant changes must obtain environmental approval (internal i.e. within Santos and/or external i.e. regulatory) prior to undertaking any activity.

8.3.1 EP Review

In order to ensure that impacts and risks are continually reduced to ALARP and acceptable levels and the requirements of legislation will continue to be met, Santos will undertake periodic verification of environmental inputs used to inform the evaluation of impacts and risks in the EP, including identifying updates to legislative requirements and environmental information.

8.3.2 MoC Process

Where an environmentally relevant change is identified, the Offshore Environment MoC Process is undertaken by a Senior Environmental Adviser.

The MoC Process defines the procedure for assessing changes or proposed changes to circumstances or operations that differ from, or are not provided for in the accepted EP, and is undertaken to ensure that any additional impacts and risks resulting from the change can be managed to ALARP and acceptable levels. If required, appropriate technical and/or legal advice is sought during this process. When completed, the documented outcomes of the MoC Process are approved by the Santos Environment Manager and Project/Activity Manager.

The change assessment is documented using the MoC Assessment Form, which is used in conjunction with the documented MoC procedure to record how the proposed change will be managed compared with the accepted EP. The accepted EP is considered the basis against which all changes are to be assessed against.

The first step of the assessment involves identifying what sections of the EP the change will impact and how it will differ from the accepted EP. For changes that are permanent and/or will affect the EP the change is to be made within the EP, taking into account all sections that the change may impact. Sections of the EP impacted by the change are recorded on the Assessment Form.

The next step in the MoC Process is to undertake an assessment against the requirements of the OPGGS (E) Regulations, specifically Regulations 17(1), 17(5) and 17(6). The MoC Process includes criteria for determining if an environmentally relevant change represents:

1. A new activity;
2. A significant modification or new stage of the activity;
3. A significant new environmental impact or risk; or
4. A significant increase in an existing environmental impact or risk.

Significant new impacts or risks, or increases in existing impacts or risks, include those where:

- Compliance with legal and other requirements, performance objectives and standards or the implementation strategy can no longer be demonstrated;
- The impacts or risks are no longer ALARP and acceptable; and
- The impacts or risks have a greater extent, severity, duration or uncertainty than is detailed in the accepted EP.

As an example, a new environmental impact or risk may be significant if:

- The environment consequence of the impact is greater than II as per the Santos Environment Consequence Classification.
- The risk level is greater than very low (1) as per the Santos Risk Matrix.
- Impacts and risks are no longer ALARP and acceptable.
- It has the potential to impact on sensitive receptors, including other marine users and matters of national environmental significance or State/NT protected matters (species, heritage, reserves etc.), which is not accounted for in the accepted EP.
- The magnitude and extent of the impact is outside the bounds of the accepted EP.

The findings of the OPGGS (E) Regulations assessment are documented in the MoC Assessment Form.

8.3.3 EP Revision and Resubmission

In the event that the proposed change represents a new activity, a significant modification or new stage of the activity, or introduces a significant new environmental impact or risk, results in a significant increase to an existing environmental impact or risk, or, as a cumulative effect results in an increase in environmental impact or risk, the EP will be revised and submitted for re-assessment and acceptance by NOPSEMA.

Where a change results in the EP being updated, the change/s are to be logged in the EP Change Register.

If the MoC Process results in a revision and resubmission of the EP this will trigger additional stakeholder consultation. As soon as is practicable, all relevant persons will be notified of the EP revision and resubmission, and of the identified significant new environmental impact or risk, or increase in existing impact or risk, which has resulted in this process being implemented. Stakeholders will also be notified when the revised EP has been accepted by the regulator.

8.3.4 Changes to Titleholders and Nominated Liaison Person

Section 1.4 details the titleholders, activity nominated liaison person and contact details for both. A change in any of these details are required to be notified to NOPSEMA.

8.4 Roles and Responsibilities

Regulation 14(4) requires the implementation strategy to establish a clear chain of command, setting out the roles and responsibilities of personnel in relation to the implementation, management and review of the EP, including during emergencies or potential emergencies.

As the activity defined in the EP is abandoning the production equipment *in situ* on the seabed within WA-8-L, there are no roles and responsibilities that apply to the activity. The Santos Head of Environment and Access (nominated liaison person for the EP) is responsible for the implementation, management and review of the EP.

8.5 Training and Competencies

Regulation 14(5) requires the implementation strategy to include measures to ensure that each employee or contractor working on, or in connection with, the activity is aware of his or her responsibilities in relation to the EP, including during emergencies or potential emergencies, and has the appropriate competencies and training.

As the activity defined in the EP is abandoning the production equipment *in situ* on the seabed within WA-8-L, there are no training or competencies requirements that apply to the activity.

8.6 Environmental Performance Monitoring and Reporting

8.6.1 Monitoring, Recording, Audit, Management of Non-conformance

Regulation 14(6) requires the implementation strategy to provide for sufficient monitoring, recording, audit, management of non-conformance and review of the titleholder's environmental performance and the implementation strategy to ensure that the environmental performance outcomes and standards in the EP are being met.

Section 8.1 describes the environmental performance reporting that Santos will undertake for the EP. As the activity defined in the EP is abandoning the production equipment *in situ* on the seabed within WA-8-L, there are no specific monitoring, recording, audit and management of non-conformance that apply to the activity.

Regulation 14(7) requires the implementation strategy to provide for sufficient monitoring of, and maintaining a quantitative record of, emissions and discharges (whether occurring during normal operations or otherwise), such that the record can be used to assess whether the environmental performance outcomes and standards in the EP are being met. As the activity defined in the EP is abandoning the production equipment *in situ* on the seabed within WA-8-L, there is no specific monitoring of, and maintaining a quantitative record of, emissions and discharges that apply to the activity.

8.6.2 Oil Pollution Emergency Plan

Regulation 14(8) requires the implementation strategy to contain an oil pollution emergency plan (OPEP) and provide for the updating of the plan.

As the activity defined in the EP is abandoning the production equipment *in situ* on the seabed within WA-8-L, and there are no planned operations within the title, the requirement for an OPEP does not apply to the activity. Consequently, the requirements of Regulations 14(8AA), 14(8A), 14(8B), 14(8C), 14(8D) and 14(8E) do not apply to the activity.

8.6.3 Incident Reporting

Reportable Incidents

Reportable incidents are defined under the OPGGS (E) Regulations as "*an incident relating to the activity that has caused, or has the potential to cause, moderate to significant environmental damage*".

Regulation 16(c) requires the titleholder to provide details of all reportable incidents in relation to the proposed activity. As the activity defined in the EP is abandoning the production equipment *in situ* on the seabed within WA-8-L, and there are no planned operations within the title, there are no defined reportable incidents for the activity.

Recordable Incidents

Recordable incidents are defined under the OPGGS (E) Regulations as "*a breach of an environmental performance outcome or environmental performance standard, in the environment plan that applies to the activity, that is not a reportable incident*."

If there are any breaches of the EPOs or EPSs described in Table 7-2 of this EP Santos will submit a recordable incident report to NOPSEMA, in the manner required under Regulation 26B of the OPGGS (E) Regulations.

8.7 EP Summary

In accordance with Regulation 11(3) of the OPGGS (E) Regulations, within 10 days after receiving notice that NOPSEMA has accepted this EP Santos will submit a summary of the accepted plan for public disclosure. This summary will meet the requirements of Regulation 11(4) with respect to EP summary content.

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