



Silvereye-1 Exploration Well T/44P, Bass Basin Environment Plan Summary

November 2010

This Environment Plan Summary has been submitted to comply with Regulation 11(7) of the Offshore Petroleum & Greenhouse Gas (Environment) Regulations 2009.

1. Introduction

Origin Energy Resources Limited (Origin) has contracted Australian Drilling Associates Pty Ltd (ADA) as the Project Manager for the drilling of the Silvereye-1 exploration well, located in petroleum exploration permit area T/44P in Commonwealth waters of Bass Strait (Figure 1). The proposed Silvereye-1 drill site is located in a water depth of 53.9 metres, 79 km east of King Island and 107 km north of Port Latta on the Tasmanian north coast.

This Silvereye-1 Environment Plan (EP) was approved by the Tasmanian Department of Infrastructure, Energy and Resources (DIER) of Mineral Resources Tasmania (MRT) in accordance with the *Offshore Petroleum and Greenhouse Gas (Environment) Regulations 1999* on Friday 26 November 2010.

2. Proponent

Origin is a top 50 Australian Stock Exchange (ASX) listed company involved in gas and oil exploration and production, power generation and energy retailing. It has been in existence for 140 years and has more than 4,000 employees in Australia, New Zealand and the Pacific. Origin's current 2P (proved plus probable) reserves have been estimated at 5,770 PJe. Approximately 90% of Origin's 2P reserves are natural gas.

In Victoria, Origin owns and operates the Otway Gas Project (67.23% share) and the BassGas Project (42.5% share). It holds numerous onshore and offshore exploration permits in Victoria and Tasmania.

3. Project Description

The Silvereye-1 well will be drilled by the *Kan Tan IV* semi-submersible mobile offshore drilling unit (MODU), and is scheduled to commence in late November 2010. The drilling operation will be supported by two Farstad anchor handling, tug and supply (AHTS) vessels, the *Far Fosna* and the *Far Scimitar*, working from the shore base in the Port of Melbourne.

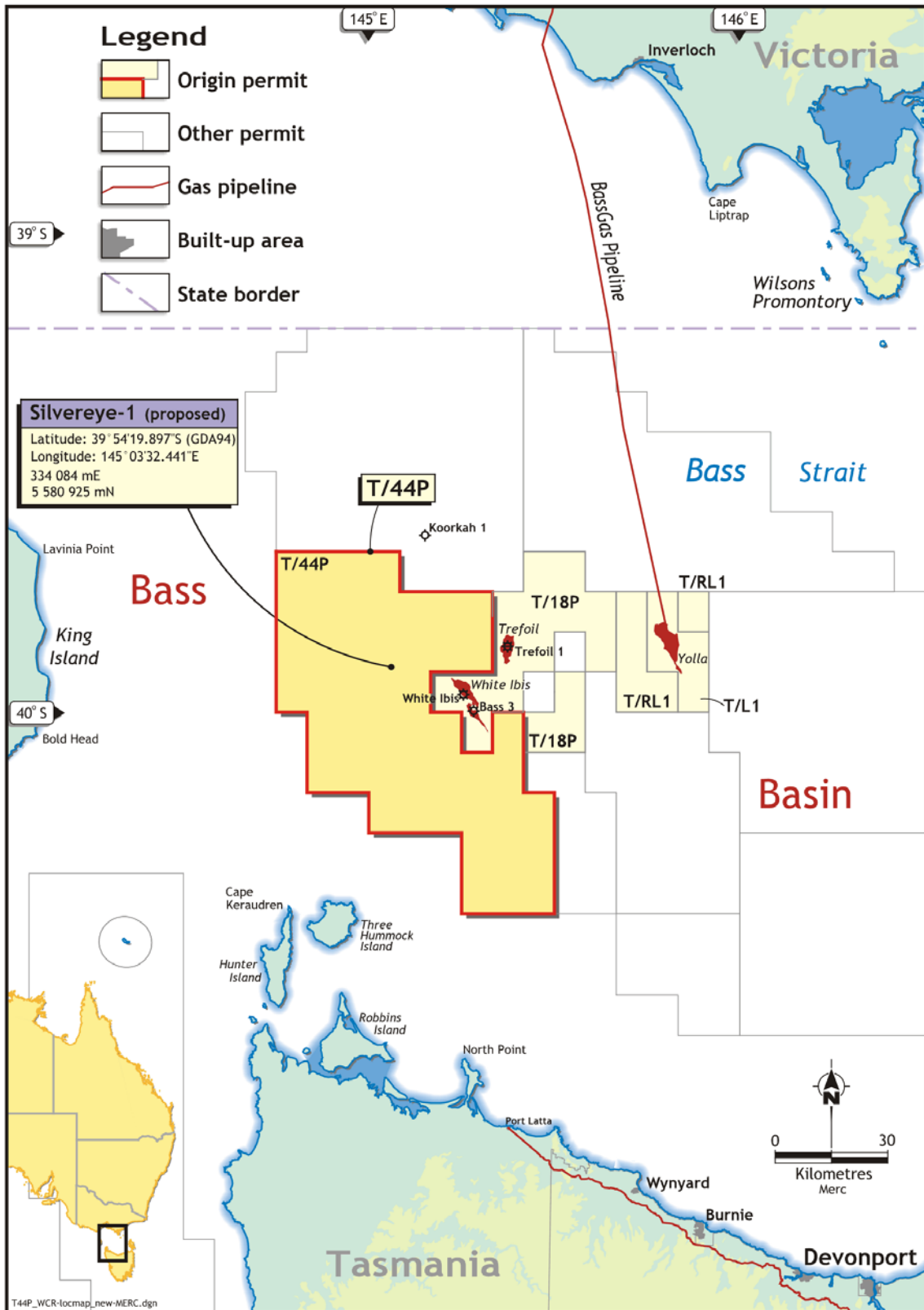


Figure 1. Location of the proposed Silvereeye-1 drilling location

During the drilling campaign the two supply vessels will be traversing to and from port for provisions and equipment to support the Kan Tan IV operations. Both vessels will return to the Port of Melbourne for refuelling - there will be no at-sea refuelling for these vessels unless required in an emergency situation. Both vessels use dynamic positioning systems that enable them to remain on location using bow thrusters rather than anchoring.

The purpose of the drilling campaign is to determine if there are economically recoverable quantities of hydrocarbons (in this case, gas and condensate) at the location. Previous exploration in the permit involved a 3D seismic survey undertaken by Origin in early 2008.

The Kan Tan IV semi-submersible MODU will be mobilised from New Zealand, where it has drilled several wells for Australian operators, including Origin. The Kan Tan IV will be towed to the drilling location by pumping water out of the four buoyancy tanks ('pontoons'), allowing the MODU to float and then be towed using one or more of the AHTS vessels.

Drilling will take place 24 hours a day, and is expected to take 25 days, weather dependant. The drilling procedure for the well will be to drill a 36 inch (914 mm) hole to 60 m below the seabed and run a 30 inch (762 mm) conductor string. The surface hole will then be drilled to approximately 1,100 m measured depth below rotary table (MDRT) and surface casing run and cemented. The blowout preventer (BOP) will then be installed and pressure tested. The exploration hole will be directionally drilled to a depth of approximately 2,400 m MDRT and the well evaluated as per the logging program.

The well design incorporates the use of a BOP stack to provide pressure control during the drilling program. The BOP system will be able to contain pressures far in excess of those encountered in the Eastern View Coal Measures (EVCM) reservoir.

In the event the well indicates the presence of petroleum resources after the logging program, vertical seismic profiling (VSP) may be undertaken. VSP is a class of borehole seismic measurements used for correlation with surface seismic data and for obtaining images of higher resolution than surface seismic images. VSP is a process of making measurements in the vertical wellbore using geophones inside the wellbore and a source (i.e., airgun) at the surface of the well. VSP typically takes less than a day (and usually just a few hours) to perform, and the volume of each airgun is generally about 150 cubic inches, as opposed to 2,000-4,000 cubic inches for a 3D seismic survey. During the VSP process a designated Marine Mammal Observer (MMO) will be present and industry standards will be implemented for the monitoring of marine mammals.

The drilling programme has been designed to use entirely water-based muds (WBM); no synthetic-based muds (SBM) or oil-based muds (OBM) will be used. WBM consists of

between 92-98% fresh or saline water, with the remaining 2-8% made up of drilling fluid additives that are either completely inert in the marine environment, naturally occurring benign materials, or readily biodegradable organic polymers with a very fast rate of biodegradation in the marine environment. Drilling additives typically used include sodium chloride, potassium chloride, bentonite (clay), barite and calcium carbonate. The drilling additives selected have the lowest environmental risk ranking possible based on the OSPAR Convention's Offshore Chemical Notification Scheme (OCNS).

No production testing (i.e., flaring) is planned for Silvereye-1. On completion of logging and VSP operations, the well will be plugged and abandoned as per regulatory requirements. Cement plugs will be set at various depths to seal the well, the casing will be cut off below the surface of the seabed. A remotely operated vehicle (ROV) will then be used to survey the seabed to ensure that no debris remains. The ROV survey is undertaken while the MODU is still on location.

While anchored on location, a 500 m radius temporary exclusion zone around the Kan Tan IV has been declared under the *Offshore Petroleum and Greenhouse Gas Storage Act 2006* (Section 329) and has been gazetted accordingly. The vessels operating in these waters will be informed by radio on approach about the exclusion zone applying around the Kan Tan IV and a temporary 'Notice to Mariners' as issued by the Australian Hydrological Office.

A seabed survey has been undertaken at the proposed drill site and has confirmed that no obstructions, including shipwrecks, occur.

An Emergency Response Plan (ERP) and an Oil Spill Contingency Plan (OSCP), both detailing safety procedures in the event of an accident or emergency situation, will be available on the MODU and AHTS vessels. Copies of these documents are introduced in the project HSE inductions on the MODU and are made available to the crew prior to the commencement of any work.

Following the completion of the drilling campaign, the MODU and AHTS vessels will demobilise from the field.

4. Stakeholder Consultation

Origin prepared a Stakeholder Consultation Plan to guide the Silvereye-1 consultation process. The objectives of the Silvereye-1 drilling campaign consultation programme are to:

- Identify all relevant stakeholders.
- Ensure all stakeholders are fully informed about the drilling campaign and its potential affect stakeholders.

- Provide timely information to all stakeholders to ensure that have adequate time to consider the information and ask questions or raise issues of concern.
- To inform stakeholders of how they can make comments about the drilling campaign to the relevant government regulatory agencies.
- To capture concerns raised by stakeholders so that they may be assessed in the relevant regulatory documentation.
- To demonstrate to the relevant government regulatory agencies that stakeholders have been consulted in line with the requirements of the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009*.
- To minimise inaccurate project information being released to stakeholders by third parties (e.g., project opponents, media, conservation organisations) by taking a pro-active lead in the provision of high quality, accurate and timely information.

Table 1 lists the stakeholders that have been identified in the Stakeholder Consultation Plan as relevant to the drilling campaign. These are the stakeholders who have been actively engaged during the planning phase of the drilling campaign.

Table 1 Stakeholders identified for the Silvereve-1 drilling campaign

Group	Stakeholder
Lead Government Regulatory Agencies	
Commonwealth	Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) - Ports and Marine Section, Environment Assessment Branch
Victorian	Department of Primary Industries (DPI) - Minerals and Petroleum Division, Environment Regulation
Tasmanian	Department of Industry, Energy and Resources (DIER) - Mineral Resources Tasmania (MRT), Petroleum Administration
Referral Government Regulatory Agencies	
Commonwealth	Australian Maritime Safety Authority (AMSA) - Rescue Coordination Centre (RCC)
	Australian Hydrographic Office (AHO)
	Border Protection Control Command
	Department of Defence
Victorian	DPI - Fisheries Division
	Department of Sustainability and Environment (DSE) - Biodiversity Section
	Heritage Victoria - Maritime Unit
Tasmanian	Department of Primary Industries, Parks, Water and the Environment (DPIPWE) - Marine Resources

Group	Stakeholder
Commercial and Recreational Fisheries	
Commonwealth	Commonwealth Fisheries Association
	Australian Fisheries Management Authority (AFMA):
	- Bass Strait Central Zone Scallop Fishery
	- Southern Squid Jig Fishery
	- Eastern Skipjack Fishery
	- Small Pelagic Fishery
Victorian	- Southern and Eastern Scalefish and Shark Fishery
	- Southern Bluefin Tuna Fishery
	Seafood Industries Victoria (SIV)
	Lakes Entrance Fishermans Cooperative Ltd (LEFCOL)
	Victorian Scallop Fishermans Association
Tasmanian	Victorian Recreational Fishing (VRFish)
	Portland Professional Fishermans Association
	Tasmanian Fishing Industry Council (TFIC)
	Tasmanian Rock Lobster Fishermans Association
	South East Trawl Fishing Industry Association (SETFIA)
	Crustacean Fisheries Advisory Committee (CFAC)
Private Stakeholders	
Ports and Shipping	Scallop Fishermans Association of Tasmania
	Tasmanian Association for Recreational Fishing Inc. (TARFish)
	Port of Melbourne Corporation
	TasPorts
	TT Line Company (Spirit of Tasmania)
Other	Toll Shipping Line
	SeaRoad Holdings
	Ocean Racing Club of Victoria
	Blue Whale Study Inc.
	Australian Marine Oil Spill Centre (AMOSC)

5. Receiving Environment

Physical Environment

Climate. The region is temperate and characterised by warm, dry summers and cool winters. The climate of the region is dominated by sub-tropical high-pressure systems in summer and the sub-polar low-pressure systems in winter.

Temperatures over the sea are less variable than over the land due to the moderating effects of the ocean. In winter, the temperature is usually higher over the sea, especially at night. In summer it is usually cooler than over the land, especially during the day. Weather data from the nearest meteorological station King Island indicates that average annual minimum temperatures range from 8.1 to 12.3°C, and average annual maximum temperatures range from 13.2 to 20.7°C. The region is dominated by winter rainfall, with significant seasonal changes in monthly rainfall. The average annual rainfall at King Island airport is 856 mm, and 977 mm at Naracoopa, also on King Island.

Winds. During summer (December-March) the high-pressure ridge is usually located between 30°S and 35°S. The subtropical high-pressure belt is found to consist of an almost continuous procession of eastward moving anti-cyclones separated by troughs of lower pressure, or by depressions. Hence the weather in this belt, although fair on the average, is highly variable, with frequent changes of wind and temperature. The winds at the Silvereye-1 location are often from the south or southeast as the high approaches from the west, and they back through east to northeast as the high passes into the Tasman Sea.

In winter (June-September) the high-pressure ridge is generally located further more north than during the summer. The migrating low pressure systems that exist to the south of the high pressure belt also move northward, bringing a westerly wind regime to western Bass Strait waters. The fresh westerly winds belong to the wind belt known as the "Roaring Forties".

Ocean currents. The predominant currents in the area are typically wind-driven currents that are aligned to the bathymetry in the area. East-west directed winds produce stronger currents than the north-south winds that traverse the Bass Strait. Tidal currents within Bass Strait are likely to exhibit four reversals per day, with an upper limit on the surface velocity approaching 0.8 knots (1.5 km/hr). The combined wind driven and tidal currents produce velocities generally in the range of 0.6 to 1.0 knot (1.1-1.9 km/hr).

Waves. Waves within the permit area are represented by a combination of locally generated wind waves (sea) and long fetch waves (thousands of kilometres) generated in the Southern Ocean. Swells generated during winter months are generally higher than those occurring in the summer months as the wind storm centres are closer to the Silvereye-1 permit area. With mature southern storms that are close to the area and not moving rapidly, swells of 3 to 7 m could occur with occasional systems generating swells greater than 7 m (significant wave heights). Typically, swells within the region average between 1 to 3 m in height. The largest and most persistent waves prevail from a south-westerly direction.

Bathymetry. Bass Strait is a shallow (no deeper than 80 m) and rectangular-like basin (about 400 km east/west by 200 km north/south), which was formed during the Post-glacial Marine Transgression and is described as a perched valley. A seabed survey undertaken for the Silvereeye-1 drilling programme shows that the seabed at the proposed drilling site is flat and featureless, with the seabed gently shoaling in an east-west direction at a gradient less than one degrees, and is composed of low relief unconsolidated silty medium sand.

Biological Environment

Vegetation. The south-east marine region has the most diverse marine benthic flora in the world, and the highest level of species endemism; up to 62% of macroalgae in southern Australia are thought to be endemic. About 1,150 species of macroalgae (seaweeds) have been recorded from southern Australian waters. Red algae have the largest numbers of species in southern Australia (about 800 species), followed by brown algae (about 240 species) and green algae (about 140 species).

Marine Invertebrates. Zooplankton includes permanent planktonic organisms (e.g., copepods) and larval forms of many invertebrates (and fish) that are key components in the Bass Strait food web. More than 170 species of zooplankton have been recorded in central and eastern Bass Strait, with copepods making up about half of the species encountered. The high diversity appears to be related to the mixing of water masses from the Great Australian Bight, Tasman Sea and Antarctic Ocean.

Benthic Invertebrates. Bass Strait displays a high diversity of benthic invertebrates, with several polychaete families, pycnogonids, pericarid crustaceans, opisthobranch molluscs, bryozoans and brachiopods being the most abundant groups. Crustaceans and polychaete worms dominate the infaunal communities, many of which are unknown species. Sponges are a widespread group and one of the most common benthic species in low-light environments. In the South-east marine Region, possibly over 1,000 species have been recorded, but most of these are yet to be identified.

Marine Mammals. A number of species of whales, dolphins and fur seals occur in Gippsland Basin waters. The humpback whale (*Megaptera novaeangliae*), the blue whale (*Balaenoptera musculus*), and the southern right whale (*Eubalaena australis*), are listed as threatened under the *Environmental Protection Biodiversity Conservation Act 1999 (EPBC Act 1999)*. The humpback whale occurs regularly in the region while migrating to and from the north-eastern Australian coast from the sub-Antarctic. However, it is not known to feed, breed or rest in Bass Strait.

The Gippsland Basin is outside the known southern right whale calving and nursery zone, which is located in the inshore waters of Western Victoria around Warrnambool, a considerable distance from the proposed drilling site.

Other whale species that may occur in the region include the minke whale (*Balaenoptera acutorostrata*), Bryde's whale (*Balaenoptera edeni*), pygmy right whale (*Caperea marginata*), and the killer whale (*Orcinus orca*).

Several dolphin species occur throughout the waters of Bass Strait, including the common dolphin (*Delphinus delphis*), Risso's dolphin (*Grampus griseus*), dusky dolphin (*Lagenorhynchus obscurus*) and the bottlenose dolphin (*Tursiops truncatus*).

The Australian fur seal (*Arctocephalus pusillus*) has established five breeding areas on Tasmanian islands in Bass Strait. With the exception of Reid Rocks, these islands are all well east of the permit area, between Wilsons Promontory and Flinders Island. Seals are frequently seen resting and foraging on the Bass Strait oil and gas platform structures.

Fish. The marine fauna of temperate southern Australia is characterised by relatively low diversity and very high species endemism. Over 500 fish species are known from temperate Australian waters, many of which are important for commercial and recreational fisheries.

Four shark species are recorded under the *EPBC Act 1999* as potentially occurring within a 5 km radius of the proposed Silvereye-1 drilling location. The two threatened species are briefly described below.

The great white shark (*Carcharodon carcharias*) is listed as vulnerable under the *EPBC Act 1999*. The great white shark is widely distributed, and located throughout temperate and sub-tropical regions in the northern and southern hemispheres. In Australia, it is mostly recorded in the southern waters, its range extends primarily from Moreton Bay in southern Queensland, around the southern coastline and to North West Cape in Western Australia. They are frequently sighted in and around seal and sea lion colonies in general, such as Wilsons Promontory in Victoria.

School shark (*Galeorhinus galeus*) occurs throughout the temperate coastal waters of southern Australia. This species is mainly found in demersal waters, over the continental and insular shelves, but also over the upper slopes, in depths from near-shore to 550 m. Inshore areas are particularly important as birthing and nursery sites.

Birds. The distributions and populations of birds in offshore Bass Strait waters are not well known, whereas coastal and nearshore distributions have been more extensively studied. Coastal and marine birds may be categorised according to their seasonal and geographic presence and their migratory or resident status. A number of species are migrants that seasonally inhabit coastal waters, beaches and coastal wetlands. Some species are protected under the CAMBA and JAMBA migratory bird agreements signed between Australia and China and Japan, respectively.

Thirteen species of albatross, four petrels, a skua and the orange-bellied parrot (*Neophema chrysogaster*) are recorded as having the potential to occur in or near the drilling area under the *EPBC Act 1999*. There are no islands (and therefore no seabird colonies) in the immediate vicinity of the permit area. Almost all these species are listed as marine migratory species, and are known to feed on fish. The orange-bellied parrot is a terrestrial bird species that migrates between Tasmania and Victoria each year, and does not depend on oceanic species as a food source.

Socio-economic Environment

Settlements. King Island is the closest settlement to the T/44P permit area. It is situated at the western entrance to Bass Strait, midway between Victoria and mainland Tasmania, being 120 km in either direction. King Island has a population of approximately 1,800 permanent residents, 800 of which reside in the township of Currie situated on the west coast. Currie has a hospital, two doctors, schooling, a hotel, restaurants, two licensed clubs, two supermarkets, several speciality shops and is supported via the airfield nearby. King Island is a known tourism feature of the immediate area.

Marine Conservation Reserves. Bass Strait, and its coastal areas, contains several areas designated for conservation by the Commonwealth, Victorian and Tasmanian jurisdictions. The Boags Commonwealth Marine Reserve is the closest marine conservation reserve to the proposed Silveryeye-1 drill site, 27 km to the south. It covers 537 km² of Commonwealth ocean territory and has a depth range mostly between 50-80 metres. It was proclaimed in June 2007, and represents an area of shallow continental shelf ecosystems in the major biological zone that extends through central Bass Strait. It encompasses the fauna of central Bass Strait, which is expected to be especially rich based on studies of several sea floor dwelling animal groups.

Commercial Fisheries. The T/44P permit area lies within the area encompassed by the following Commonwealth fisheries, managed by the Australian Fisheries Management Authority (AFMA):

- Southern and Eastern Scalefish and Shark Fishery (Gillnet, Hook and Trap Sector);
- Bass Strait Central Zone Scallop Fishery;
- Southern Squid Jig;
- Southern Bluefin Tuna;
- Eastern Skipjack Tuna Fishery; and
- Small Pelagic Fishery (Zone C).

Consultation with these fisheries representatives indicates that there is little or no fishing effort around the Silveryeye-1 drill site, with Bass Strait considered too shallow to fish for tuna and a trawl exclusion zone in place for some other fisheries.

Victorian and Tasmanian state-based fisheries, such as rock lobster are largely restricted to near coastal locations, distant from the T/44P permit area.

Petroleum Exploration and Production. Bass Strait contains large oil and gas deposits. In 1996, the Gippsland Basin, located at the eastern end of the Bass Strait, produced over 40% of Australia's total crude oil and nearly half of Victoria's natural gas requirements. As of 2009, Victoria (mostly the offshore Gippsland Basin), accounts for 19% of Australia's oil and condensate production, and 17% of Australia's gas production, second behind Western Australia. A total of 23 offshore platforms have been installed in Bass Strait (21 Esso/BHP, 2 Origin) since first production was established in 1969.

Oil and gas reserves from the Gippsland Basin are currently on the decline. However, the relatively unexplored Sorell and Bass Basins indicate that there will be further production in the region, with the Bass Basin having an estimated 50 million barrels of commercially exploitable oil reserves.

The proposed Silvereye-1 drill site is located 65 km to the west of the BassGas Project (operated by Origin), which has developed the Yolla, Trefoil and White Ibis gas fields. The project includes the extraction of natural gas, condensate and water from the Yolla field and transport to an offshore platform (Yolla A). Gas is subsequently treated offshore to a suitable quality for transport to mainland Victoria via a 147 km long sub-sea pipeline. The project has been operational since 2006.

Wells that have been drilled in the vicinity of the proposed Silvereye-1 drill site include Aroo-1, Trefoil-1, White Ibis-1, Bass-1 and 3, Yolla-1 to 4, Barramundi-1, Tarook-1 and Koorkah-1.

Shipping. Bass Strait is one of the busiest shipping routes in Australia with more than 3,000 vessels transiting through the area each year, though consultation with the main shipping lines have indicated that the shipping density around the T/44P permit area is low. By volume, most heavy shipping movements in Bass Strait are east-west and west-east, north of the permit area, between the ports of Fremantle, Western Australia, and Melbourne and Sydney.

An 'Area to be Avoided' exclusion zone exists around the operating oil and gas platforms in the Gippsland Basin, a significant distance to the northeast of the permit area, whereby unauthorised vessels larger than 200 gross tonnes are excluded.

Two traffic separation schemes were implemented to enhance safety of navigation around the 'Area to be Avoided' by separating shipping into one-direction lanes for vessels heading north eastwards and those heading south westwards. One separation area is located south of Wilson's Promontory, and the other south of the Kingfisher B platform.

Maritime Heritage. The available literature indicates that no shipwrecks are known to occur within the T/44P permit area and there are no historic shipwreck protected zones in the area. Consultation with the Heritage Victoria (Maritime Unit) reveals that four ships have gone missing in the region however the exact location wrecks of unknown, though not in the permit area. The seabed survey conducted around the proposed drill site indicates that no shipwrecks occur in the immediate vicinity of the proposed Silvereye-1 location.

Offshore Infrastructure. The Basslink submarine high voltage electricity cable that connects Tasmania with the mainland electricity network, is located to the east of the T/44P permit area, with the Victorian end of the marine cable starting at McGaurans Beach (on the Ninety Mile Beach), and the Tasmanian section starting at Four Mile Bluff, east of the Tamar River.

The Tasmanian Gas Pipeline follows a similar route to the Basslink cable. This pipeline starts its marine crossing at Seaspray on Victoria's Ninety Mile Beach and terminates at Five Mile Bluff on Tasmania's north coast.

Telstra's Bass Strait 1 and 2 cables were laid in 1995 and 2003 respectively, between Victoria and Tasmania. Both cables are located to the east of the proposed drill site.

6. Environmental Impact Assessment

The potential environmental impacts resulting from routine activities and accidental discharges and other aspects associated with exploration drilling in the Bass Basin are outlined in detail in the Silvereye-1 Drilling EP.

Table 2 provides a summary of the detailed environmental impact assessment and mitigation measures that will be put in place to ensure that impacts are as low as reasonably practicable. The consequences, mitigation measures and risk rankings of each risk were determined in a hazard identification (HAZID) workshop with offshore drilling experts including representatives for specific campaign areas including drilling, logistics, mud engineering, reservoir engineering and offshore safety and environmental personnel that will be involved in the Silvereye-1 drilling campaign.

The risk assessment methodology used to undertake risk assessments for the activities associated with the Silvereye-1 drilling campaign includes:

- Identify risks - risk causes, consequences, assumptions, existing controls;
- Analyse risks - inherent consequence, consequence, exposure, probability, likelihood, residual risk;
- Evaluate risks;
- Treat risks (where required); and
- Monitor and review.

Table 2. Summary environmental impact assessment for the Silvereeye-1 drilling campaign

Potential risk	Potential consequence	Mitigation measures	Residual Risk Ranking
<i>Physical impacts</i>			
MODU and AHTS vessel anchoring	Temporary and localised seabed disturbance, shallow seabed depressions. Impact on marine biodiversity.	<ul style="list-style-type: none"> - Pre-drilling seabed survey for pre rig positioning to identify key features. - Anchoring procedures. - Depressions fill rapidly after drilling ceases. - AHTS vessels unlikely to anchor. 	Medium
Underwater vessel noise	Temporary physiological impacts on sensitive fauna, such as cetaceans. Disruption to migration, feeding or breeding patterns.	<ul style="list-style-type: none"> - Drilling not undertaken during key migration time for threatened cetaceans. - Region not a known breeding or feeding area. - Short-term temporary activity. - VSP to be undertaken only for a few hours and will incorporate marine mammal monitoring. 	Low
Artificial lighting	Attractant to fauna, temporary increase in predation rates on fauna attracted to lights. Nuisance to fishers.	<ul style="list-style-type: none"> - Lighting will be kept as minimal as possible in accordance with safety standards. - Lights directed downwards to the water will be minimised. 	Low
Atmospheric emissions	Temporary and localised reduction in air quality.	<ul style="list-style-type: none"> - Marine-grade (low sulphur) diesel used. - All engines and machinery maintained in accordance with maintenance systems. - No production testing (flaring). 	Low
Introduction of foreign organisms from vessel hulls and/or ballast	Establishment of foreign species to open ocean and/or seabed, competing with and displacing native species. Impact on marine biodiversity.	<ul style="list-style-type: none"> - MODU has been provided advice by AQIS to enter Australian waters after marine experts undertook marine pest risk assessment. - Biofouling management plan in place. - Remote operated vehicle (ROV) inspection program in place. - Support vessels stripped to 	Low

Potential risk	Potential consequence	Mitigation measures	Residual Risk Ranking
		coastal status - Vessel audit process	
<i>Routine liquid and solid discharges</i>			
Discharge of cuttings and adhered WBM	Temporary and localised smothering/burial and disturbance of immediate seabed area. Temporary and localised loss of water quality from suspended sediments.	- WBM will be used, containing recognised lowest-impact additives. - Studies show no long-term impacts from WBM cuttings on seabed. - Well planning to minimise mud production to required amounts - Use of experience mud engineers.	Medium
Overboard discharge of contaminated deck drainage	Temporary and localised reduction in water quality. Impact on marine biodiversity. Release of contaminants to marine environment.	- Oily water treatment systems in place, with no discharge over 15 ppm oil-in-water. - Chemical storage areas bunded. - Fuel transfer areas bunded. - Decks cleaned with biodegradable detergents.	Medium
Overboard discharge of sewage and putrescible waste	Temporary and localised reduction in water quality. Modification of fauna feeding patterns. Impact on marine biodiversity. Release of contaminants to marine environment.	- MARPOL-approved sewage treatment systems used. - No discharge of sewage and putrescible waste within 12 nm of land. - Putrescible waste macerated prior to discharge.	Low
Overboard discharge of solid waste	Marine pollution. Impact on marine biodiversity. Release of contaminants to marine environment.	- Waste management procedures - Solid wastes bagged and sent ashore for disposal. - All bins secured to deck and covered with lids.	Low
Waste oil, chemical and/or oil-contaminated drainage water spill/leak	Temporary and localised reduction in water quality. Impact on marine biodiversity. Release of contaminants to marine environment.	- Oily water treatment systems in place, with no discharge over 15 ppm oil-in-water. - Chemical storage areas bunded. - Fuel transfer areas bunded. - Decks cleaned with biodegradable detergents. - SOPEP kits available on board for rapid clean-up response.	Low

Potential risk	Potential consequence	Mitigation measures	Residual Risk Ranking
		- Maintenance procedures and inspection programs.	
Cooling water discharge	Localised elevation in surface water temperature. Thermal impacts to pelagic species	- Non-hazardous chemicals (e.g., biocides and anti-scalents) used in cooling water.	Low
Brine water discharge	Localised elevation in surface water temperature and salinity levels. Impact on marine biodiversity. Release of contaminants to marine environment.	- Non-hazardous chemicals (e.g., biocides and anti-scalents) used.	Low
Cement discharges	Temporary and localised loss of water quality from suspended sediments. Smothering of benthic habitat and fauna. Impact on marine biodiversity.	- Minor volumes (1-2m ²) of cement released at seabed during grouting of upper bore casing. - Cement hose flushing and minor releases rapidly diluted and dispersed by ocean currents. - Minimisation of left-over product through inventory control and well planning.	Medium
Socio-economic impacts			
Commercial fishing	Temporary loss of fishing grounds from drill rig safety exclusion zone, resultant loss of income. Collision risk. Trawling gear snagging on anchors and anchor lines.	- Consultation with key fisheries in the region indicates low fishing effort around drill site. - Temporary Notice to Mariners has been issued. - Drill rig has been gazetted. - Standard maritime safety measures will be in place.	Medium
Commercial shipping	Collision risk. Minor detours required if drill rig is in path of large ships.	- Consultation with key shipping lines in the region indicates drill site not in key shipping lanes and not of concern to shipping companies. - Temporary Notice to Mariners has been issued. - Drill rig has been gazetted. - Standard maritime safety measures will be in place.	Medium

Potential risk	Potential consequence	Mitigation measures	Residual Risk Ranking
Recreational activities	Collision risk.	<ul style="list-style-type: none"> - Recreational fishing associations indicate drill site located too far offshore to be of concern. - Notices will be issued to yachting clubs potentially racing through the area during December/January. 	Medium
<i>Non-routine activities</i>			
Loss of well control (i.e., blowout)	Marine pollution. Tainting of commercial fisheries species (e.g., shellfish). Injury and death of species such as seabirds. Pathological effects on fish larvae and plankton. Pollution of shoreline habitats such as sandy beaches and cliff faces.	<ul style="list-style-type: none"> - Well bore and casing designed to minimise risks. - BOP preventer tested and installed. - Oil spill contingency plan (OSCP) and Emergency Response Plan (ERP) in place. - Approved Safety Case Revision in place. - Oil spill modelling completed, with less than 10% of spilled oil predicted to strand on land, with a significant amount of evaporation reducing risks. 	Medium
Refuelling spill	Temporary marine pollution. Impact on marine biodiversity. Release of contaminants to marine environment.	<ul style="list-style-type: none"> - Maersk and Farstad refuelling procedures in place. - Use of dry-break couplings. - Job hazard analysis undertaken prior to refuelling. - Oil spill modelling indicates that 40% of spilled diesel would evaporate within 24 hours. 	Medium

7. Environmental Management

Origin manages the environmental impacts of all its activities and operations through implementation of its Health, Safety and Environment (HSE) Management System. The Origin HSE Management System is consistent with ISO 14001 (Environmental Management Systems), OHSAS 18001 and AS4801 (Occupational Health and Safety Management Systems) to provide a formal and consistent framework for all activities undertaken by Origin employees and contractors. The HSE Management System is premised on the beliefs that effective management of health, safety and the environment is based on a systematic approach to continual improvement with appropriate governance structures set in place, with clearly defined accountabilities

that must be met to meet that objective. The Origin HSE Management System includes 20 management standards that define the requirements necessary to ensure that environmental, health and safety risks are systematically managed, within the continual improvement methodology of Commit-Plan-Do-Check and Review.

An environmental implementation strategy for the Silvereye-1 drilling campaign was detailed in the EP and approved by the Tasmanian DIER. This strategy, which involves a crew training and awareness program, environmental audits, reporting to government, environmental monitoring and recording and incident reporting, is supported by the Origin HSE Management System.

In addition with the EP, several other documents have been submitted to relevant regulatory agencies for review and approval before drilling can commence. These include:

- Vessel Safety Case (VSC) Revision - issued to the National Offshore Petroleum Safety Authority (NOPSA) for review and approval.
- Emergency Response Plan - issued to NOPSA for information.
- EPBC Referral - issued to the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) for review and approval.
- Oil Spill Contingency Plan (OSCP) - issued to the DIER for review and approval, and the Australian Maritime Safety Authority (AMSA), Australian Marine Oil Spill Centre (AMOSOC) and Transport Safety Victoria (TSV) for information.
- Well Operations Management Plan (WOMP) - issued to the DIER for review and approval.
- Reservoir Management Plan - issued to the DIER for review and approval.
- Data Management Plan - issued to the DIER for review and approval.

8. Performance, Standards and Criteria

The overall effectiveness of the project Environmental Plan will be assessed by the Origin Environmental Specialist the completion of the survey to ensure continual improvement and effectiveness. Origin's management commitments for the surveys are outlined in Table 3.

Table 3 Silvereeye-1 drilling campaign environmental management commitments

Management Commitment	Performance Objective	Standards and Procedures	Criteria
Environmental audit	Ensure compliance with environmental management objectives.	Measures outlined in this Environmental Plan.	Environmental management verification undertaken in accordance with the Environmental Plan requirements
Operational environment awareness	Make all personnel involved in the drilling campaign aware of the environmental sensitivities of the region and their environmental commitments.	Environmental Plan in place. On-site HSE induction required for all personnel.	Environmental inductions undertaken - sign off sheets available.
Incident reporting	Report any incidents that may impact the environment.	Origin incident reporting procedure. OPGGS (Environment) Regulations 26A - Reporting of incidents within 2 hours to the Designated Authority.	Incident reports promptly completed and forwarded to Origin. All OPGGS (Environment) Regulations reportable incidents reported in a timely manner.
Emergency response management	Have an Emergency Response Plan in place and tested prior to the campaign.	Approved Emergency Response Plan	Emergency Response Plan tested for its effectiveness, updated where short-comings are noted.
Cetacean observations	Collate data on the presence and behaviour of cetaceans encountered or observed during the survey.	Cetacean observation sheets provided to vessels. Crew inducted on how to identify such fauna and how to report sightings.	Sightings are recorded and forwarded to the Department of Sustainability, Environment, Water, Populations and Community.

9. Further Information

For further information about the Silvereeye-1 drilling campaign, please contact:

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