



Part 1 – Operator Details		OPGGS(ER) Reg 32(2)
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Position:		
Australian address:		
Phone:		Email:
Signature:		Date:

Part 2 – Activity Details		
Activity type(s) included in environment plan. Please select from the following (may be more than one):	Number of these activities in plan	Applicable instrument / permit area(s):
1. Operation of a facility used for the recovery or processing of petroleum	N/A	
2. Operation of a facility that is used for the storage of petroleum but not for the recovery or processing of petroleum	N/A	
3. Recovery of petroleum using a subsea installation that: (a) is not itself a facility mentioned in item 1; and (b) is not connected to a facility mentioned in item 1 or 2 that is located in the same production licence area; and (c) is not connected to a licensed pipeline in the same production licence area	N/A	
4. Operation of a licensed petroleum pipeline	Yes	Vic/PL37, Vic/PL37(V) and Vic/PL42
5. Construction or installation of a facility mentioned in item 1 or 2	N/A	
6. Construction or installation of a licensed petroleum pipeline	N/A	
7. Decommissioning, dismantling or removing a facility mentioned in item 1 or 2	N/A	
8. Decommissioning, dismantling or removing a licensed petroleum pipeline	N/A	
9. Significant modification of a facility mentioned in item 1 or 2	N/A	
10. Significant modification of a licensed petroleum pipeline	N/A	
11. Drilling	N/A	
12. Seismic survey	N/A	
13. Other survey	N/A	
14. Any other petroleum-related activity	N/A	

Part 3 – Submission Details (principal document only)

Document Title:	Vic/P44 Environment Plan Summary		
Document No:	VICP44-STO-2050-0005	Revision:	Issue Date: 6 Sept 2013

Part 4 – Submission Basis (reason for making this submission)

Submission Type:	Initial submission, Reg 9 <input checked="" type="checkbox"/> <small>(new environment plan)</small>	Resubmission with modifications, Reg 11(2) or 10(1c) <input type="checkbox"/> <small>(as a result of Regulator feedback on initial submission)</small>
	Formal revision <input type="checkbox"/> <small>(select revision trigger below)</small>	
Revision Trigger(s):	Revision because of a change, or proposed change, of circumstances or operations, Reg 17 <input type="checkbox"/> Revision on request by the Regulator, Reg 18 <input type="checkbox"/> Revision at the end of each 5 years, Reg 19 <input type="checkbox"/>	

Part 5 – Items Considered for Completeness Yes ✓

1	The instrument holder for this activity has notified NOPSEMA of the name and contact details of the nominated operator for the activity, Reg 31. (This nomination may be provided in conjunction with this submission, using the Appointment of Operator form)	Yes
2	Submission is being made by the operator of the activity (or their agent)	Yes
3	There is a cover letter (or this form) seeking acceptance by NOPSEMA under the applicable regulations	Yes
4	1 electronic copy and 1 hard copy of the submission is provided (Note 2)	Yes

Instructions for use:

- This form is intended for use by operators of activities as a pre-submission check and cover page for environment plan submissions being made directly to NOPSEMA.
- Operators should complete Parts 1, 2, 3 & 4 and use Part 5 as a checklist to ensure all items have been address/included as part of the submission.
- The completed form should be included with the environment plan submission.

Notes:

- All regulations quoted are from the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009
- Electronic submissions should comprise a single Adobe Acrobat file, fully searchable, full size drawings and unprotected.

Santos

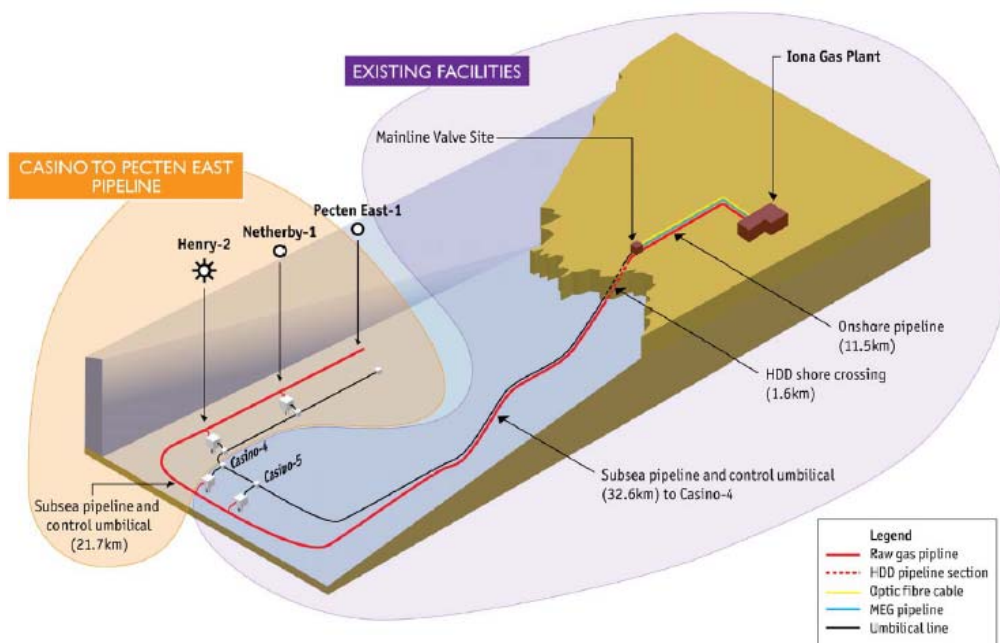
We have the energy.

Casino, Henry and Netherby Developments (Production Licence Areas Vic/L24 & Vic/L30, Licenced Pipelines Vic/PL37, Vic/PL37(V) & Vic/PL42)

Operations Environment Plan Summary

August 2013

(VICP44-STO-2050-0005)



This Environment Plan summary has been prepared to comply with Regulations 11(7) and 11(8) of the Offshore Petroleum & Greenhouse Gas (Environment) Regulations 2009.

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1. Introduction

Santos Ltd (Santos) is the Operator of the Casino, Henry and Netherby gas fields, located in Production Licence Areas Vic/L24 (Casino) and Vic/L30 (Henry and Netherby), on behalf of the Vic/P44 Joint Venture (which consists of Santos, 50%, Peedamullah Petroleum Pty Ltd, 25%, and Mittwell Energy Resources Pty Ltd, 25%). The asset is located in the Otway Basin, off Victoria’s southwest coast in Bass Strait (Figure 1).

Gas and condensate is produced via four subsea wells and transported through a subsea pipeline to the Iona Gas Plant (north of Port Campbell) for processing.

The offshore facilities, collectively known as the Vic/P44 asset (because the production licences are excised out of the Vic/P44 exploration permit), consist of:

- Four subsea production wells (Casino-4, Casino-5, Henry-2 and Netherby-1).
- A 32.6-km subsea pipeline (Casino pipeline) connecting the Casino wells to the Iona Gas Plant
- A 22-km subsea pipeline (Casino to Pecten East pipeline) tying in to the Casino Pipeline, carrying gas from the Henry-2 and Netherby-1 wells, with an additional section to a potential production well in the Pecten reservoir (not yet drilled).
- A 31.2-km electro-hydraulic umbilical (EHU) cable connecting the Casino wells to the onshore Iona Gas Plant.
- A 22-km EHU cable (extension of the umbilical above) connecting the Henry and Netherby wells to the Iona Gas Plant.

This EP Summary provides an identification and assessment of environmental impacts associated with the operation of the offshore facilities and maintenance activities associated with the Vic/P44 asset.

The EP for the operation of the Vic/P44 asset was approved by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) on the 30th of August 2013 in accordance with the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009.

As the pipeline traverses Victorian state waters, the EP was also submitted to the then Victorian Department of Primary Industries (DPI) (now the Victorian Department of State Development, Business and Innovation (DSDBI)) and was accepted on the 25th of June 2013.

2. Location

The Vic/P44 asset is located in water depths ranging from 60 to 70 m, approximately 30 km southwest of Port Campbell, Victoria (see Figure 1). The coordinates of the infrastructure are provided in Table 1.

Table 1. Coordinates of Vic/P44 asset infrastructure

Infrastructure	Latitude	Longitude
<i>Wells</i>		
Casino-4	38° 47' 13.031"	142° 41' 54.488"
Casino-5	38° 47' 43.681"	142° 44' 44.599"
Henry-2	38° 42' 14.558"	142° 37' 13.058"

Netherby-1	38° 40' 48.580"	142° 38' 25.739"
<i>Casino pipeline (Vic/PL37 & Vic/PL37(V))</i>		
HDD Entry	38° 36' 55.881"	142° 57' 49.439"
HDD Exit	38° 37' 46.543"	142° 57' 46.025"
Tangent Point 1	38° 39' 59.269"	142° 57' 37.111"
Tangent Point 2	38° 40' 45.832"	142° 57' 7.220"
Tangent Point 3	38° 47' 37.487"	142° 46' 29.836"
Tangent Point 4	38° 47' 50.631"	142° 45' 18.615"
Pipeline End	38° 47' 13.819"	142° 41' 54.086"
<i>Casino to Pecten East pipeline (Vic/PL42)</i>		
Pecten East laydown flange	38° 38' 10.833"	142° 41' 8.712"
Tangent Point 1	38° 41' 29.189"	142° 37' 43.018"
Tangent Point 2	38° 41' 36.042 "	142° 37' 37.337"
Tangent Point 3	38° 42' 35.283"	142° 36' 58.866"
Tangent Point 4	38° 43' 19.764"	142° 37' 7.146"
Casino Tie-in Initiation Flange	38° 47' 04.774"	142° 41' 52.360"

All coordinates supplied are GDA 94, GRS80, UTM Zone 55.

3. Proponent

Santos is the appointed Instrument Holder of the Vic/L24 and Vic/L30 production permits on behalf of the Vic/P44 Joint Venture.

Santos was established in 1954 and is an active oil and gas exploration and production company, having interests and operations in every major Australian petroleum province and in Indonesia, Papua New Guinea, Vietnam, Bangladesh, India and central Asia. Additional information regarding Santos can be obtained from its website at: www.santos.com.

4. Project Description

4.1 Overview

Production from the Casino wells commenced in February 2006 and production from the Henry and Netherby wells commenced in February 2010. The Iona Gas Plant is managed by Energy Australia, which processes gas and condensate from Vic/P44 wells along with gas and condensate from other sources.

4.2 Field Characteristics

The condensate of the Casino, Henry and Netherby reservoirs is classified as a Group 1 (non-persistent) oil. It has a density of 774 kg/m³ (@ 16°C), a dynamic viscosity of 0.14 cP (@ 25°C) and a pour point of -54°C (when fresh). The condensate is highly evaporative when released into the environment, with a zero percent estimated residual (persistent) component.

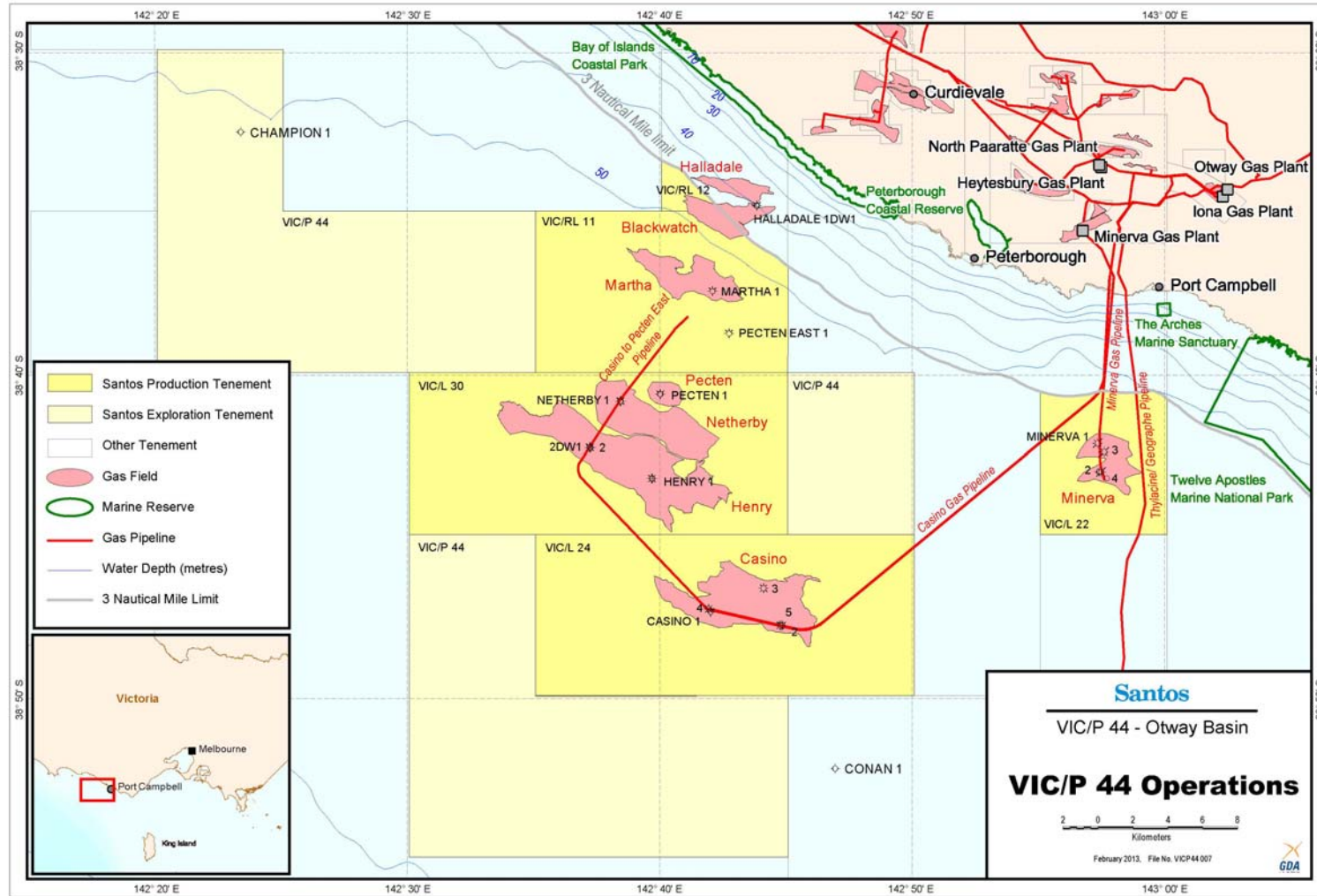


Figure 1. Location of the Vic/P44 asset

4.3 Subsea Operations

The operation, monitoring and control of the Casino, Henry and Netherby wells is conducted remotely from the Iona Gas Plant through the control of the EHU. All well functions are monitored and controlled from the gas plant control room through a Master Control System (MCS) via a Subsea Control Module (SCM) located at each wellhead. All subsea control systems are electro-hydraulic. The Hydraulic Power Unit (HPU) and the Electrical Power Unit (EPU) at the Iona Gas Plant provide the hydraulic and electric power to the subsea controls. The EHU cable is linked to each wellhead via subsea Umbilical Termination Assemblies (UTAs) located at each tree take-off point. The connection between the UTAs and the trees is by electro-hydraulic flying leads.

Monoethylene glycol (MEG) (90% MEG, 10% water) is continuously injected into the well head pipelines to prevent the formation of hydrates that could lead to pipeline blockages via three dedicated cores within the EHU. The MEG delivery, recovery and regeneration systems are located at the Iona Gas Plant. MEG is not discharged to the ocean.

Methanol can be injected to dissipate any hydrates that form. The delivery of methanol to the pipelines is via one dedicated core within the EHU.

Corrosion inhibitor is continuously injected into the MEG system, thereby entering the pipelines via dedicated cores within the EHU cable to prevent pipeline corrosion. There is no discharge to the environment.

There are two high-pressure (HP) and two low-pressure (LP) hydraulic lines within the EHU. These lines carry hydraulic fluid (comprised of 25% ethylene glycol). Approximately 3 litres of hydraulic fluid is discharged when each wellhead isolation valve closes (<3,500 litres of total discharges across all valves per year).

4.4 Pipeline Stabilisation

The Casino Pipeline was laid directly on to the seabed (not trenched in to it). It is stabilised with 271 concrete articulated mattresses to prevent movements induced by ocean currents at the seabed.

The Casino to Pecten East Pipeline was also laid directly onto the seabed and is stabilised with 390 concrete mattresses. The Casino to Pecten East pipeline umbilical is stabilised by 240 concrete mattresses along its length.

4.5 The Iona Gas Plant

The activities occurring within the Iona Gas Plant are excluded from the scope of the EP, but brief details are provided for contextual purposes.

The Iona Gas Plant is operated by Energy Australia and is located at 305 Waarre Road, Port Campbell. The gas plant receives raw gas from the Casino, Henry and Netherby fields via a 12-km long onshore pipeline. In addition it also receives gas from its onshore wells (Wallaby Creek, North Paaratte and Iona). The plant provides gas conditioning (dehydration and dew point), injection and compression services for delivery into the Victorian and South Australian gas markets.

Emissions to air, land and water from the Iona Gas Plant are licensed by the Victorian Environment Protection Authority (EPA) (Licence EM66125).

Production from the Vic/P44 asset varies day-to-day dependent on monthly/daily nominations, however typical daily average gas production is around 96 Terajoules (TJ) per day and 63 barrels (bbl) of condensate per day.

4.6 Provision for Future Operations

The Casino to Pecten East Pipeline makes provision for connection to a future gas production well that may be drilled in the Pecten East prospect. The pipeline extends northeast past the Nertherby-1 well (see Figure 1) so that a future Pecten East production well requires only a short connection to the existing pipeline. The timing of drilling this well and connection to existing infrastructure for gas production will be determined by the rate of gas production decline from existing production wells however, it is not guaranteed that this well will be drilled.

4.7 Maintenance and Intervention Activities

Inspection, maintenance and intervention activities on the Vic/P44 asset are conducted on a planned and an as-needed basis. Intervention work may be carried out to inspect and make repairs to subsea infrastructure from time to time. This may involve, but is not limited to, the following:

- Inline inspections (ILI) (pigging) of the offshore pipelines.
- Inspection and repair work using Remote Operated Vehicle (ROV), Field Support Vessels (FSV) and/or diving from a Diver Support Vessel (DSV), such as:
 - Periodic visual survey to assess the condition of the pipeline, umbilical and wellheads.
 - Non-destructive testing (NDT) of the offshore pipeline.
 - Pipeline span rectification.
 - Marine growth removal.
 - Rectification of an electrical or hydraulic fault associated with the EHU and associated connected equipment.
 - Choke replacement and repairs as required.
 - Replacement and repairs of damaged cathodic protection anodes on an as-needs basis.

All maintenance activities are expected to be of short duration, lasting from 2 to 7 days dependent on activity type and weather conditions.

5. Stakeholder Consultation

Santos has been actively involved in stakeholder engagement since the Casino Development environmental approvals process commenced in 2003 and during the Henry and Netherby Development approvals processes in 2005 and 2007 respectively.

Engagement with stakeholders in the Vic/P44 asset operations phase is ad-hoc. This is largely because the Iona Gas Plant is operated by Energy Australia, with no permanent Santos personnel presence in the region. Energy Australia is instructed to pass on any Vic/P44 asset-specific stakeholder concerns to Santos. Since they took over operation of the Iona Gas Plant (from TRUenergy in 2011), Energy Australia has not received any stakeholder feedback regarding the Vic/P44 asset.

Meetings with stakeholders are generally held when significant activities are proposed, such as:

- Additional exploration or production drilling.
- Well intervention.

- Additional field development (e.g., Henry and Netherby).
- Vessel-based maintenance activities.

Routine operations do not necessitate the need for meetings, as all stakeholders are aware of the location of the offshore pipelines and wellheads.

Consultation generally takes the form of meetings held in Port Campbell (at the Surf Life Saving Club, where Santos sponsors a function room) with stakeholders who have responded to Santos-instigated phone calls, meetings or advertisements in the local newspaper (Cobden Times, Corangamite Extra).

Since acceptance of the last Vic/P44 Asset Operations EP (February 2010), Santos held a stakeholder consultation meeting in January 2013 regarding planned offshore intervention work. Fisheries representatives in attendance indicated that their activities would not be impacted by this work.

Letters (flyers) shall be sent out to stakeholders prior to the commencement of planned intervention work. After the completion of the planned activities, a close out notice will also be sent out.

As part of Santos' Australia-wide exploration and operations activities, Santos is in constant communication with agencies responsible for oil spill preparedness and response, such as AMOSC, AMSA, and state-based Departments of Transport. Information gathered from these communications is used to continuously update and improve oil spill response preparedness and response capabilities.

Other external communications on environmental matters may arise in response to complaints or incidents. Any complaints that are received are reported in the Santos EHS Toolbox Incident Management System and actions are assigned appropriately and tracked to ensure full implementation and closure.

6. Receiving Environment

6.1 Physical Environment

Climate. The region's climate is cool temperate, with cool wet winters and cool summers. It is influenced by rain bearing cold fronts that move from south-west to north-east across the region, producing strong winds from the west, north-west and south-west.

Bass Strait is located on the northern edge of the westerly wind belt known as the Roaring Forties, and wind speeds in the project area are typically in the range of 5 to 25 km/hr.

Oceanography. Bass Strait is a sea strait separating Tasmania from the southern Australian mainland. The strait is a relatively shallow area of the continental shelf, connecting the southeast Indian Ocean with the Tasman Sea.

Tides are semi-diurnal with some diurnal inequalities, generating tidal currents along a north-east/south-west axis, with speeds generally ranging from 0.1 to 2.5 m/s.

Currents in Bass Strait are primarily driven by tides, winds and density driven flows. During winter the South Australian current moves dense, salty, warmer water eastward from the Great Australian Bight into the western margin of the Bass Strait. In winter and spring, waters within the strait are well mixed with no obvious stratification, while during summer the central regions of the strait become stratified.

Bass Strait is a high-energy environment exposed to frequent storms and significant wave heights. Storms may occur several times a month resulting in wave heights of 3 to 4 m or more.

Coastal environment. The coastline of southwest Victoria is dominated by intertidal rocky shorelines backed by steep rocky cliffs, interspersed with small sections of sandy beach. These sandy beaches and dunes provide nesting sites for shorebirds that are found along many parts of the Victorian coastline including the hooded plover and little tern.

6.2 Benthic Assmeblages

Benthic communities across Bass Strait are determined by the seafloor habitat and have a wide distribution with high diversity. ROV surveys along the Casino pipeline route were undertaken in 2004. The survey revealed an intertidal environment (0–2 m water depth) comprising horizontal zonation of algal types over rocky platforms, shallow water environments (2–8 m depth) dominated by brown algae, sponges and molluscs over non-contiguous rocky reef interspersed with sandy seabed. The mid-depth environment (8–20 m depth) is relatively uniform throughout the region and is dominated by sand with intermittent patch reefs dominated by brown algae. The deep environment (20–70 m depth) is characterised by open sand with little or no epifauna. Relative to depths, the seabed along the Casino to Pecten East pipeline is likely to be similar to that along the Casino pipeline.

6.3 Biological Environment

Marine migratory species with broad distributions such as cetaceans, fish, sharks, marine turtles and seabirds may traverse the Vic/P44 offshore asset.

A search of the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) Protected Matters Search Tool identified 30 EPBC Act-listed threatened (endangered or vulnerable) or migratory species within a 10 km buffer around the offshore pipeline (Table 2). No Threatened Ecological Communities or critical habitats for any species were identified.

Table 2. EPBC Act-listed marine fauna that may occur around the Vic/P44 asset

Fauna group	Details
Fish	4 species, including 3 shark species that are all migratory. The Australian grayling and great white shark are threatened.
Mammals	7 species of marine mammals, including 6 whale species that are migratory. The blue, southern right and humpback whales are threatened.
Reptiles	2 turtle species (loggerhead and leatherback) listed as migratory and endangered.
Birds	17 species of albatross, petrel and giant-petrel. All are migratory and threatened.

Iconic species that are not listed under the EPBC Act, such as the Australian fur seal and little penguin, are also present in waters around the Vic/P44 asset.

6.4 Socio-economic Environment

Commercial fisheries. Commonwealth-managed fisheries are unlikely to operate around the Vic/P44 asset. Victorian-managed fisheries that may operate around the asset include the Rock Lobster Fishery (fished from rocky reefs in waters up to 150 m deep), Abalone

Fishery (diving to depths less than 20 m), Scallop Fishery (using dredges operating up to 20 nm south of the coastline) and the Snapper Fishery (using lines and nets in State waters).

Consultation with fishers operating out of Port Campbell indicates that they do not fish in waters as deep as those where the Vic/P44 wells are located.

Recreation. Marine-based tourism and recreation in the Bass Strait is primarily associated with recreational fishing and boating.

Recreational fishing and boating is largely confined to near-shore coastal waters due to the unpredictable seas of Bass Strait. Common inshore fish species caught by recreational fishers include sand flathead (*Platycephalus bassensis*), John dory (*Zeus faber Linnaeus*), jackass morwong (*Namadactylus macropterus*), silver trevally (*Pseudocaranx dentex*), snapper (*Pagrus auratus*), barracouta (*Thyrsites atun*) and mullet (*Aldrichetta forsteri*). Common species caught at Curdies Inlet include black bream (*Acanthopagrus butcheri*), estuary perch (*Macquaria colonorum*), mullet (*Aldrichetta forsteri*) and Australian salmon (*Arripis* sp.).

Coastal sight-seeing along the Great Ocean Road, surfing, diving and snorkelling are other popular recreational pursuits in the coastal region of southwest Victoria.

Petroleum exploration and production. Australia's first discoveries of gas were in Bass Strait in the mid-1960s. As of 2011, Victoria (mostly the offshore Gippsland Basin), accounts for 14% of Australia's oil and condensate production, and 17% of Australia's gas production, second behind WA.

Petroleum exploration has been undertaken within the Otway Basin since the early 1960s. Gas reserves of approximately 2 trillion cubic feet (tcf) have been discovered in the offshore Otway Basin since 1995, coming from five gas fields using 700 km of offshore and onshore pipeline.

In 2010-11, there was 97 ML of condensate production from the Otway Basin, down from 120 ML in 2008-09, and 148 ML of liquefied petroleum gas (LPG) in 2010-11, up from 6 ML in 2007-08.

Other oil and gas facilities in the Otway basin include the Minerva Gas Development (operated by BHP Billiton, with Santos as a 10% JV partner) and the Geographe and Thylacine Gas Developments (operated by Origin Energy).

Shipping. Bass Strait is one of the busiest shipping regions in Australia, consisting of both passenger and cargo vessels travelling between mainland Australia and Tasmania as well as between Australia and New Zealand. The Australian Maritime Safety Authority (AMSA) advises that there are no designated shipping lanes in the vicinity of the Vic/P44 asset, however local commercial fishing vessels utilise the area frequently. The main shipping channel for vessels (e.g., cargo tankers) travelling between major Australian and foreign ports is located south of Vic/P44, about 75 km (40 nm) south of Warrnambool. This shipping channel is used by over 1,000 vessels per year, or about 3-4 vessels per day

Marine values and sensitivities. There are no World Heritage Sites, Commonwealth Heritage Places, National Heritage Places or Wetlands of International Importance near the Vic/P44 asset.

The nearest Commonwealth Marine Reserve (CMR) is the Apollo CMR, located about 70 km southeast of the Vic/P44 asset. This reserve is located in waters 80 m to 120 m deep and covers 1,184 km² of Commonwealth ocean territory. The reserve encompasses the continental shelf ecosystem of the major biological zone that extends from South

Australia to the west of Tasmania. The area includes the Otway Depression, an undersea valley that joins the Bass Basin to the open ocean. Apollo is a relatively shallow reserve with big waves and strong tidal flows, while the rough seas are habitats for fur seals and school sharks.

Several State Marine Parks occur in the vicinity of the Vic/P44 asset, described below:

- The Arches Marine Sanctuary - located 3 km east of the closest point to the Casino pipeline. It is located 19 to 25 m below the water surface and protects a labyrinth of limestone canyons, caves, arches and walls characterised by high-energy waves. A diverse array of life including gorgonians, sponges, bryozoans and hydroids exists in the sanctuary, with the upper side of the structures covered in the thick, brown kelp (*Ecklonia radiata*) with an understory of delicate red algae. These habitats support schools of reef fish, seals and a range of invertebrates such as lobster, abalone and sea urchins.
- Twelve Apostles Marine National Park - located 7 km east of the closest point to the Casino pipeline. This park covers 16 km of coastline and an area of 75 km². The area is characterised by a submarine network of canyons, caves, arches and walls with a large variety of seaweed and sponge gardens plus resident schools of reef fish. The park contains calcarenite reef supporting the highest diversity of intertidal and sub-tidal invertebrates found on that rock type in Victoria and includes large sandy sub-tidal areas that are extremely high in biodiversity, with 860 species recorded in a 10 m² area.
- Bay of Islands Coastal Park - located 11 km northeast of the closest point to the Casino to Pecten East pipeline.
- Port Campbell National Park - located on the coastline, with the pipeline passing beneath (but within) the onshore park.

Archaeological heritage. Aboriginal groups inhabited the southwest Victorian coast as is evident from the terrestrial sites of Aboriginal archaeological significance throughout the area. It is highly unlikely, however, that any evidence of occupation or sites of significance would remain in such a high-energy marine environment around the Vic/P44 asset.

There are no registered claims or determinations for Native Title over the Vic/P44 asset.

Maritime heritage. The stretch of coastline around the Vic/P44 asset is known as the 'Shipwreck Coast' because of the number of shipwrecks, most of which were wrecked during the late nineteenth century. Shipwrecks closest to the Vic/P44 asset are:

- *Napier* – located 3 km east of the Casino Pipeline. Wrecked in 1878.
- *Newfield* – located 6.5 km west of the Casino Pipeline. Wrecked in 1892.
- *Schomberg* – located 7 km west of the Casino Pipeline. Wrecked in 1856.
- *Loch Ard* – located 9 km southeast of the Casino Pipeline. Wrecked in 1878.
- *Falls of Halladale* – located 10 km west of the Casino Pipeline. Wrecked in 1908.

7. Environmental Impact Assessment

The known and potential environmental impacts resulting from the operation of the Vic/P44 asset are outlined in detail in the EP. Table 3 provides a summary of the detailed environmental impact assessment and mitigation measures that are in place, which have been assessed to be as low as reasonably practicable (ALARP).

Table 3. Summary environmental impact assessment for the Vic/P44 asset

Hazard	Impacts	Key avoidance, mitigation & management measures	Residual risk ranking
<i>Planned events – operations and maintenance</i>			
Discharge of control fluids	Localised and temporary decrease in water quality.	<ul style="list-style-type: none"> Use of low-toxicity fluids. Valves are designed to minimise leakage. 	Low
Seabed disturbance	Localised turbidity, temporary disturbance to habitats, habitat smothering.	<ul style="list-style-type: none"> Regular inspections by ROV. Implementation of the Integrity Management Plan (IMP). Design of installation footprint to minimise area of disturbance. Campaign-specific risk assessments undertaken. Preference given to dynamically positioned vessels over anchored vessels (for vessels with gross tonnage >400 t). Implementation of a vessel anchoring procedure. 	Very low
Discharge of gas and condensate during wellhead choke replacement	Localised and temporary decrease in water quality.	<ul style="list-style-type: none"> Condensate is displaced from pipeline with MEG prior to choke removal so that condensate is not released. Campaign-specific risk assessments undertaken. ROV is onboard the vessel to enable shut-in of the choke. 	Very low
Discharge of chemicals during inline inspections	Localised and temporary decrease in water quality.	<ul style="list-style-type: none"> Chemicals used have high OCNS ratings ('E'/'D' or 'Gold'/'Silver') (i.e., they are of low toxicity). Campaign-specific risk assessments undertaken. 	Low
Removal of marine growth	Localised and temporary decrease in water quality. Loss of encrusting biota.	<ul style="list-style-type: none"> Only areas subject to maintenance works are blasted. Only beach sand (with no additives) is used during blasting. 	Low
<i>Planned events – routine vessel emissions and discharges</i>			
Underwater noise	Temporary physiological impacts on sensitive fauna,	<ul style="list-style-type: none"> Each vessel has a specific vessel planned maintenance system (PMS) that ensures engines and thrusters are maintained for optimum performance. 	Low

	such as cetaceans. Disruption to migration, feeding or breeding patterns.	<ul style="list-style-type: none"> Adherence to Part 8 of the EPBC Regulations 2000. The Australian Guidelines for Whale and Dolphin Watching (2005) for sea-faring activities is incorporated into Santos's Marine Operations Manual. 	
Air emissions	Temporary and localised reduction in air quality.	<ul style="list-style-type: none"> Marine-grade (low sulphur) diesel is used. All engines and machinery maintained in accordance with vessel PMS. 	Low
Light emissions	Attractant to fauna, temporary increase in predation rates on fauna attracted to lights.	<ul style="list-style-type: none"> Lighting managed in accordance with maritime safety standards. 	Low
Sewage and grey water	Temporary and localised increase in surface water nutrient levels. Modification of fauna feeding patterns.	<ul style="list-style-type: none"> MARPOL-approved sewage treatment plants used by vessels. No discharge of sewage within 12 nm of land. 	Low
Putrescible waste	Temporary and localised increase in surface water nutrient levels. Modification of fauna feeding patterns.	<ul style="list-style-type: none"> Vessel galley macerator macerates food scraps to a diameter of at least 25 mm before being disposed of overboard, in compliance with MARPOL Annexes IV and V. If the macerator fails, no un-macerated food waste will be disposed overboard. All food waste will be bagged and sent ashore for disposal. Macerated food waste is not discharged overboard within 12 nm of any shoreline. All non-food galley wastes (e.g., cooking oils, grease, packaging) is collected in containers and transported back to shore for recycling or disposal. 	Low
Deck drainage and bilge water	Temporary and localised reduction in water quality.	<ul style="list-style-type: none"> Vessel equipment is arranged to minimise the likelihood of discharge overboard (i.e., permanent rotating machinery (engines, generators) and the ROV spread are located in bunded areas so that any spills are not lost overboard). These areas are drained to the bilge tank and discharged via the oily water separator (OWS). The OWS is set to ensure discharged water has no greater than 15 ppm oil-in-water (OIW) content. Treated bilge water volumes are recorded in the Oil Record Book. Chemical storage and handling areas are bunded to prevent overboard discharge. 	Very low

		<ul style="list-style-type: none"> Onboard storage tanks/containers will be available to store hydrocarbons for appropriate onshore disposal. Any temporary equipment with potential for spill of chemicals or fuels (e.g., leak testing spread) is located within temporary bunding so that spills are contained for subsequent treatment or disposal of the fluids, without uncontrolled discharge to the sea. The vessel has a current and valid International Oil Pollution Prevention (IOPP) Certificate. The vessel has a Shipboard Oil Pollution Emergency Plan (SOPEP). A high focus is placed on housekeeping. 	
Disposal of non-hazardous waste	Temporary and localised reduction in water quality. Marine pollution.	<ul style="list-style-type: none"> As far as practicable, waste is transferred from the vessels in sheltered waters, thus minimising the likelihood of accidental loss of waste to sea at the project area during transfers. All stored waste material to be disposed-of onshore at a licensed waste management facility, or recycled. Maintenance logistics planning ensures only essential items are brought on board the vessel in line with project requirements. Vessel induction for crew on waste management. A Shipboard Waste Management Plan is in place and implemented. Only licensed shore-based waste contractors are used. 	Very low
Disposal of hazardous waste	Temporary and localised reduction in water quality. Marine pollution.	<ul style="list-style-type: none"> As above, plus; Up-to-date Material Safety Data Sheet (MSDS) registers are available in key locations throughout the vessel (e.g., bridge, chemical locker). Chemical drums are securely stored in bunded areas. SOPEP response kits are located throughout the vessel in appropriate locations and used to respond to deck spills of hazardous liquids. Hazardous waste is not discharged overboard. 	Very low
<i>Unplanned events – operations and maintenance</i>			
Gas condensate release	Marine pollution, potentially leading to injury or death of marine fauna or	<ul style="list-style-type: none"> Pipeline is designed to withstand 1 in 100 year storm event and expected seismic activity of the region. A 500-m radius exclusion zone exists 	Low

	seabirds through ingestion or contact.	<p>around the wellheads and pipelines (acting to minimise impacts to infrastructure).</p> <ul style="list-style-type: none"> • Overpressure is managed by high-pressure alarms and the Hydrate Management Plan. • The low-pressure trip is tested every 6 months. • The SCSSV will shut-in the wells in the event of a loss of pressure (e.g., pipeline rupture). • Pipeline pressure is constantly monitored by the Iona Gas Plant. • Pipeline and associated subsea infrastructure is regularly inspected and tested in accordance with the Asset Integrity Management Plan (IMP). • Only trained, certified and experienced personnel are in charge of offshore operations and maintenance. • Operator errors are minimised by following the Santos Permit to Work procedure. • The Santos Vic/P44 OSCP and Emergency Response Plan (ERP) will be implemented in the event of a condensate leak or rupture. • The Vic/P44 Operation and Scientific Monitoring Program (OSMP) will be implemented in the event of a Tier 2 or 3-sized condensate spill. 	
Control fluid release from the EHU	Localised and temporary decrease in water quality.	<ul style="list-style-type: none"> • EHU is designed with fail-safe valves, non-return valves, pressure alarms, and best practice with regards to free span. It has also been designed to withstand a 1 in 100 year storm event. • The EHU is managed and maintained in accordance with the Asset IMP. • Chemicals selected for pipeline operations have low toxicity, are dosed in low concentrations and are not bioaccumulating. • EHU is located within the pipeline corridor marked on navigation charts. • Emergency Shutdown System and ERP will be implemented in the event of a release. 	Very low
<i>Unplanned events – vessel-based activities</i>			
Interference with other marine users	Temporary loss of fishing grounds from drill rig safety exclusion zone, resultant loss of income.	<ul style="list-style-type: none"> • 500-m radius Petroleum Safety Zone is in place around wellheads. • Vessels will be manned by competent, trained and experienced crew. • The Vic/P44 asset is marked on nautical charts and nautical publications. 	Very low

	Collision risk. Snagging on anchors and anchor lines.	<ul style="list-style-type: none"> • Radio communications are maintained with vessels in the vicinity of the safety exclusion zones and pipeline corridors. • All vessels use the Automatic Identification System (AIS) to monitor the movements of nearby vessels. • All stakeholders will be notified at least 1 month prior to the commencement of a planned maintenance activity. • Vessels are lit in accordance with maritime safety requirements to alert other users to their presence. 	
Introduction of invasive marine species	Establishment of foreign species to open ocean and/or seabed, competing with and displacing native species.	<ul style="list-style-type: none"> • Vessels will be sourced from Victorian waters where possible. • No ballast water exchange will occur within 12 nm of land. • Vessels will comply with: <ul style="list-style-type: none"> ○ The Victorian EPA Domestic Ballast Water Management Protocol (2010). ○ The Australian Ballast Water Management Requirements (2011, v5). ○ The National Biofouling Guidance for the Petroleum Production and Exploration Industry (AQIS, 2009). ○ Any requirement for cleaning due to reoccurrence of abalone virus. • Any vessels entering from outside Australian waters will have to pass AQIS ballasting requirements (Australian Ballast Water Management Requirements, 2011, v5) prior to entering Australian waters. This includes: <ul style="list-style-type: none"> ○ Undertaking full ballast water exchange at sea (deep water where sediment is not visible) through one of several tank flooding and flushing techniques. ○ Completing a Quarantine Pre-Arrival Report (QPAR) and submitting this to AQIS between 12 and 96 hours prior to arrival. ○ Obtaining AQIS permission to discharge ballast water in Australian waters. ○ Maintaining a ballast water log. 	Low
Diesel spill	Temporary marine pollution.	<ul style="list-style-type: none"> • Vessels will maintain 24 hour visual, radio and radar watch. • The location of the vessel will be noted in the Notice to Mariners, issued by the Australian Hydrographic Office. • No offshore refuelling will be conducted. • Consultation with AMSA has taken place regarding spill response control roles. 	Very low

		<ul style="list-style-type: none"> • SOPEP material is available on board and personnel are trained in its use. • The Vessel SOPEP and Santos Vic/P44 OSCP will be implemented in the event of a diesel spill to sea. • The Vic/P44 OSMP will be implemented in the event of a Tier 2-sized diesel spill. 	
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8. Environmental Management

Santos manages the environmental and safety impacts of all its activities through the implementation of its Environment, Health and Safety Management System (EHSMS). The EHSMS is certified against ISO 14001 (Environmental Management Systems) and meets the requirements of AS4801-2001 (Occupational Health and Safety Management Systems). The EHSMS includes 18 management standards and 30 hazard standards.

An environmental implementation strategy for the Vic/P44 asset operation is detailed in the EP. This strategy involves a crew training and awareness program, environmental audits, routine government reporting, environmental monitoring and recording, and incident reporting.

9. Hydrocarbon Spill Preparedness and Response

The Vic/P44 asset Oil Spill Contingency Plan (OSCP, accepted with the EP) is the primary reference document to be used in the event of a large-scale hydrocarbon spill (e.g., diesel spill resulting from a vessel collision or release of condensate from a pipeline rupture).

Hydrocarbon spill modelling undertaken for the operating phase of the Vic/P44 asset indicates small 'Zones of Potential Impact' (ZPI) for diesel and condensate spill scenarios, with limited shoreline contact at thresholds that are likely to have ecological impacts.

In consultation with agencies including the Australian Maritime Safety Authority (AMSA), the Victorian Department of Transport (DoT) and the Australian Marine Oil Spill Centre (AMOSOC), Santos has determined that in the event of a large-scale diesel or gas condensate spill, the order of preference for spill response is:

1. Natural weathering and biodegradation.
2. Monitor and evaluate.

Factors taken into consideration in determining these strategies include:

- The light, highly evaporative nature of gas condensate and diesel.
- The health and safety risks of deploying containment and recovery equipment in high seas for hydrocarbons that are difficult to capture due to their composition (i.e., rapid spreadability).
- The steep, rocky nature of the contacted coastlines (largely 'self-cleaning').
- Dispersant application and other intervention measures may cause greater harm to sensitive environments than the hydrocarbons themselves.

An OSMP has been developed for the Vic/P44 asset that details monitoring to be undertaken in the event of a large-scale hydrocarbon spill. The OSMP is designed to assist in refining real-time response options (operations monitoring) and quantify impacts (scientific monitoring).

10. Further Information

For further information about the Vic/P44 asset operations, please contact:

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