Balnaves Development Environment Plan Summary

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CONTENTS

1. INTRODUCTION

Apache Energy Ltd (Apache) proposes to develop the offshore Balnaves oil field within the Northern Carnarvon Basin of the North West Shelf (NWS) in Production Licence WA-49-L (Commonwealth waters) in order to carry out its obligations under the permit.

The purpose of the Balnaves Development is to produce oil from the Balnaves field. The Balnaves field consists of a small, light oil reservoir in the Mungaroo Formation (B20 Sandstone) part of which is overlain by a separate gas bearing formation (B10 Sandstone) approximately 90 m above the oil reservoir.

The development will comprise a subsea production system tied back to a FPSO which includes two production wells, up to two water injection wells and one gas injection well tied back to the FPSO by four flexible flowlines, and a gas lift system, chemical injection system and electro-hydraulic umbilical (EHU).

Apache is the operator of the WA-49-L permit and will be conducting the construction and installation work on behalf of joint venture partner Kufpec Australia Pty Ltd (35%).

1.1 Schedule

Construction and installation includes the installation of mooring legs for the RTM (Phase 1) and installation of riser column, remaining subsea infrastructure and cold commissioning (Phase 2). Phase 1 is scheduled to commence in March 2013, and is expected to take approximately 20 days. Phase 2 is scheduled to commence in October 2013 and will take approximately 90 days to complete. The EP remains in effect until completion of Phase 2, expected January 2014.

1.2 Compliance

The proposed Balnaves Field Development was referred under the Environment Protection and Biodiversity Conservation (EPBC) Act to the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) on the 10th of November 2011 (Ref 2011: 6188). A decision on this action was subsequently provided on the 10th of April 2012, approving the development on the basis that it is 'Not a controlled action if undertaken in a particular manner'.

The Balnaves Development EP has been prepared to comply with the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (OPGGS (E)) under the Offshore Petroleum and Greenhouse Gas Storage Act 2006 (OPGGS Act) (Cmlth). The EP has been reviewed and accepted by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA).

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

2. LOCATION OF THE ACTIVITY

The Balnaves Development is located approximately 172 km west-northwest of Dampier and 216 km northeast of the North West Cape in 136 m of water (**Figure 2-1**). The geographic coordinates for the FPSO mooring and subsea infrastructure are provided in **Table 2-1**.

Table 2-1: Surface locations for the Balnaves oil field development infrastructure

Parameter	Coordinates (Datum/Projection: GDA 94 Zone 50)			
	Latitude	Longitude	Easting	Northing
Balnaves FPSO	-20° 03’ 31.302”	115° 11’ 31.069”	310 916.00	7 781 000.00
Production 1 Well	-20° 04’ 12.667”	115° 11’ 00.611”	310 044.81	7 779 718.37
Production 2 Well	-20° 04’ 14.444”	115° 11’ 00.257”	310 035.13	7 779 663.60
Gas Injection Well	-20° 04’ 14.037”	115° 11’ 01.758”	310 078.58	7 779 676.60
Water Injection Well	-20° 04’ 12.850”	115° 11’ 01.550”	310 072.14	7 779 713.04
Balnaves Manifold	-20° 04’ 13.624”	115° 11’ 00.813”	310 051.00	7 779 689.00

For the purposes of defining operational boundaries, all project vessels are considered to be undertaking the described activity when they are located within the area defined (‘defined area’) by the geographic coordinates shown in **Figure 2-2.**

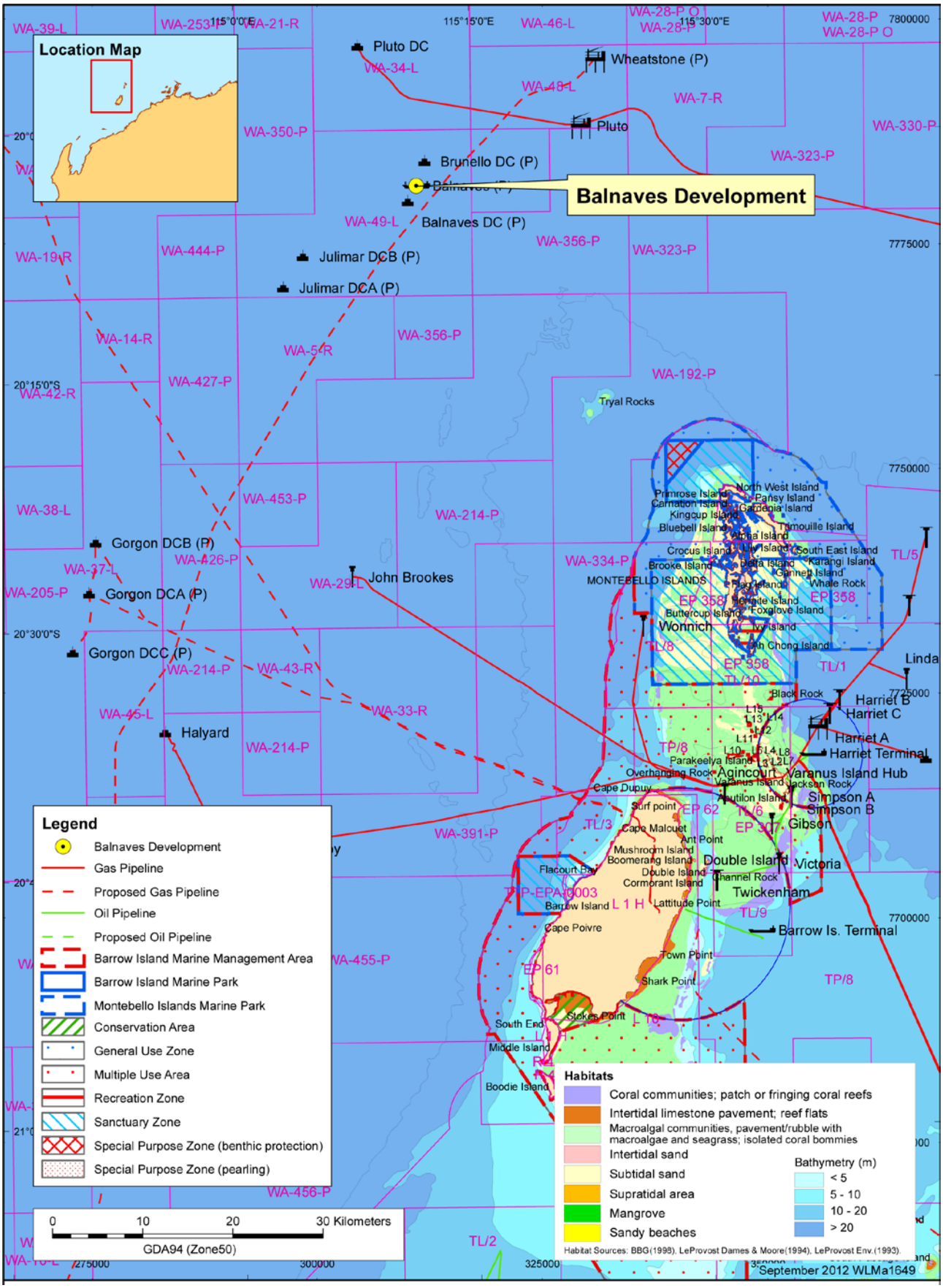

Figure 2-1: Location map for the Balnaves Field Development

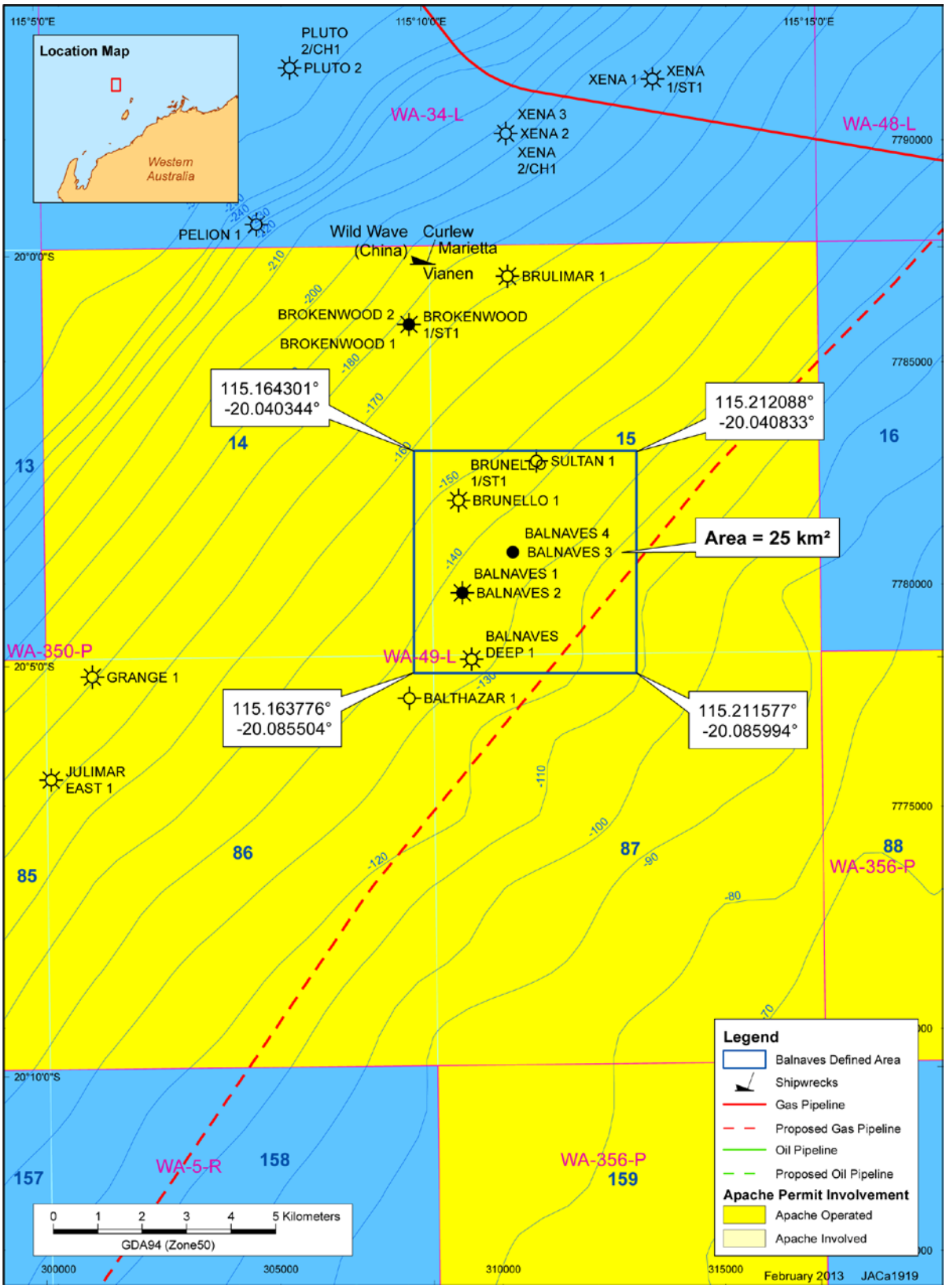

Figure 2-2: Balnaves Field Development 'defined area'

3. DESCRIPTION OF THE RECEIVING ENVIRONMENT

3.1 Physical Environment

The proposed Balnaves Development is located in the North West Shelf (NWS). The region is typical of the arid tropics; high summer temperatures, periodic cyclones and associated rainfall. Rainfall is generally low although intense rainfall may occur during passage of summer tropical cyclones. NWS waters are usually thermally stratified with a marked change in water density at approximately 20 m (SSE, 1993). Surface temperatures vary annually, being warmest in March (32^{o}C) and coolest in August (19^{o}C). Vertical gradients are correlated to sea surface temperatures, and are greatest during the warm-water season (SSE, 1991). Near bottom water temperature is approximately 23^{o}C, with no discernible seasonal variation.

Wind shear on surface waters generates local-scale drift currents that can persist for extended periods (hours to days). During summer (October–March), the prevailing non-storm winds are from the southwest, west and northwest at an average speed of less than 10 knots, peak average speeds of 15–25 knots, and maximum speeds of 30 knots. Winds from the southeast to northeast quadrant are experienced at a frequency of less than 10% over summer. In winter (May–August), winds are generally lighter and more variable in direction than in summer. Non-storm winds prevail from the northeast through to southeast at 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. 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). 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).

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) and thus will have greater influence upon the trajectory of slicks over time scales exceeding a few hours (APASA, 2011).

3.2 Biological environment

Benthic habitats within the ‘defined area’ are composed of soft sediments and associated benthic fauna. Soft sediments support a diverse benthic infauna consisting predominantly of mobile burrowing species which include molluscs, crustaceans (crabs, shrimps and smaller related species), polychaetes, spinculid and platyhelminth worms, asteroids (sea stars), echinoids (sea urchins) and other small animals.

The spatial and temporal distribution and density of these organisms depends on factors such as substrate composition, season, depth and water temperature (Ward and Rainer, 1988; Rainer, 1991; Kinhill, 1997). Ward and Rainer (1988) reported a seasonal pattern in the abundance of small species of decapod crustaceans in this region. It was not clear if this pattern was related to season or to other factors, such as storm events, which operate on much shorter time scales. By comparison, the diversity and abundance of large encrusting animal species in this region is relatively low (Ward and Rainer, 1988; LeProvost Environmental Consultants (LEC), 1990). This is probably due to instability of the sediment and the lack of exposed and colonisable reef.

The Balnaves Development is located in Commonwealth waters, offshore from the WA mainland. Significant features in the region include Dampier Archipelago (1146 km SE), Varanus Island (76 km SE), Montebello Marine Park (40 km SE), Barrow Island (72 km SE), Montebello and Lowendal Island group (48km SE), and the Ningaloo World Heritage Area (189 km S). The defined area does not overlie any of these identified features. Key ecological features are the parts of the marine ecosystem that are considered to be important for the biodiversity or ecosystem functioning and integrity of the Commonwealth Marine Area. From the EPBC Act Protected Matters search one feature was identified: Ancient coastline at 125 m contour was identified within the defined area. This is a unique seafloor feature which may be used by migratory species as a guide when moving throughout the region.

The EPBC Act Protected Matters Database (DSEWPaC, 2012a) identified nine species of marine fauna found in the defined area area listed as threatened species (endangered or vulnerable) under the EPBC Act, all of which are migratory, and a further seven migratory species were also identified. The species listed included three fish, seven cetaceans, five turtles and one seabird.

Phase 2 of the development may coincide with the southern migration of humpback whales (September – October) and blue whale (November – December), and peak turtle nesting season (November – January). The width of the blue whale migration corridor in the region (>200 km) indicates interactions will be highly unlikely. The nearest turtle nesting sites are located in the Montebello, Lowendal and Barrow Islands (48 to 72 km SE).

3.3 Socio-economic environment

Both the offshore and coastal waters in the NWC Region support a valuable and diverse commercial fishing industry, mainly dominated by the Pilbara fisheries. There is one Commonwealth fishery overlapping or close to the area of the development - the North West Slope Trawl Fishery. Other Commonwealth fisheries, such as the Western Tuna and Billfish Fishery (WTBF), Southern Bluefin Tuna Fishery (SBFTF) and the Western Skipjack Tuna Fishery (WSTF), are licenced to fish within the defined area, but no recent fishing effort has been reported. In addition, seven State managed fisheries have boundaries that overlie or are in close proximity to part or all of the activity location (DoF, 2011): Onslow Prawn Managed Fishery (OPMF), Mackerel Fishery, Pilbara Demersal Scalefish Fishery (Trap and Trawl), Pearl Oyster Managed Fishery, Beche-de-mer Fishery, Marine Aquarium Fish Fishery and Specimen Shell Managed Fishery.

The defined area falls within the North Coast Bioregion (DoF, 2011) where recreational fishing is experiencing significant growth. Offshore islands, coral reefs and continental shelf provide species of major recreational interest (DoF, 2011). However, recreational fishing within the defined area is unlikely given the distance offshore.

There are no recognised shipping routes in or near the Balnaves Field Development area. Construction and installation is located approximately 40 km southeast of a designated shipping route (AMSA, 2012).

The Balnaves Development area and surrounding waters are also used for petroleum exploration and development. The defined area is located approximately 2-3 km south of the Brunello gas field, approximately 13 km northeast of the Julimar gas field and approximately 1.5 km northwest of the proposed pipeline from the Wheatstone offshore facilities to the proposed LNG plant at Ashburton.

Tourism activities are concentrated in the vicinity of Exmouth, Dampier, Onslow, Point Samson and Port Hedland. In the waters immediately surrounding the Balnaves development area, tourism activities are limited due to its distance from the mainland and island shorelines.

There are no World Heritage, Commonwealth Heritage or National Heritage sites, or Wetlands of International Importance (Ramsar sites) in or adjacent to the construction and installation. The nearest sites are Ningaloo World Heritage Area (189 km SW), Montebello-Barrow Islands Marine Conservation Reserve (48 km SE), Ningaloo Marine Area (205 km SW) and Eighty Mile Beach (525 km east). No registered

Aboriginal heritage sites are located within or in close proximity to the Balnaves Field Development. The National Shipwrecks Database lists seven shipwrecks in the 'Montebellos Area' (DSEWPaC, 2012c), 183 shipwrecks near/around 'Broome Area', and eight shipwrecks in the 'Onslow Area'. The Wild Wave shipwreck is approximately 5 km northwest of the construction and installation defined area. As activities will not occur outside of the defined area, no impact is expected on the Wild Wave shipwreck.

4. DESCRIPTION OF THE ACTIVITY

There are two phases to the construction and installation for the Balnaves Development: Phase 1 involves the installation of six mooring legs for the Riser Turret Mooring (RTM), Phase 2 involves installing the RTM column and all remaining subsea infrastructure and functional testing.

Two Mooring Installation Vessels (MIV) will be used during Phase 1, *Lewek Teal* and *Deep Sea 1*. One Dynamically-Positioned Installation Vessel (DPIV) will be used during Phase 2, the *Deep Orient*. In addition, two AHV/Tow vessels (yet to be identified) and one support vessel (on long-term charter to Apache) will be used temporarily during both phases of the development.

Installation activities are conducted 24 hours a day, seven days a week.

4.1 Installation activities

Phase 1 – Installation of the six mooring leg

The mooring legs, each consisting of a 35 tonne anchor shackled to 800 m of studless chain (102 mm), will be proof-loaded to bed the anchors below the seabed. The mooring chains will then be lowered from the MIV and laid down on the seabed with recovery rigging attached. All six anchors will be set, chains trimmed to final length required and laid along their respective corridors before abandoning them on the seabed. Anchor depth penetration is expected to be approximately 4m at the full proof load.

Phase 2 – Installation of the RTM column and all remaining subsea infrastructure and functional testing

The RTM is towed to the defined area and upended into a vertical orientation and design stability achieved from solid ballast pumped into the clumpweight compartments. After upending, a work platform is lifted onto the RTM supporting subsequent chain and riser pull in operations. Installation of the manifold (central control unit for the wells) will be with a crane lift off the deck of the DPIV and down to the seabed. Riser tether bases provide a hold down point on the seabed for the riser tethers and will be installed by lifting off the deck of the DPIV onto the seabed. The risers, flowlines and an electro-hydraulic umbilical are installed from the DPIV, laid from the RTM to the manifold. Following this, subsea christmas trees, using piping and control systems to link to the manifold and FPSO, are installed using an ROV. The gas lift jumpers (60m long, 2 inch flexible pipes) are lowered to the seabed by crane and placed in the final tie-in position by ROV. The electro-hydraulic flying leads (EHFLs) provide electrical and hydraulic controls linkage between the four wells and the manifold. The EHFL is lowered to the seabed and the ROV flies it to the appropriate connection point on the manifold or well christmas tree.

Once all the subsea piping elements have been installed and tied-in, a hydrotest (or leak test) is carried out, followed by functional testing on completion of all installation works in the field.

5. ENVIRONMENTAL HAZARDS AND CONTROLS

The environmental risk assessment for operational activities and unplanned events for the construction and installation phases of the Balnaves Field Development centred around a hazard identification workshop. The workshop, held on the 12th of September 2012, was attended by a subset of Apache's environmental scientists and construction and engineering personnel, and facilitated by an independent consultancy (Oracle Risk Consultants). The outcomes of a broader scale hazard identification workshop on the Balnaves Development (Oracle, 2012), independently facilitated by risk consultants using the combined experience of Apache's Drilling, Operations, Environment and Logistics Departments, was used to inform the Balnaves Development construction and installation workshop.

The purpose of the risk assessment was to understand and identify the potential environmental hazards, their causes and the potential impacts associated with Phase 1 and 2 installation activities to ensure they are reduced to As Low As Reasonably Practicable (ALARP). Apache's management and mitigation actions aim to reduce the environmental risks arising from the activities associated with the proposed Balnaves Development to ALARP. These 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 nine routine environmental risks and seven non-routine (unplanned events) environmental risks. The key environmental hazards and control measures to be applied to the Balnaves Development are provided in **Section 9**. These 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 Balnaves Development will be managed in compliance with the *Balnaves Development Environment Plan (EA-00-RI-006/1)* 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 the Balnaves Development during both routine operational activities and unplanned events, 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 for each environmental impact identified (and assessed in the Environmental Risk Assessment) specific performance objectives, standards and procedures and identifies the range of controls to be implemented (consistent with the standards) (**Section 9**) to achieve the performance objectives. The EP also identifies the specific measurement criteria and records to be kept to demonstrate the achievement of each performance objective.

The goals of the environmental implementation strategy as detailed in the EP are to direct, review and manage activities so that environmental impacts and risks are continually being reduced to ALARP, and performance objectives and standards are met over the duration of the construction and installation activity. It includes the following:

1. Details on the systems, practices and procedures to be implemented;
2. Key roles and responsibilities;
3. Training and competencies for all personnel (Apache and contractors);
4. Monitoring, auditing, inspections, management of non-conformance and review;
5. Record Management;
6. Emergency Response and preparedness including an OSCP (EA-72-RI-006/2);
7. Consultation; and
8. End of Activity Phase Reporting and Incident Reporting

The reporting requirements for routine activities and environmental incidents (recordable and reportable) and reporting on overall compliance of the activity with the EP (e.g. conformance reports submitted to NOPSEMA within 3 months of each phase completion) are also detailed.

7. CONSULTATION

Apache maintains an updated stakeholder database containing fishing interest groups, government and non-government authorities and other stakeholder parties including the community of Exmouth and adheres to its Stakeholder Consultation Strategy. This database was used to identify stakeholders located, or operating, in the proximity of the Balnaves Field Development. Apache has maintained relationships to assist information sharing with key stakeholders for many years and regularly communicates with stakeholders on a variety of activities, always seeking comment and fielding enquiries.

Relevant interested parties for consultation directly relating to the construction and installation activities were identified on the basis of the 'defined area'. Stakeholders identified for the Balnaves Development construction and installation activities are listed in **Table 7-1**.

Table 7-1: Summary of stakeholders consulted for the construction and installation phase of the Balnaves Field Development

Group	Stakeholder
Commercial fisheries	• Australian Fisheries Management Authority (AFMA) • 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 • Pearl Producers Association
Recreational fisheries	• RecFish West
Marine conservation	• Commonwealth Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) • Department of Environment and Conservation (DEC)
Shipping safety and security	• Australian Maritime Safety Authority (AMSA) • Royal Australian Navy and General Defence • Department of Defence
Hydrocarbon spill response	• Department of Transport (DoT) • Australian Marine Oil Spill Centre (AMOSC)
Adjacent regulators	• Department of Mines and Petroleum (DMP)

The Apache Energy Quarterly Project Update was provided in response to stakeholder request for a more streamlined consultation. In December 2012, Apache Energy disseminated to all stakeholders advanced notification of proposed activities in a quarterly update for quarters Q1 and Q2 2013. Stakeholders were urged to contact Apache Energy should they require further information or have any concerns with the activities showcased. Correspondence was received following the issue of the quarterly update, but no concerns with the Balnaves Development were raised. In addition, an information package detailing both phases of the construction and installation activity was sent to stakeholders on the 6th February 2013. Apache will consider any feedback received from stakeholders over the nine months between provision of the information package and commencement of Phase 2.

Apache will remain available before, during and after completion of the construction and installation phases of the Balnaves Field Development to listen to any concerns of stakeholders. Consultation on the development project will be ongoing through to start up and operation of the Balnaves FPSO.

8. CONTACT DETAILS

Further information about the Balnaves Field Development construction and installation activities can be obtained from:

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9. ENVIRONMENTAL ASPECTS, IMPACTS AND CONTROLS

The following tables (**Table 9-1** and **Table 9-2**) provide a summary of potential environmental impacts that could be expected from the Balnaves Development construction and installation activities. It lists the activities which might give rise to environmental impacts and the subsequent controls and measures which eliminate or ensure the environmental risk is reduced to ALARP.

Table 9-1: Environmental risk summary for operational activities for Balnaves Field Development.

Hazard	Cause	Potential Impacts	Risk Treatment Avoidance, Mitigation & Management Measures
Vessel Movement	The physical presence of project vessels within the defined area	Death or injury to marine fauna, notably cetaceans, from vessel strike and behavioural disturbance.	• Fauna observation kits (including as a minimum binoculars and fauna observation recording sheets) will be available on all vessels to ensure crew have the necessary equipment available to record observations • All cetacean and whale shark sightings will be recorded on the Apache Marine Fauna Sighting Datasheet with data submitted to DSEWPaC • All crew will attend an environmental induction containing basic information on procedures to manage interactions between vessels and marine fauna. • The interaction of all vessels with cetaceans and whale sharks will be consistent with *Part 8 of the EPBC Regulations 2000*, which for these installation activities includes the following o A vessel will not travel at greater than 6 knots within 300 m (caution zone) of a cetacean (or whale shark) known to be in the area; o A vessel will not approach closer than 100 m of a cetacean (or whale shark) known to be in the area; o If a dolphin approaches the vessel or comes within 100 m the vessel master must not change the course or speed of the vessel suddenly.
Seabed disturbance	Laying of subsea infrastructure; Stirring up of sediments by ROV propellers; Dropped objects; Release of iron ore slurry during ballasting of riser column.	Localised disturbance to seabed, resulting in loss of or change in benthic habitat.	• No anchoring by the installation vessels within defined area – use of dynamic positioning only. Mooring and anchoring will only be undertaken in an emergency (e.g., poor weather) outside the project area. • A pre-installation survey will be conducted to prevent destruction of any previously unsighted significant seabed features • A remotely-operated vehicle (ROV) pre-lay survey along the chain corridors and at the anchor locations will be carried out to identify obstructions, rock outcrops and other seabed disturbances • The RTM must be anchored in the proposed manner to ensure the FPSO does not drift while the wells are operational. • Anchors will be positioned in accordance with the Mooring Analysis (GM-46295-0612-472284) specific to the wells • Subsea structures are gravity foundations (rather than piled). • Flowlines to be laid on seabed rather than trenched. • Lifting safety standards and systems will be as per the DPIV Safety Case and Safety Case Revision (SMS-HSE-201) for the DPIV and Technip's Lifting Operations Guidelines (MOS-CRN-010), General Rigging

Hazard	Cause	Potential Impacts	Risk Treatment Avoidance, Mitigation & Management Measures
			Specification (ENG-201-TN-020), and Rigging Design Guidelines (ENG-201-TN-033). • Detailed records of equipment lost overboard will be recorded • During mobilisation/demobilisation all equipment and gear on all vessels are securely sea fastened. • Mitigation measures for equipment handling and lifting procedures are included in Job Safety Assessments to minimise dropped objects entering the marine environment and will include; o Weather limits for crane lifts. o Use of competent crane operators. o Use of certified lifting equipment. • A complete as left survey of the anchors (now bedded below mudline) and chains will be conducted prior to the MIVs departing the field • An ROV survey of the seabed will be completed at the end of the installation activity to check for dropped objects. Where practically feasible, dropped objects will be retrieved. • Crew members involved with lifting and offloading equipment from the vessels will be trained in Technip's Lifting Operations Guidelines (MOS-CRN-010), General Rigging Specification (ENG-201-TN-020), and Rigging Design Guidelines (ENG-201-TN-033) and be aware of lifting and offloading requirements • Planned maintenance undertaken on material handling and lifting equipment undertaken in accordance with the DPIV and MIV's Planned Maintenance System (PMS). • Transfer of chemicals and hydrocarbons will only be carried out under suitable conditions at the discretion of both the vessels OIM and master and will be monitored at all times by competent crew.
Oily water discharges	Routine drainage system discharge from vessels Routine discharge of water through the drainage system.	Temporary reduction of water quality in the vicinity of the release point and the potential for toxicological impacts to marine flora and fauna.	• Oil filtering equipment will be designed and operated in compliance with MARPOL 73/78 Annex I, which requires: o Oily water discharged to sea after passing through filtering equipment not to exceed an oil content of 15 parts per million (ppm); and o The oily water discharge stream, on detection of an OIW content greater than 15ppm, shall be automatically shut-in or directed in-board for further treatment or storage; and o Oily water to be discharged while proceeding en route o A current and valid International Oil Pollution Prevention Certificate (IOPPC) • All shipboard operations associated with oil transfer/movement are recorded in the Oil Record Book. • The Oil Detection Monitoring Equipment (ODME) on the discharge stream will be certified and routinely calibrated. It will also be maintained in accordance with manufacturer's specifications via the vessel's PMS • Vessels without oil filtering equipment will hold oily bilge water on-board and dispose of the oily water on return to port. • Onshore oily water disposal will be at a reception facility or to a carrier licensed to receive the waste oil.

Hazard	Cause	Potential Impacts	Risk Treatment Avoidance, Mitigation & Management Measures
			• The vessel operator will record the quantity, time and onshore location of the oily water disposal in the vessel Oil Record Book. • Oily filtration residue separated in the treatment system will be collected in a dedicated on-board tank and will be disposed of onshore at a reception facility or to a carrier licensed to receive the waste. • Hydrocarbon containers and any temporary equipment containing hydrocarbons will be packaged, marked, labelled and stowed in accordance with MARPOL 73/98 Annex I, II and III regulations. • All temporary equipment (containing hydrocarbons) and hydrocarbons will be stored in appropriately bunded areas. • A Material Safety Data Sheet (MSDS) will be available for all onboard hydrocarbons
Sewage discharges	Sewage and grey water will be produced through the routine operation of the vessels.	Temporary and localised water column turbidity, localised nutrient enrichment and toxicity of water, potential negative physiological or behavioural effects to some threatened marine fauna.	• Untreated sewage will be stored onboard and disposed of onshore at a reception facility or to a carrier licensed to receive the waste, or discharged at a distance of more than 12 nautical miles from the nearest land • Treated sewage will be discharged in compliance with Regulation 11 of MARPOL 73/78 Annex IV • Sewage system will be compliant with Regulation 9 of MARPOL 73/78 Annex IV and be maintained in accordance with manufacturer's specifications. If the STP system fails, untreated sewage will be stored onboard while the STP system is being repaired, and only discharged (more than 12 nm from shore) in an emergency situation if storage reaches capacity. • Vessel masters will ensure that the maximum carrying capacity of the sewage system is not exceeded. Any vessel carrying more than 15 people is required to have an International Sewage Pollution Prevention Certificate.
Food scrap discharges	Food-scraps will be produced through the routine operation of the vessels.	Temporary and localised water column turbidity and potential negative behavioural effects to some threatened marine fauna	• Food waste will be collected, stored, processed and disposed of in accordance with the vessel's garbage or waste management plan. Placards will be displayed vessels to provide guidance on vessel garbage disposal requirements. • Offshore food waste disposal in accordance with MARPOL 73/78/97 Annex V including: o Food discharged at least 12 nautical miles from the nearest territorial baseline if unmacerated; or o Food discharged at least 3 nautical miles from the nearest territorial baseline if macerated to 25 mm or less. • Food macerators have the required Annex V MARPOL 73/78/97 approval and maintained in accordance with manufacturer's specifications. • All onshore and offshore disposed food waste will be recorded in the vessel's Garbage Record Book. • If there is no macerator onboard or macerator equipment breaks down, food will be frozen for disposal at an approved onshore facility.

Hazard	Cause	Potential Impacts	Risk Treatment Avoidance, Mitigation & Management Measures
Atmospheric emissions	Combustion fuel from the vessel and fixed and mobile deck equipment engines. The use of fuel to power vessel engines, generators and mobile and fixed plant.	Temporary and localised decrease in air quality, contribution to greenhouse gas loadings.	• Incinerators will be operated in accordance with a manufacturer's operating manual and the incineration of certain substances will be prohibited • Fuel oil will meet regulated sulphur content levels in order to control SOx and particular manner emissions • Vessel engines will be operated in a manner so that regulated NOx emission levels are achieved. To minimize emissions, vessel machinery will be maintained in accordance with the manufacturer's specifications and the vessels planned maintenance system. • Vessels will hold a valid and current International Air Pollution Prevention Certificate (IAPPC). • Ozone-depleting substances (ODS) will not be deliberately released in the course of maintaining, servicing, repairing or disposing of systems or equipment. ODS will only be handled by qualified and trained personnel • All ODS recorded in ODS Record Book
Noise emissions	Underwater noise generated by vessels, helicopters and positioning transponders within the defined area.	Potential negative physiological or behavioural effects to threatened marine fauna.	• Noise generating engines and equipment is scheduled on the PMS and is maintained in accordance with manufacturer's specifications • Interaction of all vessels with cetaceans and whale sharks will be consistent with *Part 8 of the EPBC regulations 2000*, which for these installation activities includes the following: o A vessel will not travel at greater than 6 knots within 300 m (caution zone) of a cetacean (or whale shark) known to be in the area; o A vessel will not approach closer than 100 m of a cetacean (or whale shark) known to be in the area; o If a dolphin approaches the vessel or comes within 100 m the vessel master must not change the course or speed of the vessel suddenly. • All crew will attend an environmental induction containing basic information on procedures to manage interactions between vessels and marine fauna. • Fauna observation kits (including as a minimum binoculars and fauna observation recording sheets) will be available on all vessels to ensure crew have the necessary equipment available to record observations. • All cetacean and whale shark sightings will be recorded on the Apache Marine Fauna Sighting Datasheet with data submitted to DSEWPaC • Helicopters will maintain industry accepted horizontal, altitude and hovering exclusion zones. The helicopter exclusion zones will be consistent with the Australian National Guideline for Whale and Dolphin Watching (2005).

Hazard	Cause	Potential Impacts	Risk Treatment Avoidance, Mitigation & Management Measures
			• Flowlines will be laid, not jetted, into the seabed. • Subsea infrastructures are gravity foundations, avoiding the use of piling • The high frequency acoustic transducers will be used for 2 hours at each of the eight locations, a total of only 16 hours. The transducers do not continually transmit, but are interrogated at intervals by the DPIV.
Artificial light	Deck floodlights and maritime navigational lighting kept on 24 hours a day for maritime safety purposes for all vessels.	Attraction of fauna such as fish, turtles and migratory birds, leading to possible increased predation.	• Deck lights will be switched off and spot lights directed inboard to reduce light spill onto marine waters unless inconsistent with navigation and vessel safety standards. • Night-time activities will be avoided, if practicable, to reduce direct lighting onto marine waters.
Interference with other users of the sea	500m exclusion zone around the vessels within the defined area.	Temporary loss of fishing area or inconvenience to fishing practices. Fishing gear snags or equipment damage. Navigational hazard and vessel collision.	• AFMA, Department of Fisheries and commercial fishing stakeholders five days prior to the activity commencing and three days after demobilization. • Australian Hydrographic Office (AHO) at least six weeks prior to the activities, which will trigger AHO to issue a Notice to Mariners. • Australian Maritime Safety Authority (AMSA) Rescue Coordination Centre (RCC) two weeks prior to the activities, which will trigger RCC to issue an AusCoast Warning. • Construction and Installation operations will be undertaken in accordance with all marine navigation and vessel safety requirements under the International Convention of the Safety of Life at Sea (SOLAS) 1974 and Navigation Act 1912.For the MIV, DPIV, tow and support vessels, this requires equipment and procedures to comply with AMSA Marine Orders Part 30: Prevention of Collisions and Marine Orders Part 21: Safety of Navigation and Emergency Procedures. • The MIV, DPIV, tow and support vessels will also be equipped with an automatic radar plotting aid (ARPA) system capable of identifying, tracking and projecting the closest approach for any vessel (time and location) within the operational area and radar range (up to approximately 70 km) • Visual observations will be conducted by trained watch keepers on all vessels 24 hours per day. • Support vessels will be employed to aid in the detection of other vessels and to provide additional communication with other vessels where necessary. • The support vessels will assist in maintaining the requested clearance of 500m around the MIVs and DPIV.

Table 9-2: Environmental risk assessment summary for unplanned events for Balnaves Field Development.

Hazard	Cause	Potential Impacts	Risk Treatment Avoidance, Mitigation & Management Measures
Solid waste discharges	Waste not properly contained.	Marine pollution. Injury or death of marine fauna through ingestion (e.g. flatback turtles) or entanglement	• Non-biodegradable and hazardous wastes will be collected, stored, processed and disposed of in accordance with the vessel's: o Garbage Management Plan as required under Regulation 9 of MARPOL 73/78 Annex V; and o Shipboard Waste Management Plan as required under AMSA Marine Order 95: Marine Pollution Prevention – Garbage. o Accidental release of waste to the marine environment is reported and investigated and corrective actions are implemented. • All crew will be required to attend an environmental induction containing basic information on waste management. • Hazardous wastes (e.g. used oils, lithium batteries, chemical and metallic wastes) will be segregated, labelled and stored onboard with secondary containment (e.g. bin located in a bund). • Incinerators will be operated in accordance with a manufacturer's operating manual and the incineration of certain substances will be prohibited (as defined in Regulation 16 (2) in MARPOL 73/78 Annex VI). • Solid non-biodegradable and hazardous wastes that cannot be incinerated will be disposed of onshore at a reception facility or to a carrier licensed to receive the waste if required by jurisdictional legislation.
Discharge of treated water	Leak testing of the flowlines.	Marine Pollution Short-term reduction in water quality Toxic effects on marine fauna	• Hydrotest and preservative fluids will be packaged, marked, labelled and stowed in accordance with MARPOL 73/98 Annex I, II and III regulations. Specifically, all chemicals (environmentally hazardous) and hydrocarbons will be stored in appropriately bunded areas. • A Material Safety Data Sheet (MSDS) will be available for all onboard chemicals. • Vessel personnel involved in hazardous material transfer and handling will follow Technip's Handling of Hazardous Substances (GWP-HSE-209) and complete a PTW. • All crew will be required to attend an environmental induction containing basic information on chemical management, as well as spill prevention, response measures and management of the waste from spill response. An oil spill exercise will be conducted prior to the commencement of the activities and at a minimum of every three months thereafter. • Spill clean-up equipment will be located where chemicals and hydrocarbons are stored and frequently handled (i.e. 'high risk' areas) and will be regularly inspected. • Hydrotest and preservative fluids spills will be immediately cleaned up and contaminated material will be contained onboard for onshore disposal. All shipboard chemical spills will be managed in accordance with the Shipboard Oil Pollution Emergency Plan (SOPEP). • All vessels will be compliant with MARPOL 78/78/97 Annex I. Vessels over 400 gross tonnage will have a

Hazard	Cause	Potential Impacts	Risk Treatment Avoidance, Mitigation & Management Measures
			current SOPEP and IOPP certificate. • Scupper plugs or equivalent will be available vessel decks where chemicals are stored and frequently handled (i.e.' high risk' areas). Non-hazardous, biodegradable detergents will be used for deck washing. • Drip trays will be used under portable equipment • All subsea infrastructure will be pressure (strength) tested in the factory, minimising the offshore testing required to only a system leak test. • Pressure will be used to test joint integrity in the field. • The hydrotest and preservative fluids have the lowest environmental toxicity possible for the purpose.
Discharge of subsea control fluid	Release of fluid during connection of EHFLs; Functional testing of valves during cold commissioning; Equipment failure; Tie-in of umbilicals to Manifold and Christmas trees.	Temporary decrease in water quality	• Chemicals will be packaged, marked, labelled and stowed in accordance with MARPOL 73/98 Annex I, II and III regulations. Specifically, all chemicals (environmentally hazardous) and hydrocarbons will be stored in appropriately bunded areas. • A Material Safety Data Sheet (MSDS) will be available for all onboard chemicals. • Vessel personnel involved in hazardous material transfer and handling will follow Technip's Handling of Hazardous Substances (GWP-HSE-209) and complete a PTW. • All crew will be required to attend an environmental induction containing basic information on chemical management, as well as spill prevention, response measures and management of the waste from spill response. An oil spill exercise will be conducted prior to the commencement of the installation activities and at a minimum of every three months thereafter. • Spill clean-up equipment will be located where chemicals and hydrocarbons are stored and frequently handled (i.e. 'high risk' areas). • Chemical spills will be immediately cleaned up and contaminated material will be contained onboard for onshore disposal. All shipboard chemical spills will be managed in accordance with the Shipboard Oil Pollution Emergency Plan (SOPEP). • All vessels will be compliant with MARPOL 78/78/97 Annex I. Vessels over 400 gross tonnage will have a current SOPEP and IOPP certificate • Scupper plugs or equivalent will be available on rig and support vessel decks where chemicals are stored and frequently handled (i.e.' high risk' areas). Non-hazardous, biodegradable detergents will be used for deck washing. • Drip trays will be used under portable equipment. • All subsea infrastructure will be pressure (strength) tested in the factory, minimising the offshore testing required to only a system leak test. • Pressure will be used to test joint integrity in the field. • The chemicals added to the leak test water have the lowest environmental toxicity possible for the purpose. • Use armoured cable for umbilicals to protect them from dropped objects.

Hazard	Cause	Potential Impacts	Risk Treatment Avoidance, Mitigation & Management Measures
Spillage of hydrocarbons and chemicals to the sea	Equipment malfunction, corrosion and inadequate bunding.	Short term decrease in surface water quality and subsequent contamination of marine organisms.	• All crew will be required to attend an environmental induction containing basic information on chemical and hydrocarbon management, as well as spill prevention and response measures. An oil spill exercise will be conducted prior to the commencement of the construction and installation activities and at a minimum of every three months thereafter. • Chemicals and hydrocarbons will be packaged, marked, labelled and stowed in accordance with MARPOL 73/98 Annex III regulations. Specifically, all chemicals (environmentally hazardous) and hydrocarbons will be stored in appropriately bunded areas. • A Material Safety Data Sheet (MSDS) will be available for all onboard chemicals and hydrocarbons. • Chemical and hydrocarbon storage areas will be frequently inspected (at least weekly). • All vessel machinery will be included on the vessel's PMS and maintained in accordance with manufacturer's specifications. • Spill clean-up equipment will be located where chemicals and hydrocarbons are stored and frequently handled (i.e. 'high risk' areas). • Chemical and hydrocarbon spills will be immediately cleaned up and contaminated material will be contained onboard for onshore disposal. All shipboard chemical and hydrocarbon spills will be managed in accordance with the Shipboard Oil Pollution Emergency Plan (SOPEP) and the Balnaves Development Construction and Installation OSCP (EA-72-RI-006/2). • Scupper plugs or equivalent will be available on vessel decks where chemicals and hydrocarbons are stored and frequently handled (i.e.' high risk' areas). Non-hazardous, biodegradable detergents will be used for deck washing. • Marine Diesel Oil compliant with the MARPOL Annex VI Regulation 14.2 (i.e. sulphur content of less than 3.50%m/m) is the only engine fuel recorded on the fuel bunkering register for vessels.
Hydrocarbon spill from ruptured vessel fuel tank	Vessel collision	Surface water diesel slick, with death, physiological or behavioural impacts to marine fauna Decrease in surface water quality	• The Australian Hydrographic Office of proposed activity, location (i.e. vessel location) and commencement date to enable a Notice to Mariners to be issued. • The AMSA RCC of proposed activity, location (i.e. vessel location) and commencement date to enable a AusCoast warning to be issued. • Consultation with other users, e.g. fishing industry. • Vessel operations will be undertaken in accordance with all marine navigation and vessel safety requirements under the International Convention of the Safety of Life at Sea (SOLAS) 1974 and Navigation Act 1912. For vessels, this requires equipment and procedures to comply with AMSA Marine Orders Part 30: Prevention of Collisions and Marine Orders Part 21: Safety of Navigation and Emergency Procedures, Marine Orders Parts 3 and 6 – Seagoing Qualifications and Marine Radio Qualifications Marine Orders Part 27 – Radio Equipment. • Adherence to the NOPSEMA-approved DPIV Safety Case and Safety Case Revision (SMS-HSE-201). • All vessels undergo an International Marine Contractors Association (IMCA), Common Marine Inspection Audit (CMID) inspections to confirm that they meet international HSE and maintenance standards.

Hazard	Cause	Potential Impacts	Risk Treatment Avoidance, Mitigation & Management Measures
			• Surveillance of the 500-m safety exclusion zone to prevent third party vessels colliding with the DPIV and MIV. • 24 hour visual, radio and radar watch will be maintained by all vessels. • A support vessel will be employed to aid in the detection of other vessels and to provide additional communication with other vessels where necessary. The support vessel will assist in maintaining the 500 m exclusion zone around the MIVs and DPIV. • All vessels will travel less than 6 knots within the exclusion zone to reduce the chance and severity of collisions. • DPIV fuel tanks are internal to the wing water ballast tanks. • Impact protection (fenders) on all vessels. • Marine Diesel Oil compliant with the MARPOL Annex VI Regulation 14.2 is the only engine fuel recorded on the fuel bunkering register for vessels. • Oil spill responses executed in accordance with *Balnaves Development Construction and Installation OSCP (EA-72-RI-006/2*) and vessel's Shipboard Oil Pollution Emergency Plan (SOPEP) as required under MARPOL 73/78. • In the event diesel is released from a vessel due to a ruptured fuel tank, the following tier 2 spill response source control activities would be immediately implemented in accordance with *Balnaves Development Construction and Installation OSCP (EA-72-RI-006/2*): o Reduce the head of cargo by dropping or pumping the tank contents into an empty or slack tank; o Consider the possibility of pumping water into the leaking tank to create a water cushion to prevent further cargo loss (only if density lower than water); o If the affected tank is not easily identified, reduce the level of the cargo in the tanks in the vicinity of the suspected area if stability of the vessel will not be compromised; o Evaluate the transfer of cargo to other vessels; and/or o Trimming or lightening the vessel to avoid further damage to intact tanks. • Oil spill exercises are conducted prior to the commencement of the installation activity and every 3 months thereafter. • Vessel crew will be experienced and competent to standards required by the International Convention of Standards of Training, Certification and Watch-keeping for Seafarers (STCW95) and/ or AMSA marine orders, seagoing qualifications. • All crew must attend an environmental induction containing basic information on spill response measures.

Hazard	Cause	Potential Impacts	Risk Treatment Avoidance, Mitigation & Management Measures
Hydrocarbon spill during at sea refuelling	Hose breaks, coupling failures or tank overfilling	Surface water diesel slick, with death or physiological impacts on sensitive species such as planktonic crustaceans. Decrease in surface water quality.	• Refuelling to occur under suitable weather conditions and subject to Barge Engineer and Supply Vessel Captain's agreement transfer shall be conducted only during daylight hours as per EPBC referral conditions. • All vessels will not be refuelled within 12 nautical miles of the North and South Muiron islands, Montebello Islands, Lowendal Islands and Barrow Island (as defined by the lowest astronomical tide), unless refuelling is to occur in a port or harbour (e.g. Exmouth boat harbour) as per EPBC referral conditions. • Competent marine crew will follow strict refuelling procedures (Apache *Refuelling and Chemical Transfer Management procedure (AE-91-IQ-098)* during transfer operations. • DPIV Safety Case and Safety Case Revision (SMS-HSE-201) in place. • In line with MARPOL 73/78/97 Annex 1, vessels over 400 gross tonnage will have a current and valid SOPEP and IOPP. • Marine diesel will be the only fuel type used by the support vessels. • Adequate bunding beneath the refuelling hose connections on the supply vessel and the rig. • Drains closed in fuel transfer areas to contain spills. • All vessels have valid and current International Oil Pollution Prevention Certificates ensuring vessels have MARPOL certified oil filtering equipment. • All shipboard chemical spills and hydrocarbon spills managed in accordance with the Shipboard Oil Pollution Emergency Plan (SOPEP). • Implementation of the Balnaves Development Construction and Installation Oil Spill Contingency Plan (OSCP) (EA-72-RI-006/2). • Spill exercises conducted prior to the commencement of the activity and every 3 months thereafter. • Diesel storage tanks and fuel transfer hoses will be maintained on all vessels in line with the PMS (*RigMax*). • All crew involved with refuelling will follow Apache *Refuelling and Chemical Transfer Management procedure (AE-91-IQ-098)* with adherence to the procedure reflected in a PTW for the refuelling activity. • All crew must attend an environmental induction which includes basic spill response procedures.
Hydrocarbon Spill Response	Implementation of hydrocarbon spill response strategies	Increased emissions, light, noise; Reduction in water quality Continued release of hydrocarbon into the pelagic environment, with death or	Management controls for activities and associated hazards have been previously described above relating to: • Artificial lights and noise associated with response vessels and aircraft • Movement of response vessels to minimise disturbance to marine fauna. • Planned discharges from response vessels . • Release of air emissions from response vessels and aircraft. • Interference with other users of the sea during operation of response vessels. • Unplanned liquid waste discharges that may occur from response vessels.

Hazard	Cause	Potential Impacts	Risk Treatment Avoidance, Mitigation & Management Measures
		physiological impacts to sensitive species.	• Unplanned hydrocarbon spills that may arise from response vessels. • Affected stakeholders.

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