Brunello Appraisal and Production Drilling

Environment Plan Summary

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CONTENTS

1. INTRODUCTION

Apache Energy Ltd (Apache) proposes to continue appraisal and production drilling associated with the development of the Brunello gas field within the Production Permit License WA-49-L (**Figure 2-1**). The Activity within WA-49-L will include the continuation of drilling from intermediate hole sections and the re-drill of previously drilled production wells, installation of Christmas trees and drilling of new appraisal and production wells and is referred to within this Environment Plan Summary collectively as the 'Activity'. Actions to carry out the Activity will include anchoring, drilling, completion, Christmas tree installation, production testing and workover/re-entry operations on up to eight Brunello production wells.

Apache undertakes this Activity as the operator of the WA-49-L permit, with its joint venture partner, Kufpec Australia Pty Ltd holding a 35% share.

1.1 Schedule

Drilling of the remaining conductor, surface and intermediate hole sections of up to three Brunello production wells will take approximately 120 days and is scheduled to commence in February/March 2014. Drilling of the remaining production hole sections and completion of installation for five Brunello production wells will take approximately 180 days and is scheduled to commence in Q2/Q3 2015.

The required timeframe to complete the Activity will be influenced by weather, rig availability and drilling schedules.

1.2 Compliance

The EP has been prepared to comply with the Commonwealth *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009* (OPGGS (E) Regulations). The EP has been reviewed and accepted by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) on the 13 February 2014.

This EP summary has been prepared in accordance with the requirements of Regulation 11 (7) and (8) of the referenced OPGGS(E) Regulations.

2. LOCATION OF THE ACTIVITY

The drilling will take place at the Brunello Drill Centre (DC) located approximately 35 km northwest of the Montebello Islands and 77 km northwest from Varanus Island in approximately 148 m of water depth. The wells are located at the Brunello Drill Centre (DC) or manifold (see **Table 2-1**).

Table 2-1: Surface location for the Brunello gas field development infrastructure

Parameter	Permit Area	Coordinates (Datum/Projection: GDA 94 Zone 50)				Approx. Water Depth (m)
		Latitude	Longitude	Easting	Northing	
Brunello DC	WA-49-L	20° 01' 49.08" S	115° 12' 06.87" E	311,992.40	7,784,154.70	148 m

For the mobile offshore drilling unit (MODU), the operational boundary is defined as the MODU's footprint while at the drilling location including the anchor spread (approximately 1.5 km radius around the surface hole location). For support vessels and aircraft, for which risks are also assessed within the EP, a 500 m radius around the MODU when stationary on location is defined as the operational boundary; this also represents the MODU exclusion zone.

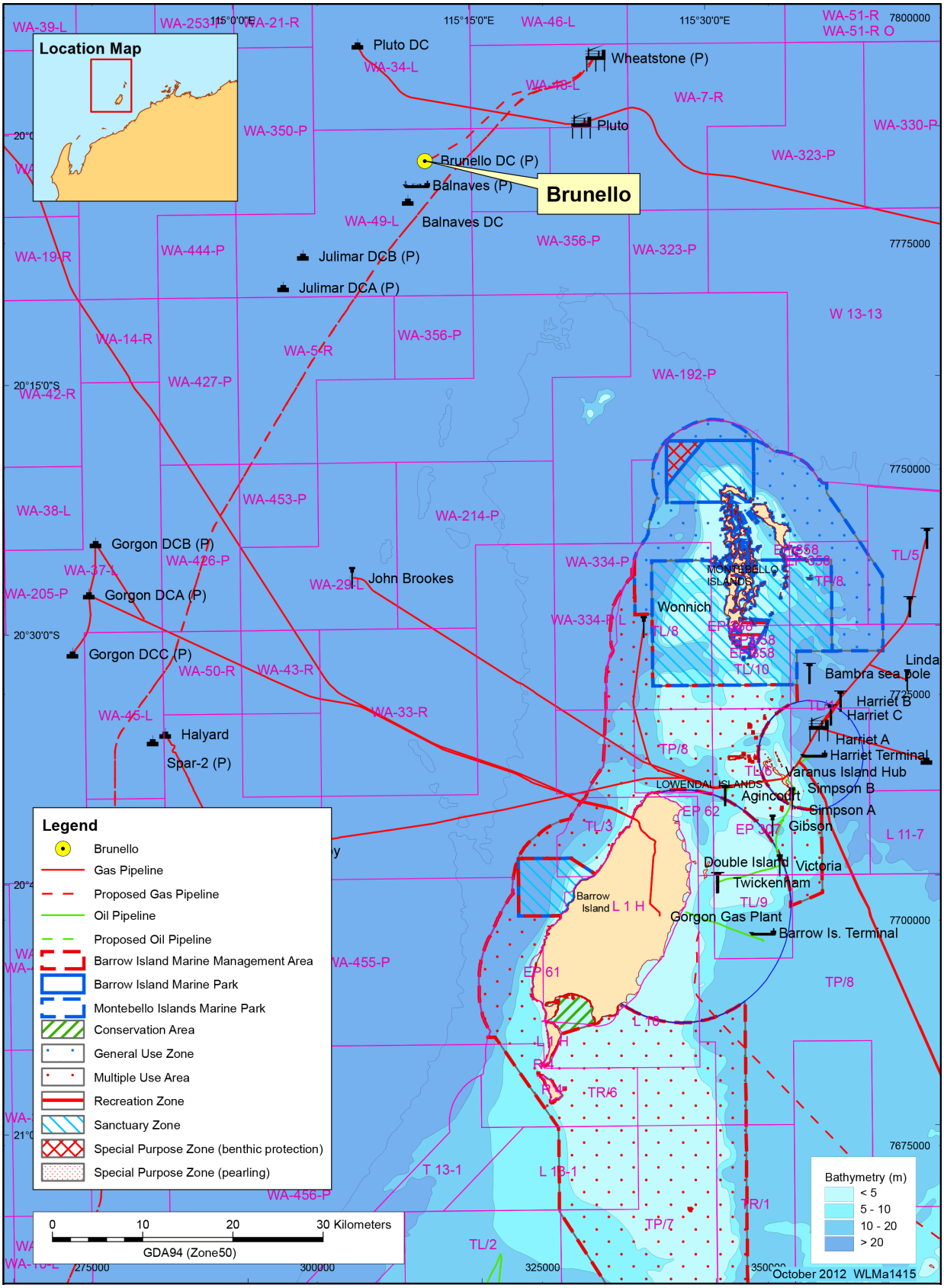

Figure 2-1: Location map for the Activity

3. DESCRIPTION OF THE RECEIVING ENVIRONMENT

3.1 Physical environment

The appraisal and production drilling activity is located on the North West Shelf. The region lies in the arid tropics experiencing high summer temperatures, periodic cyclones and associated rainfall. Rainfall in the region is generally low with evaporation exceeding rainfall throughout the year. Intense rainfall may occur during the passage of summer tropical cyclones and thunderstorms (NSR, 1995). Mean sea surface temperatures over the NWS range from a minimum of 15°C in winter to a maximum of 33°C in summer (WNI, 1996). Due to the arid climate, daytime visibility in the area is generally greater than five nautical miles (SSE, 1991).

During the summer period, the prevailing non-storm winds are from the southwest, west and northwest, bringing with them warm, humid air. Average wind speeds are less than 10 knots, with peak average speeds of 15–25 knots, and maximum speeds of 30 knots. The hotter and more humid summer season (October–March) is also associated with higher rainfall and periodic tropical cyclones and thunderstorms (NSR, 1995). During extreme cyclonic events, winds may reach 95 knots.

Winds in winter (May–August) are more variable in direction than in summer. Non-storm winds prevail from the northeast through to southeast, carrying dry air from the continent's interior. Winds during this period are generally lighter, with average speeds of 5–6 knots, peak average speeds of 10–15 knots, and maximum speeds of 20 knots. Transitional wind periods, during which either pattern may predominate, can be experienced in April and September of each year.

The wave climate is generally composed of locally generated wind waves (seas) and swells that are propagated from distant areas (WNI, 1995; 1996). In summer, seas typically approach from the west and southwest, while in winter from the south and east. Mean sea wave heights of less than 1 m with peak heights of less than 2 m are experienced in all months of the year (WNI, 1995). Mean swell heights are low at around 0.4–0.6 m in all months of the year. Tropical cyclones have generated significant swell heights of up to 5 m in this area, although the predicted frequency of swells exceeding 2 m is less than 5% (WNI, 1995). In the open ocean, sustained winds result in wind-forced currents of approximately 3% of the wind speed (Holloway and Nye, 1985).

The dominant sea surface offshore current (typically seaward of the 200 m isobath) is the Leeuwin Current, which carries warm tropical water south along the edge of WA's continental shelf, reaching its peak strength in winter and becoming weaker and more variable in summer. The Indonesian Throughflow is the other important current influencing the upper 200 m of the outer NWS (Woodside, 2005).

Offshore drift currents are represented as a series of interconnected eddies and connecting flows that can generate relatively fast (1–2 knots) and complex water movement. These offshore drift currents also tend to persist longer (days to weeks) than tidal current flows (hours between reversals).

3.2 Biological environment

A seabed survey of the Balnaves Development location (3 km to the SSW) was conducted by RPS in 2011, consisting of remotely operated underwater vehicle (ROV) video transects and sediment sampling (RPS, 2012). The areas surveyed were found to consist of soft sediments with associated epifauna and infauna, with no areas of hard substrate or significant habitat identified. Given the proximity and similar water depths to the Balnaves Development Area, it is expected that the seabed at the Brunello Appraisal and Production Drilling site will be largely consistent with that described by RPS (2012).

Within the wider environment considered in impact assessment of unplanned spill scenarios, benthic habitats including coral reefs, macroalgae, seagrasses, hard substrate and associated assemblages are also found. These habitats are found near the shoreline of the mainland coast and offshore reefs such as the Rowley Shoals. Shoreline habitats within the impact assessment for spill scenarios included sandy beaches, intertidal and subtidal zones and rocky shorelines, as well as marine protected areas.

An EPBC Act Protected Matters search (DoE, 2013) identified 17 Key Ecological Features (KEF) (parts of the marine ecosystem that are considered to be important for the biodiversity or ecosystem functioning and integrity of the Commonwealth Marine Area) within the environment assessed for impacts resulting from the worst case credible spill scenario due to a loss of well control. The EPBC search of the area identified 141 listed marine species, 26 of which are threatened species (endangered or vulnerable) and 59 of which are migratory species. The EPBC search also identified 41 whales and other cetaceans, of which 5 are threatened species (endangered or vulnerable) and 15 of which are migratory. The species listed, or habitat important for these species, may occur within the predicted PSTA impact as a result of a loss of well control.

3.3 Socio-economic environment

Both the offshore and coastal waters in the NWS Region support a valuable and diverse commercial fishing industry, mainly dominated by the Pilbara fisheries. The Commonwealth licensed fisheries Western Tuna and Billfish Fishery, North West Slope Trawl Fishery, the Western Skipjack Tuna Fishery and the Southern Bluefin Tuna Fishery all fall within the operational boundary. These fisheries as well as the Western Deepwater Trawl Fishery also fall within the worst case credible spill assessment area, although none of these fisheries have had recent fishing effort reported (Fletcher and Santoro, 2012).

In addition, 33 State managed fisheries (Fletcher and Santoro, 2012) have boundaries that overlie or are in close proximity to part or all of the operational boundary and the worst case credible spill assessment area:

- Pilbara Trap Managed Fishery;
- Pilbara Fish Trawl Managed Fishery;
- Pearl Oyster Managed Fishery (Zones 1, 2 and 3);
- Onslow Prawn Managed Fishery;
- Nickol Bay Prawn Managed Fishery;
- Kimberley Prawn Managed Fishery;
- Broome Prawn Managed Fishery;
- Northern Demersal Scalefish Fishery;
- Aquaculture Pearling Sites;
- West Coast Rock Lobster Managed Fishery;
- Roe's Abalone Fishery;
- Abrolhos Islands and Mid West Trawl Managed Fishery;
- West Coast Deep Sea Crab Managed Fishery;
- West Coast Demersal Gillnet and Demersal Longline Managed Fishery;
- West Coast Demersal Scalefish Managed Fishery;
- West Coast Purse Seine Fishery;
- Cockburn Sound Crab Managed Fishery;
- Cockburn Sound Fish Net Managed Fishery;
- Cockburn Sound Line and Pot Fishery;
- South West Coast Salmon Managed Fishery;
- West Coast Estuarine Fishery;
- West Coast Beach Bait Managed Fishery;
- South West Beach Seine Fishery;
- Exmouth Gulf Prawn Managed Fishery;
- Gasgoyne Demersal Scalefish Fishery;
- Shark Bay Prawn and Scallop Managed Fishery;
- Shark Bay Crab Managed Fishery;
- Shark Bay Beach Seine and Mesh Net Managed Fishery;
- Mackerel Managed Fishery;
- Beche-de-Mer Fishery;
- Marine Aquarium Fish Managed Fishery;
- Octopus; and
- Specimen Shell Managed Fishery.

The worst case credible spill assessment area falls within the North West Coast and Gascoyne Coast Bioregions. Recreational fishing is experiencing significant growth, with a distinct seasonal peak in winter when the local population increases significantly from tourists visiting the Exmouth/Onslow area and Dampier Archipelago (Fletcher and Santoro, 2012). Offshore islands, coral reefs, shoals (e.g. Rankin Bank and Glomar Shoals) and the continental shelf provide species of major recreational interest (Fletcher and

Santoro, 2012). However, recreational fishing within the 500 m exclusion zone around the MODU is unlikely given the distance offshore.

The Brunello Drilling Centre location lies between two shipping lanes, with the closest being approximately 40 km to the north-west.

The area of the NSW is a major oil and gas hub in Australia, with several companies operating on the Shelf. The Balnaves Development is situated within production licence WA-49-L, awarded for the Julimar Development in September 2011 and was originated from exploration permit WA-356-P. The Balnaves Development is expected to be commissioned in Q1/Q2 2014. The Balnaves FPSO (the Armada Claire) will be located approximately 3 km from the Brunello DC location. These developments are operated by Apache, and no conflicts were identified during project planning.

In the waters immediately surrounding the operational area, tourism activities are limited due to the water depth of water and the distance from the mainland and island shorelines (approximately 165 km and 35 km, respectively). Aquatic recreational activities such as boating, diving and fishing occur nearer the coast and offshore islands. The likelihood of vessel traffic involved with tourism-based activity to be transiting through the operational area is low.

There are no World Heritage, Commonwealth Heritage or National Heritage sites, or Wetlands of International Importance (Ramsar sites) in or adjacent to the operational boundary. No registered Aboriginal heritage sites are located within or in close proximity to the drilling activity location.

No shipwrecks were recorded within the operational area. A search of the Protected Matters Database revealed two shipwrecks in the worst case spill trajectory area.

4. DESCRIPTION OF THE ACTIVITY

The Activity is to continue appraisal and production drilling associated with the development of the Brunello gas field within WA-49-L. Previous drilling undertaken in 2012 and 2013 to develop the Brunello gas field has included the appraisal drilling and sidetrack of Balnaves Deep-2/3 well and the drilling of conductor, surface and intermediate hole sections for four Brunello production wells (BruA-2A, BruA-3, BruA-4ST2, Bru-A5ST1). Actions to carry out the Activity will include anchoring, drilling, completion, Christmas tree installation, production testing and workover/re-entry operations on up to eight Brunello production wells, including those four Brunello wells already commenced in 2013.

The Activity will be undertaken with a moored semi-submersible mobile offshore drilling unit (MODU). Once securely in position, the MODU will carry out the following actions and operations (not necessarily in the sequence listed):

- Installation of mooring equipment (potentially pre-laid);
- Riserless drilling of conductor and surface hole sections;
- Installation and cementing of conductors and casing in riserless drilled conductor and surface hole sections;
- Installation of the blow-out preventer (BOP);
- Drilling of intermediate hole section(s) with synthetic-based muds (SBM) or water-based muds (WBM);
- Drilling of reservoir hole section with SBM or WBM;
- Installation and cementing of casing and liners in intermediate and reservoir hole sections;
- Installation of Christmas Trees and Guide Bases;
- Wireline operations including formation evaluation logging, vertical seismic profiling (VSP) or checkshot surveys, potential stuck pipe recovery and perforating;
- Installation of lower completions;
- Gravel packing;
- Displacement of SBM to WBM and/or displacement of WBM to SBM;
- Displacement of WBM or SBM to inhibited brine;
- Installation of upper completions;
- Coiled tubing activities including Nitrogen lifting and displacement, wellbore cleanouts and fishing operations;
- Installation of Drill Stem Testing (DST) strings, including perforating;
- Well testing of reservoir sections including flaring of hydrocarbons;
- Well suspension;
- Plugging, casing retrieval and abandonment of surface, intermediate and reservoir hole sections;
- Severing and retrieval of surface and conductor casing strings and Guide Bases;
- Sidetracking and drilling of intermediate hole sections to alternative reservoir development targets with SBM and/or WBM; and
- Retrieval of pre-laid/MODU mooring equipment.

Anchor-handling vessels (AHV) will be required to deploy and retrieve the anchors upon arrival and departure from the drilling location. Anchor handling-vessels (AHVs) will be required to deploy the anchors at the drilling location with an eight anchor array, with anchors laid on the seabed approximately 1.5 km from the MODU position, and then retrieve them upon the completion of the Activity and departure of the

MODU from the drilling location. In some cases, the AHV may pre-lay the anchors; this would likely be done 2-4 weeks prior to the MODU's arrival. At least one support vessel will be utilised during the activity to supply food, bulk drilling materials, transportation of equipment, monitoring and maintenance of the 500 m exclusion zone around the MODU.

5. ENVIRONMENTAL HAZARDS AND CONTROLS

The environmental risk assessment for the evaluation of hazards and risks associated with the Activity centred around a hazard identification workshop attended by a subset of Apache's environmental scientists and drilling personnel, held on 29 October 2013. Throughout the preparation of the EP, further evaluation of hazards and risks were undertaken as appropriate, as the activity scope was defined. Apache's Environmental Scientists and other participants from Drilling, Logistics and Safety were also involved where necessary to ensure compliance with Apache's *Environmental Risk Identification Procedure (AE-91-IF-039)*.

The purpose of the risk assessment was to understand and identify the potential environmental hazards, their causes and the potential impacts associated with the Activity to ensure they are reduced to As Low As Reasonably Practicable (ALARP). Apache's management and mitigation actions corresponding to the potential hazards and impacts have been developed from experience in the environmental management of offshore petroleum activities in Australia, and are based on Australian petroleum industry best practice environmental management guidelines, as defined by the APPEA Code of Environmental Practice (2008).

The environmental risk assessment identified ten routine environmental hazards and nine non-routine (unplanned events) environmental risks. These environmental hazards, risks and control measures to be applied to the drilling activity are provided in **Section 10**. The control measures are consistent with Apache corporate and project specific performance objectives, standards and criteria. All commitments associated with these will be used to reduce environmental risk to ALARP and will be of an acceptable level.

6. MANAGEMENT APPROACH

The Activity will be managed in compliance with all measures and controls detailed within the EP accepted by NOPSEMA under the OPGGS(E) Regulations, other environmental legislation and Apache's Management System (e.g. Apache Environmental Management Policy).

The objective of the EP is to ensure that potential adverse environmental impacts associated with routine operational events and unplanned events associated with the drilling activity, are identified and assessed and to stipulate mitigation measures to avoid and/or reduce any adverse impacts to the marine environment to ALARP.

The EP details specific performance objectives, standards and procedures, and identifies the range of controls to be implemented (consistent with the standards) to achieve the performance objectives. The controls for the drilling activity are summarised in **Section 10**. The EP also identifies the specific measurement criteria and records to be kept to demonstrate the achievement of each performance objective.

As described in the EP, the implementation strategy includes the following:

1. Details on the systems, practices and procedures to be implemented;
2. Key roles and responsibilities;
3. Training, competencies and on-going awareness;
4. Monitoring, auditing, management of non-conformance and review;
5. Incident response including an Oil Spill Contingency Plan (*Brunello Appraisal and Production Drilling OSCP*);
6. Record management; and
7. Stakeholder consultation.

The reporting requirements for routine events and environmental incidents (recordable and reportable) and reporting on overall compliance of the Activity with the EP are also detailed.

7. HYDROCARBON SPILL PREPAREDNESS AND RESPONSE

Credible hydrocarbon spill scenarios are identified in the EP requiring 1, 2, and 3 spill response tiers include:

- **Tier 1:** small spill from vessel and/or MODU;
- **Tier 2:** spill from vessel and/or MODU such as during refuelling and base oil transfer, and/ or a vessel collision resulting in a ruptured fuel tank; and
- **Tier 3:** spill from a loss of well control discharging at the seabed.

These oil spill scenarios include the worst-case spill scenario. Strategies for oil spill response are outlined in the *Brunello Appraisal and Production Drilling OSCP*. The response strategies include:

- **Source control:** activating emergency shutdown of valves and pumps, closing scuppers to prevent spill escape, pumping oil on decks to storage or pumping hydrocarbons from ruptured to slack tanks, and drilling a relief well – all tiers;
- **Monitoring and evaluation:** including aerial and vessel surveillance, tracking buoys and spill fate modelling – all tiers;
- **Mechanical dispersion:** removing surface oil through mechanical dispersion (propeller wash) near sensitive shorelines and marine fauna – all tiers;
- **Protection and deflection:** the use of booms to deflect surface oil away from sensitive shorelines/ wildlife to less sensitive areas and/or areas where shoreline clean-up can be better undertaken – tier 2 and 3 spills;
- **Shoreline clean-up:** activities to remove oil from sensitive areas (bagging and removing) or to promote the natural breakdown of hydrocarbons (low pressure washing, tilling and turning sediments – tier 2 and 3 spills;
- **Oiled wildlife response:** may include activities such as identifying at risk wildlife, hazing, pre-emptive capture and collection and rehabilitation of oiled wildlife – tier 2 and 3 spills;
- **Waste management:** oil and oily wastes will be generated by activities such as shoreline clean-up and offshore containment and recovery. These wastes will be transferred to offshore oil processing facilities, decanted within contained areas and/or transferred to onshore waste disposal facilities – tier 2 and 3 spills; and
- **Operational and scientific monitoring:** determine the extent, severity and persistence of environmental impacts from an oil spill. Activities may include surveillance, spill modelling, hydrocarbon assays and weathering studies, dispersant efficacy studies, shoreline and habitat assessment and megafauna assessment – tier 2 and 3 spills.

8. CONSULTATION

As stated in Apache's Environmental Management Policy, our company is committed to maintaining open community and government consultation regarding its activities and environmental performance.

Apache's operating presence (e.g. gas processing facilities at Devil Creek and Varanus Island) off the North West Shelf ensures that communication is regular with relevant stakeholders, including those potentially affected by this activity.

The identified stakeholders are commercial fishers in the region, fishing bodies, federal departments and regulators. Relevant stakeholders identified for the drilling activity based on the defined operational area are summarised in **Table 8-1**.

Table 8-1: Summary of stakeholders relevant to the drilling of the Brunello Field Development

Group	Stakeholder
Commercial fisheries	• Australian Fisheries Management Authority (AFMA) • State Department of Fisheries (DoF) • Western Australian Fishing Industry Council (WAFIC) • Commonwealth Fisheries Association (CFA) • A Raptis and Sons • WestMore Seafoods • Shark Bay Seafoods • Austral Fisheries • MG Kalis • Pearl Producers Association • Individual fishing licence holders
Recreational fisheries	• RecFish West
Conservation	• Department of Environment (DOE) • State Department of Parks and Wildlife (DPaW)
Marine activities, spill response and safety	• Australian Marine Oil Spill Centre (AMOSC) • Australian Maritime Safety Authority (AMSA) • State Department of Mines and Petroleum (DMP) • State Department of Defence • State Department of Transport (DoT)
Tourism	• Marine Tourism WA

Consultation regarding Brunello has been underway since 2012, with appraisal and production drilling consultation commencing with a Consultation Pack distributed to all listed stakeholders in September 2013. Stakeholders were provided with an update notification document in October 2013 advising of a new drilling schedule.

The most recent consultation for the Brunello Appraisal and Production Drilling activity was the distribution of a stakeholder consultation package in January 2014 advising stakeholders that reservoir sands bearing crude oil may be encountered during this phase of the drilling program and information on the maximum credible spill volume.

Apache has commenced with issuing quarterly updates to relevant stakeholders. These updates consist of details for the on-going, plus proposed upcoming activities on the NWS for the next 3–6 months. This update provides the stakeholders with information inclusive of proposed activity, activity location and the activity duration, and gives the stakeholders an opportunity to request additional information on the

specific activities that may be of interest to them. The quarterly update issued in September 2013, included the Brunello activities.

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9. CONTACT DETAILS

Further information about the Brunello Appraisal and Production drilling activity can be obtained from:

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10. MANAGEMENT CONTROLS FOR THE DRILLING ACTIVITY

The following tables (**Table 10-1** and **Table 10-2**) summarise the control measures corresponding to the potential environmental hazards identified for the Activity which eliminate or reduce the environmental risks to ALARP.

Table 10-1: Management controls and performance standards for planned events during the Activity

Hazard	Management Control Measures and Performance Standards
MODU positioning	• No vessel anchoring within operational area ensures seabed disturbance is minimised. • Mooring analysis to be undertaken and MODU positioned to avoid placement of anchor assembly on identified seabed features. • Star Fix Moor (a 3D software program which indicates touch down points of the cantenaries and anchor positioning) to be utilised during anchoring to ensure anchor positions are within areas defined in the mooring analysis. • Contractor MODU positioning procedures are reviewed and approved by Apache prior to their use.
Artificial light	• Deck lighting managed in accordance with *Environmental Requirements for offshore marine vessels (AE-91-IQ-202)* which requires: o No floodlights permitted unless essential as directed by vessel/MODU master; o Restrictions on lighting within 10 km of islands/mainland in August to April (not applicable given distance to shore); o To minimise potential impacts on marine fauna. • Deck lighting managed in accordance with AE-91-IQ-202 or a MODU or Vessel Master safety direction.
Noise	• Noise emissions minimised by maintaining MODU and support vessel machinery in accordance with the planned maintenance system (PMS). • Unless an action is reasonably necessary to prevent a risk to human health or to deal with an emergency, helicopters will operate in accordance with Part 8 of the EPBC Regulations (Aircraft). In particular: o Must not operate at a height lower than 1,650 feet (500 m) or within a horizontal radius of 500 m of a cetacean; o Must not allow the aircraft to approach a cetacean from head on; and o Must not land the aircraft on water so that the aircraft comes within a 500 m radius of a cetacean (if the aircraft can land on water). • In accordance with Part 8 of the EPBC Regulations (Vessels), all vessels must travel at less than 6 knots and minimise noise within the caution zone of a cetacean (150 m radius for dolphins, 300 m for whales) known to be in the area. • VSP or Check-shot survey activities will implement mitigation measures outlined in the EPBC Act Policy Statement 2.1 Part A (DEWHA, 2008) as appropriate for the activity, for cetaceans and whale sharks: o Precaution zones will be implemented (Observation (3+ km), Low Power (1 km) and Shut-Down (500 m)); o Pre-start visual observation of precaution zones (>30 mins before soft-start); o VSP/Check shot survey will not commence if cetaceans/whale sharks are within Low Power or Shut-Down Zone; o Visual observations by trained crew maintained continuously from pre-starts to end of survey/VSP;

Hazard	Management Control Measures and Performance Standards
	○ VSP/Check-shot survey will be shut down if cetacean or whale shark enters Shut-Down Zone; ○ Relevant crew members are briefed on EPBC Act Policy Statement requirements; ○ Soft-start, start-up delay, operations and stop work procedures; ○ Night-time and low visibility procedures.
Discharge of Water-Based Muds (WBMs) and cuttings	• Apache's drilling fluid selection process is utilised to ensure the mud selected for the Activity presents the lowest environmental impact based on the formation properties. • The drilling chemicals selected are either Gold/Silver/D or E rated through OCNS or Apache's risk assessment procedure as per Apache's *Drilling Fluid and Chemical Selection (EA-91-II-007)* to ensure product is environmentally acceptable. • Chemicals which are not Gold/Silver/D or E rated have a complete risk assessment of the environmental impact of the chemicals to ensure product is environmentally acceptable. • WBM cuttings returned to the MODU are treated through the on board cuttings management system (shale shakers and centrifuges – if required) to maximise reconditioning and re-use of residual mud and significantly reduce the concentration of WBM fluid on cuttings prior to discharge. • Shaker screens are selected and inspected daily during drilling operations once the BOP and riser are in place, by the Mud Engineer on location and are in an acceptable condition for treatment of drill cuttings ensuring efficient re-use. • Re-use and treatment of mud maximised by maintaining the cuttings management system in accordance with the PMS. • To ensure correct volumes are recorded, mud pit sensor calibration is checked every two weeks, with re-calibration only required if calibration is out. • If cuttings centrifuge system is required, it is inspected daily during drilling operations. • All hoses used for pumping of mud and drilling fluids are maintained according to PMS to ensure 'fit for purpose'.
Discharge of synthetic-based mud (SBM) drill cuttings, base oil and SBM drilling fluids	• Apache's drilling fluid selection process is utilised to ensure the mud selected for the Activity presents the lowest environmental impact based on the formation properties. • The drilling chemicals selected are either Gold/Silver/D or E rated through OCNS or Apache's risk assessment procedure as per Apache's *Environmental Guidelines for Drilling Fluid and Chemical Selection in Activities (EA-91-II-007)*. • Chemicals which are not Gold/Silver/D or E rated have a complete risk assessment of the environmental impact of the chemicals as per Apache's *Drilling Fluid and Chemical Risk Assessment Procedure (EA-91-II-008)*. • SBM cuttings returned to the rig are treated through the on board cuttings management system (shale shakers, centrifuges and cuttings dryers) and discharged with an average of <10% oil on cuttings for each section. Discharges made to the marine environment associated with mud pit cleaning will also achieve an average of <10% oil on cuttings for each section. Measurement is made with a retort and is reported as weight percentage of oil on dry rock. Measurement method as per Apache's *Operational Guidelines and Environmental Performance Measures for Handling and Usage of Drilling Fluids and Bulks (DR-91-ID-016)*. • Shaker screens are selected by the Mud Engineer on location and are in an acceptable condition for treatment of drill cuttings.

Hazard	Management Control Measures and Performance Standards
	• In the unlikely event that an average <10% OOC per interval cannot be achieved all cuttings will be shipped to shore for onshore processing. • Fluids generated during mud pit cleaning containing surfactants/ solvents will be returned to shore for processing and disposal. • SBM displaced from the well bore (and returned base oil, surfactant/solvent/high viscosity pills) are collected and stored for re-use or onshore disposal. Only interface fluids (seawater/brine/WBM) with residual oil (SBM) content <1% is discharged overboard, measurement is made with a hand crank 100 ml centrifuge as per Apache's *Operational Guidelines and Environmental Performance Measures for Handling and Usage of Drilling Fluids and Bulks (DR-91-ID-016)*. • The volume and oil content of seawater/brine/WBM discharged overboard as part of SBM displacement is recorded and the total volume of oil included in the calculation of oil on cuttings for the well selection. • Average oil on cuttings is <10% for each well section. • Re-use and treatment of mud maximised by maintaining the cuttings management system in accordance with the PMS. • Cuttings dryer and centrifuge system are inspected daily during drilling operations. • All hoses used for pumping of mud and drilling fluids are maintained according to PMS to ensure 'fit for purpose'.
Discharge of cement	• The chemicals selected are either Gold/Silver/D or E rated through OCNS or Apache's risk assessment procedure as per Apache's *Drilling Fluid and Chemical Selection (EA-91-II-007)* to ensure produce is environmentally acceptable. • Chemicals which are not Gold/Silver/D or E rated have a complete risk assessment of the environmental impact of the chemicals as per Apache's *Drilling Fluid and Chemical Risk Assessment Procedure (EA-91-II-008)* to ensure produce is environmentally acceptable • Left-over bulk cement will be stored on board and transferred to a licensed carrier or to an onshore reception facility, in accordance with the *Environmental Protection (Controlled Waste) Regulations (2004)*. • While cementing prior to riser installation, a remotely operated vehicle (ROV) will monitor the top of the well to ensure excessive volumes of cement are not pumped. • Liquid or semi liquid cement that returns to surface or is flushed during tank/pipe cleaning will be diverted overboard. If using SBM OOC measurements will be taken and included in the interval totals as per Apache's *Environmental Performance Measures for Handling and Usage of Drilling Fluids and Bulks (DR-91-ID-016)*. • Hard cement which returns to surface and is removed through the on board cuttings treatment system will be diverted overboard. If using SBM OOC measurements will be taken and included in the interval totals as per Apache's *Environmental Performance Measures for Handling and Usage of Drilling Fluids and Bulks (DR-91-ID-016)*. • Bulk cement will not be discharged overboard except in an emergency; it will either be left on board for the subsequent campaign, returned to a supply vessel for re-use or will be sent back to shore for storage or appropriate disposal. The majority of cement will be mixed and used downhole below the seabed, resulting in limited discharges of any mixed cement. Through inventory control and well planning, left over cement product will be minimised. • Cement volume requirements are calculated using the volume of cement necessary plus industry accepted excess volumes to meet the downhole requirements and minimise surface discharges. Calliper logs will be used for this calculation when available.

Hazard	Management Control Measures and Performance Standards
	• PMS is up to date and includes drill cuttings management system equipment.
Planned discharges	• Untreated sewage will be stored on board and only discharged at a distance of more than 12 nautical miles from the territorial baseline in accordance with Regulation 11 of MARPOL Annex IV or disposal at a reception facility or to a carrier licensed to receive the waste. • Treated sewage will be discharged in compliance with Regulation 11 of MARPOL Annex IV. • The sewage (treatment) system will be compliant with Regulation 9 of MARPOL Annex IV and maintained in accordance with PMS. • Persons on board (POB) do not exceed the maximum carrying capacity of the MODU or support vessels' sewage system. • Food waste collected, stored, processed and disposed of in accordance with MODU/support vessel Garbage Management Plan (as required under Regulation 9 of MARPOL); and/ or Shipboard Waste Management Plan (as required under AMSA Marine Order 95: Marine Pollution Prevention – Garbage). • In accordance with MARPOL Annex V Regulation 9.1, AMSA placards will be displayed on support vessels and MODU to provide guidance on garbage disposal requirements. • In accordance with Regulation 4 of MARPOL Annex V, food waste discharge from the MODU and support vessels (when inside the 500 m exclusion zone) must be ground or comminuted to <25 mm and discharged only when >12 nautical miles from the territorial baseline. • Food macerators are maintained in accordance with PMS. • Food waste that cannot meet the requirements for disposal in the operational area (e.g. due to equipment failure or otherwise) will be transferred to land for disposal. • As required by MARPOL Annex I Regulations, while in the operational area, support vessels may discharge oily water after treatment to 15 ppm in a MARPOL compliant oily water filter system. • To discharge oily water, the support vessels will require a current International Oil Pollution Prevention (IOPP) certificate for oily water filtering equipment. • If a MARPOL approved OWS is not present/functioning, the MODU/support vessel will store machinery space oily water which will be shipped to shore for appropriate disposal at a reception facility or to a carrier licensed to receive the waste. • Scupper plugs or equivalent deck drainage control measures available where chemicals and hydrocarbons are stored and frequently handled. • Only non-hazardous, biodegradable detergents used for deck washing. • Continuous bunding will be in place around all machinery or equipment with potential to leak.
Atmospheric emissions	• No incineration will take place on board the MODU and support vessels will not use incinerators within the 500 m exclusion zone as per Apache's *Offshore Requirements for Marine Vessels*. • Sulphur content of fuel oil complies with Regulation 14 of MARPOL Annex VI in order to control SOx and particular matter emissions. • MODU and support vessel engines meet NOx emission levels as required by Regulation 13 of MARPOL Annex VI. • MODU/ vessel machinery maintained in accordance with PMS. • Ozone-depleting substances (ODS) will be managed in accordance with Regulation 13 of MARPOL Annex VI.

Hazard	Management Control Measures and Performance Standards
	• Burners will have pilot flames to ensure ignition of hydrocarbons. • Well test programme (DR-23-LD-003) includes requirement for dedicated flare watchers to monitor burners during well testing. • Flare waters in communication with well test supervisor and other relevant crew during well test. • Well testing equipment will have an emergency shutdown system.
Interference with other users of the sea	• Australian Hydrographic Office (AHO) (including hydro.NTM@defence.gov.au) notified of the operational area, activity and duration prior to mobilisation to the drill location, which will trigger AHO to issue a 'Notice to Mariners'. • AMSA RCC notified of notified of the operational area, activity and duration prior to mobilisation, which triggers RCC to issue an AusCoast Warning. • Relevant stakeholders identified and notified of operation area, activity and duration prior to mobilisation. • Navigation equipment and vessels procedures compliant with all marine navigational and vessel safety requirements under the *International Convention of the Safety of Life at Sea (SOLAS) 1974* and *Navigation Act 2012* (or equivalent). • Support vessels will be equipped with an automatic identification system (AIS) and an ARPA system which can identify, track and project the closest approach for any vessel (time and location) within the operational area and radar range (<70 km away). • Bridge-watch will be maintained on all support vessels 24 hours per day. • At least one support vessel to be monitoring the 500 m exclusion zone around the MODU at all times to aid in the detection of other vessels and to provide additional communication with other vessels where necessary.
Well testing	• Any formation water or returned completion brine will be treated through an oily water filtration system and will not be discharged overboard unless <15 ppm. • Oil in water will be measured and monitored throughout operations. • In the event that formation water cannot be filtered to <15 ppm, it will be stored in tote tanks for appropriate onshore disposal. • Filtration equipment will be calibrated prior to well testing and maintained in accordance with the manufacturer's specifications. • Oily water filtration equipment maintained and calibrated in accordance with manufacturer's specifications to ensure oil content is not exceeding 15 parts per million (ppm). • Environmentally friendly burners will be used with pilots for gas and oil flares to ensure ignition and prevent drop out of hydrocarbons. • Well testing facilities are designed and approved as per the scope of the validation as described in the well testing safety case revision. • A dedicated HAZID assessment forms part of the Apache-Atwood Safety Case Revision Well Test Supplement. • A well test HAZOP assessment performed prior to testing operations. • Burners will be constantly monitored by dedicated flare watchers to ensure flare stays lit and no sheen is seen on surrounding waters. • In the event that flare drop out is noted, radio communication will ensure well is shut in immediately. • An emergency shutdown (ESD) system will be in place to prevent/limit hydrocarbon drop out.

Hazard	Management Control Measures and Performance Standards
	• ESD system is function tested prior to activities to ensure it performs shut in within 20 seconds of pressing the button. • Pressure Safety Valves (PSVs) are installed within the surface well test package to automatically relieve system overpressure if the ESD system (primary barrier) fails to activate. The installation of these are designed and reviewed as part of the HAZOP process

Table 10-2: Management control measures and performance standards for unplanned events during the Activity

Hazard	Management Control Measures and Performance Standards
Introduction of marine pest species	• Vessel anti-foulant systems are maintained in compliance with *International Convention on the Control of Harmful Anti-fouling Systems on Ships*. • MODU has AQIS clearance to be in Australian waters. • A biofouling vessel risk assessment (VRASS) is completed prior to mobilisation to Australia as defined within the *National Biofouling Management Guidance for the Petroleum Production and Exploration Industry (Commonwealth of Australia, 2008)* and ranked as 'low'. • Vessels shall exchange 'high-risk' ballast water, as defined in Australian *Ballast Water Management Requirements (AQIS, 2011)*, outside Australian territorial seas and in waters at least 200 m deep.
Solid waste discharges	• Non-hazardous and hazardous wastes collected, stored, processed and disposed of in accordance with the MODU and support vessels' Garbage Management Plan, as required under Regulation 9 of MARPOL Annex V. • Hazardous wastes will be separated, labelled and stored on board with secondary containment (e.g. bin located in a bund) and non-hazardous waste is stored within suitably enclosed bins. • As a minimum, non-hazardous waste produced on the MODU that will be recycled/ segregated from general waste to include paper, cardboard, aluminium cans, scrap metal and empty containers/drums (plastic, tin, metal). • All scrap metal to be collected in bins for appropriate onshore disposal. • Bunding around stored bulk wet chemicals or hazardous waste storage areas are continuous around the entire area. • Solid non-biodegradable and hazardous waste will be disposed of onshore at a suitable waste facility or to a carrier licensed to receive the waste if required by legislation. • Accidental release of waste to the marine environment is reported and investigated and corrective actions are implemented.

Dropped objects	• Compliance with anchor handling procedures which includes:
	  ○ Restrictions during unsafe weather conditions;
	  ○ Double securing of anchors; and
	  ○ No passing of anchors to anchor handling vessels directly over subsea infrastructure;
	• Support vessels will not anchor within the 500 m exclusion zone around the MODU.
	• Material handling and lifting equipment maintained in accordance with the PMS.
	• Lifting equipment certified.
	• All lifts to be completed in accordance with the LEMS as described in the MODU HSE Case and the Apache *Drilling and Completions Standards Manual (AE-91-ID-004)*.
	• Detailed records of any equipment lost overboard completed.
	• Equipment securely sea fastened prior to MODU moving.

Hazard	Management Control Measures and Performance Standards
	• Compliance with equipment handling and lifting procedures demonstrated by mitigation measures being included in JSA. • Wellheads designed to withstand dropped objects, snag loads to prevent loss of containment.
Marine fauna collisions	• Marine fauna identification posters and Marine Fauna Sighting Datasheets will be available on MODU and all support vessels. • In accordance with Part 8 of the EPBC Regulations (Vessels), all vessels must travel at less than 6 knots and minimise noise within the caution zone of a cetacean (150 m radius for dolphins, 300 m for whales) known to be in the area.
Spillage of hydrocarbons, environmentally hazardous chemicals and liquid wastes to the sea	• Chemicals and hydrocarbons will be packaged, marked, labelled and stowed in accordance with MARPOL Annex III regulations. • Chemicals (environmentally hazardous) and hydrocarbons will be stored in bunded areas. • Chemicals and hydrocarbons stored in accordance with relevant MSDS. • All hazardous wastes stored on board the MODU in closed, secure and bunded storage areas prior to transport back to shore for disposal/recycling/treatment in accordance with local regulations. • Chemical and hydrocarbon storage areas will be inspected weekly. • Contaminated material contained on board for onshore disposal in accordance with the *Environmental Protection (Controlled Waste) Regulations (2004)*. • All shipboard chemical spills and hydrocarbon spills will be managed in accordance with SOPEP/ SMPEP. • Spill clean-up equipment will be located where chemicals and hydrocarbons are stored and frequently handled. • Left-over bulk drilling solids (e.g. barite, bentonite) will be stored on board and transferred to a licensed carrier or onshore reception facility, in accordance with the Environmental Protection (controlled waste) Regulations (2004). • During bulk loading of silos, a crew member will be posted at the vent and will remain in contact with the supply vessel to prevent overfilling. • Scupper plugs or equivalent deck drainage control measures available where chemicals and hydrocarbons are stored and frequently handled. • Only non-hazardous, biodegradable detergents will be used for deck washing. • Continuous bunding, or drip trays where appropriate, will be in place around all machinery or equipment with potential to leak hydrocarbons. • Following rainfall events, bunded areas on open decks of the vessels will be cleared of rainwater. • Maintenance records on the MODU and support vessels indicate that all machinery and equipment containing hydrocarbons and equipment involved in the discharge and transfer of liquids have maintenance scheduled on their respective PMS. • Only licensed facility or carrier to receive fuel or oily waste. • Transfer of fuel to and from the MODU in compliance with the MODU's fuel transfer procedure. • All MODU machinery space oily water waste will be disposed of at a licensed onshore reception facility or to a carrier licenced to receive the waste. • As required by MARPOL Annex I Regulations, while in the operational area, support vessels may discharge oily water after treatment to 15 ppm in a MARPOL compliant oily water filter system. • To discharge, the support vessels will require a current International Oil Pollution Prevention (IOPP) certificate for oily water filtering equipment.

Hazard	Management Control Measures and Performance Standards

Hydrocarbon spill during refuelling, base oil transfer, failure of slip joint packer, or inadvertent release of bulk SBM	• Refuelling will only take place if more than 12 nautical miles from the territorial baseline.
	• Fuel and base oil transfers will be undertaken in accordance with Apache's/ Atwood's Refuelling and Chemical Transfer Management Procedure, safe work procedure and checklist for fuel transfers, including but not limited to:
	  ○ Manual sounding of fuel tanks;
	  ○ Visual inspection of dry break couplings and hoses;
	  ○ Fully manned operation;
	  ○ Permit-to-work documentation is complete and signed off to ensure refuelling is undertaken in accordance with the refuelling procedure; and
	  ○ All refuelling hoses fitted with dry break couplings and are buoyant or fitted with floats.
	• Sulphur content of fuel oil complies with Regulation 14 of MARPOL Annex VI in order to control SOx and particulate matter emissions.
	• Adequate bunding in fuel transfer areas as per MARPOL Annex IV.
	• Drainage and bunding systems are subject to on-going monitoring and maintenance to ensure integrity and capacity.
	• Support vessels have oily water filtering systems that are compliant (i.e. discharge oily water only when oil in water <15 ppm), and surveyed, as per MARPOL Annex I/ Marine Order 91.
	• Diesel storage tanks and fuel transfer hose maintenance (including replacement of refuelling hoses every six months and base oil transfer lines at least every 12 months) undertaken in accordance with the PMS.
	• Mud pits to have at least two isolation valves in place, locked shut with the installation management keeping the keys, and only operated under the permit to work system.
	• Mud logging volume sensors calibrated.
	• Oil spill response executed in accordance with the Apache *Brunello Appraisal and Production Drilling OSCP (EA-72-R1-10004.02)*.
	• Oil spill response executed in accordance with the vessel's Shipboard Oil Pollution Emergency Plan (SOPEP) as required under MARPOL.
	• Oil spill exercise conducted prior to the commencement of the drilling activity and then every three months thereafter.
	• In line with MARPOL Annex I, all vessels involved in the drilling activity over 400 gross tonnage will have a current SOPEP in place and a valid IOPP certificate.

Hydrocarbon spill from a ruptured vessel fuel tank due to a collision	• Notification provided to key stakeholders including relevant Australian Government agencies. • AHO (including hydro.NTM@defence.gov.au) notified of operational area, activity and duration prior to mobilisation, which triggers AHO to issue 'Notice to Mariners'. • AMSA RCC notified of operational area, activity and duration prior to mobilisation, which triggers RCC to issue an AusCoast Warning. • Australian Fisheries Management Authority (AMFA), Department of Fisheries and commercial fishing stakeholders notified prior to mobilisation. • Navigation equipment and vessel procedures will be compliant with all marine navigation and vessel safety requirements under the *International Convention of the SOLAS 1974* and *Navigation Act 2012* (or equivalent). • Support vessels equipped with an automatic identification system (AIS) and an ARPA system which can identify, track and project the closest approach for

Hazard	Management Control Measures and Performance Standards
	any vessel (time and location) within the operational area and radar range (<70 km away). • Bridge-watch on all support vessels 24 hours per day. • At least one support vessel monitoring the MODU 500 m exclusion zone at all times to aid in the detection of other vessels and provide additional communication with other vessels where necessary. • Sulphur content of fuel oil complies with Regulation 14 of MARPOL Annex VI in order to control SOx and particulate matter emissions. • Oil spill response executed in accordance with the Apache *Brunello Appraisal and Production Drilling OSCP (EA-72-RI-10004.02)*. • Oil spill response executed in accordance with the vessel's SOPEP as required under MARPOL. • Oil spill exercises conducted as per the OSCP and the SOPEP.
Hydrocarbon spill from a loss of well control	• WOMP details specific well control standards for this Activity and will be approved prior to the commencement of the Activity. • During preparation of the MODU safety case, all risks associated with well blowout are assessed and reduced to ALARP. • After BOP's are installed, the well will have two barriers maintained during drilling, suspension and abandonment activities in accordance with Apache's *Drilling and Completions Standards Manual (AE-91-004, Section 11)*. • The well will be drilled in accordance with Apache's *Well Management Drilling System (WMDS)* to ensure blowout prevention and well control. • Apache's Fluid Selection Process must be followed in order to select the most appropriate drilling mud following offset well data reviews and analysis. • Well control equipment (e.g. BOP) included on the PMS as per Apache's *Drilling and Completions Standards Manual (AE-91-004, Section 11)*. • BOP test conducted at the frequency detailed in the approved Safety Case with date of last test recorded in daily drilling report. • All well control equipment, casings and wellhead equipment will be tested to MASP in accordance with the Apache *Drilling and Completions Barrier Standard (AE-91-ID-004*). • Oil spill response executed in accordance with the Apache *Brunello Appraisal and Production Drilling OSCP (EA-72-RI-10004.02)*. • Oil spill response executed in accordance with the vessel's SOPEP as required under MARPOL. • Oil spill exercises will be conducted as per the OSCP and SOPEP.
Hydrocarbon spill response	Management controls for activities and associated hazards relating to the following are described above: • Disturbance to marine habitat and seabed; • Artificial light; • Noise; • Drilling and cementing liquid discharges; • Oily water discharges; • Liquid non-hazardous and potentially hazardous materials; • Discharge of sewage and sullage; • Discharge of cooling water;

Hazard	Management Control Measures and Performance Standards
	• Desalination brine discharge; • Atmospheric emissions; • Interaction with commercial and recreational fishing; • Interaction with shipping; • Disruption to tourism and/or visual amenity; • Marine pest introduction; • Non-hazardous and hazardous solid waste; • Disturbance to marine fauna; and • Surface release of diesel. Performance standards applicable to all response strategies include: <u>Protection and Deflection Response Strategy</u>: • Development of targeted protection and deflection plans that consider environmental conditions (sea state, currents, habitats), protection priorities against the NatPlan priorities for protection, prior to implementation of boom; • Prior demarcation at shoreline protection areas delineating no-go zones based on protecting environmental sensitivities; • Equipment appropriate for the environmental conditions; • Lead response personnel trained and experienced in planning and deployment of protection and deflection booming; • Booming not deployed during periods of weather and sea state conditions that are not conducive to successful protection; and • Regular (at least daily) check and maintenance of boom to ensure boom is functioning as intended. <u>Shoreline Clean-up Response Strategy</u>: • Development of shoreline clean-up plan appropriate to the nature and scale of the activity; • Lead response personnel trained and experienced in shoreline clean-up operations; • Shoreline assessments used to plan clean-up operations; • Flushing and washing to only use seawater; • Shoreline access permissions and restrictions to be provided by Department of Parks and Wildlife (DPaW) and Department of Transport (DoT) prior to implementation of clean-up operations; • In the case of natural recovery, scientific monitoring of shoreline habitats to inform on recovery; • Pre-planning to include access requirements, no-go zones, and hot/warm/cold zones; • Pre-cleaning of shorelines predicted for contact will reduce the volume of oily waste and reduce the required clean-up resources; • No machinery to be used in mangroves or on turtle nesting beaches; and

Hazard	Management Control Measures and Performance Standards
	• Waste generated to be managed in accordance with the Waste Management Plan. Oiled Wildlife Response (OWR) Strategy: • Development of oiled wildlife response plan appropriate to the nature and scale of the activity; • Lead response personnel trained and experienced in OWR activities; • Field teams accompanied by wildlife experts experienced with identification and behaviour of wildlife at risk; • Planning and implementation of OWR activities to be led by trained and experienced personnel; • Planning of capture and relocation activities to be approved by DPaW prior to implementation; • Effective provision of operational monitoring data to OWR planning teams to identify and prioritise oiled habitats and areas predicted for contact; • Provision of capture equipment appropriate for the fauna being targeted; • Provision of timely and adequate resources to ensure collected fauna begin transport to intended destination within two hours of capture; • Confirmation that the OWR facility able to accommodate washing and rehabilitation of intakes received prior to collection of fauna; and • Prioritisation of conservation status fauna in all OWR activities.

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