Stag Facility

Water Injection Modifications

Environment Plan Summary

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1. INTRODUCTION

Apache Energy Ltd (Apache) is the operator of the Stag Field Production and Export Facility (Stag Facility) located in Production Licence WA-15-L, 60 km northwest of Dampier in the Commonwealth waters of the North West Shelf (NWS). The facility location, in approximately 49 m water depth, is shown in **Figure 1-1.** The *Stag Water Injection Modifications Environment Plan (EA-62-RI-044.01)* has been prepared to cover the modification of subsea equipment associated with the water injection system for the Stag facility.

1.1 Schedule

The activity will be a 24 hour a day operation, seven days per week. The work will commence as soon as practicable upon receipt of all required approvals. The modifications will take approximately 7 to 10 days to complete.

1.2 Compliance

The proposed *Stag Water Injection Modifications EP* was 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.

1.3 Location coordinate of operational area for the activity

The coordinates of the water injection wells are provided in **Table 1-1**. The Stag 40H, Stag 32 and Stag 29H water injection well heads are located approximately 3.2 km west from the Stag CPF and in water depths of approximately 49 m.

The operational area of the activity is a 500-m radius around the Dive Support Vessel (DSV), when stationary onsite within the WA-15-L permit while undertaking the water injection modifications.

Table 1-1: Water injection well locations

Well	Co-ordinates
Stag 40H	421 277.28 mE 7 756 245.06 mN
Stag 29H	421 279.61 mE 7 756 237.47 mN
Stag 32	421 281.67 mE 7 756 231.54 mN

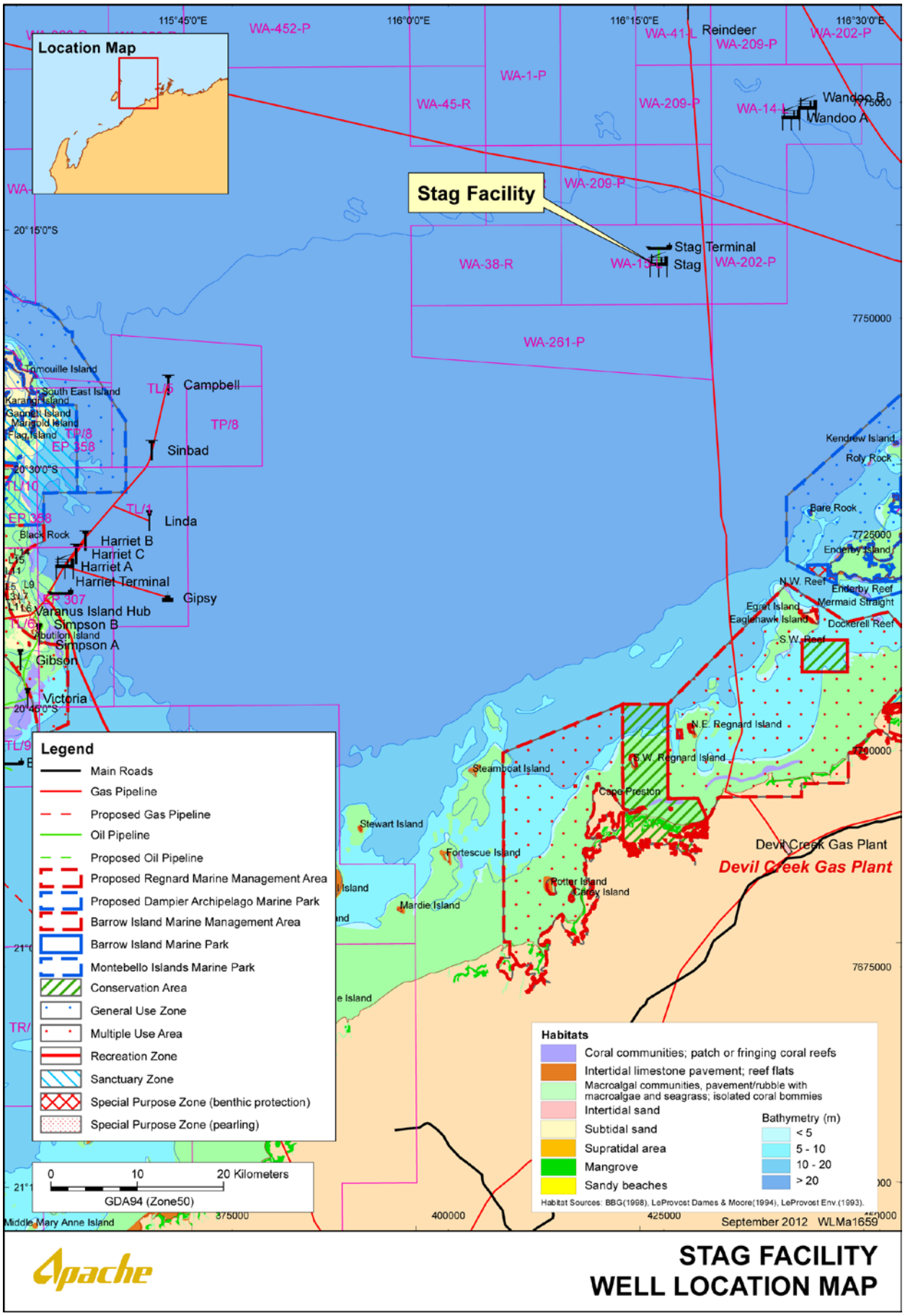

Figure 1-1: Stag Facility location

2. Description of Activity

The Stag Central Production Facility (CPF) is located in Production Licence WA-15-L (**Figure 1-1**). Presently water is injected from the Stag CPF via an existing 8" flowline through a Y-spool to two water injection wells – Stag 29H and Stag 32, to drive the oil accumulations in the reservoir to the Stag CPF risers. A new water injection well, Stag 40H, was completed in December 2011 and now requires connection to the existing infrastructure that provides water injection capability for the recovery of oil from the Stag reservoir. Modification of the existing infrastructure is required to tie-in the water injection wells, Stag 40H (new) and Stag 32 (already connected) via the installation of two tie-in spools. One of the spools will replace an existing tie-in to Stag 32, while the other will tie-in to Stag 40H. The Stag 29H water injection well will become redundant and disconnected from the system. An illustration of the new tie-in spool arrangement is presented in **Figure 2-1 .** The tie-in of the Stag 40H water injection well will be performed in the following sequence:

- Vessel enters the operational area, defined as a 500m radius around the DSV while undertaking water injection modification works; and positions the vessel within the operational area by dynamic positioning geographic system (DPGS);
- Depressurisation of the Stag 29H and Stag 32 water injection flow line; and
- Deployment of divers to carry out the tie in works in two phases
    - Phase 1: Stag 32 tie-in spool replacement
    - Phase 2: Stag 40H tie-in spool installation

The modifications will be carried out by divers working from a diving support vessel (DSV). No additional support vessels will be required. Remote operated vehicles (ROVs) may be required to assist with some parts of the activity, such as resetting valves on the spools.

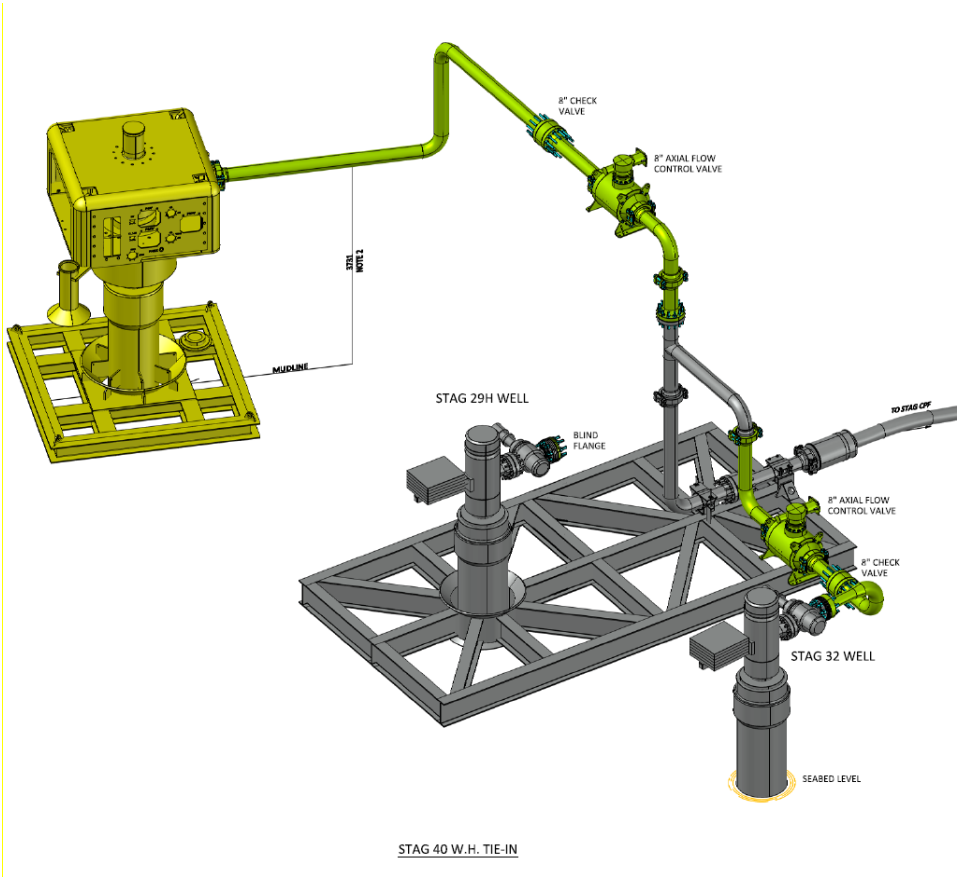

Figure 2-1: Stag 40H (yellow well) and Stag 32 tie-in spool arrangement

3. DESCRIPTION OF THE ENVIRONMENT

3.1 Physical Environment

The region lies in the arid tropics experiencing high summer temperatures, periodic cyclones and associated rainfall. The climate of the region has two distinct seasons, a mild, dry winter from May to July and a hot summer from September to March.

Rainfall in the region is generally low with evaporation exceeding rainfall throughout the year. Intense rainfall may sometimes occur during the passage of summer tropical cyclones and thunderstorms.

Shelf 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 (32oC) and coolest in August (19°C).

The wind direction at the Stag facility is predominately from the southwest to west-southwest during the summer months. Winds during autumn transition (April) are generally light and variable and trend to stronger east to east-southeast during the winter months. During the spring transition (September) winds are from the southwest (APASA, 2013). Extreme wind conditions may be generated in the area by tropical cyclones, strong easterly pressure gradients, squalls, tornadoes and waterspouts.

Surface currents over the NWS at the Stag field are generated by several components, including tidal-forcing, local wind-forcing, inertial oscillations, shelf waves, trapped waves and regional current systems, including the Indonesian Through-flow (DSEWPaC, 2012a). Tidal and wind forcing are the dominant contributions to local surface currents. The dominant surface offshore current (typically seaward of the 200 m isobath) in the Exmouth Sub-basin 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. Closer to the coast, the Ningaloo Current flows in a northerly direction, in the opposite direction to the Leeuwin Current, along the outside of the Ningaloo Reef and across the inner shelf from September to mid-April (BHPB, 2005; Woodside, 2005). The Indonesian Throughflow is the other important current influencing the upper 200 m of the outer NWS (Woodside, 2005). This current brings warm and relatively fresh water to the region from the western Pacific via the Indonesian Archipelago. Initial modelling undertaken by Woodside indicates that significant east-west flows across the NWS to the north of the North West Cape, possibly linking water masses in the area (Woodside, 2005).

The area of shelf within the Stag field is characterised by a thick sequence of carbonate rock that is overlain by thin layers of unconsolidated fine to medium grained, carbonate sediments with occasional shell or gravel patches (Racal, 1994; Dames and Moore, 1995). Surface seabed sediments in the area are predominantly composed of skeletal remains of marine fauna, with lenses of weathered sands (McLoughlin and Young, 1985). Two seabed types surround the Stag CPF; Type A: Low relief unconsolidated calcareous fine to medium sand; and Type B: Low relief unconsolidated calcareous gravelly medium to coarse sand.

3.2 Biological Environment

The activity occurs within the Commonwealth waters of the North-west Marine Bioregion, within the Northwest Shelf Province (DSEWPaC, 2012a). The Northwest Shelf Province is located almost entirely on the continental shelf, except for a small area to the north of Cape Leveque that extends onto the continental slope. Low density benthic communities of bryozoans, molluscs and echinoids are supported within the bioregion. Unconsolidated sediments support a diverse benthic infauna consisting predominantly of mobile burrowing species including molluscs, crustaceans (crabs, shrimps and smaller related species), polychaetes, sipunculid and platyhelminth worms, asteroids (sea stars), echinoids (sea urchins) and other small animals. Numerous migratory species including

humpback whales, whale sharks and dugongs travel through the bioregion. The bioregion also supports bottlenose and indo-pacific humpback dolphins, turtle nesting sites including green, hawksbill, flatback and loggerhead turtles, and several seabird breeding populations including wedge-tailed shearwaters, crested, bridled and sooty terns, brown boobies and lesser frigatebirds.

From the operational area; in a south-west direction it is approximately 25 km to the boundary of the Montebello Commonwealth Marine Reserve; 60km to the Montebello Island Marine Park and 69 km to the Montebello/Barrow/Lowendal islands.

Key ecological features (KEFs) are components of the marine ecosystem that are considered to be important for biodiversity or ecosystem function (DSEWPaC, 2012a). There are no Key Ecological Features (KEFs) within the operational area, however, three KEFs were identified by the activity:

- The Ancient Coastline at 125 m Contour
- The Continental Slope Demersal Fish Communities
- The Glomar Shoals

The Ancient Coastline at 125 m Contour is a submerged coastline which provides areas of hard substrate and may contribute to higher diversity and enhanced species richness relative to soft sediment habitat (DSEWPaC, 2012a). *The Continental Slope Demersal Fish Communities* has a high level of endemism of demersal fish species compared to anywhere else along the Australian continental slope (DSEWPaC, 2012a). The Glomar Shoals are a unique seafloor feature of highly fractured molluscan debris, coralline rubble and coarse carbonate sand that occurs approximately 30 to 40 km offshore of Dampier in Commonwealth waters, between depths of 26 to 70 m.

The activity will occur over soft sediments at approximately 50 m water depth. Unconsolidated sediments support a diverse benthic infauna consisting predominantly of mobile burrowing species including molluscs, crustaceans (crabs, shrimps and smaller related species), polychaetes, sipunculid and platyhelminth worms, asteroids (sea stars), echinoids (sea urchins) and other small animals.There are no shorelines within the operational area.

Distant from the operational area, are other benthic habitats, sub-tidal/inter-tidal and the shoreline habitats of the mainland and offshore islands. The habitat types include:

- Open water environment with benthic soft sediments;
- Benthic primary producer habitats such as marcoalgae and seagrasses and corals/coral reefs;
- Intertidal and subtidal coral reefs; and
- Tidal zone and shoreline habitats such as intertidal sand shoals, exposed rocky platforms, sandy beaches, mangroves and mud flats.

A search of the EPBC Act Protected Matters Database identified 16 threatened and/or migratory species listed under the EPBC Act that may occur within the operational area and surrounds of 5 km. The species listed included three fish, six marine mammals, five turtles, one seasnake and one seabird. No threatened ecological communities, protected under the EPBC Act, have been identified within the operational area. Additionally,there are no World and/or National Heritage Sites within the area.

Cetaceans listed as threatened or migratory that may occur within the operational area and surrounds, including the blue whale (*Balaenoptera musculus*) – endangered; the Humpback whale (*Megaptera novaengliae*) – vulnerable (DSEWPaC (2012a) and (2012b). The most commonly sighted whale in continental shelf waters of the region is the humpback whale. The Exmouth Gulf is used as a resting ground by many pairs during the transition period on their southern migration, with many males entering the gulf with the intention of mating (Jenner et al., 2001). The activity may be undertaken at any time of year, in water depths of approximately 49 m. This work schedule may coincide with migratory activity, although it is highly unlikely that a significant number of humpback whales will be encountered within the operational area.

Blue whales are widely distributed throughout the world's oceans. As southern blue whales feed predominantly in polar waters it has been suggested that all blue whales sighted in Australian waters are pygmy blue whales (DEH, 2005). The Perth Canyon is the only area so far identified off the WA coast where pygmy blue whales aggregate with some predictability. Although the operational area is not associated with any recognised blue whale migratory routes or known feeding, breeding or resting areas, individuals may be observed during the activity (DSEWPaC, 2012a).

The whale shark (*Rhincodon typus*) is known to aggregate in and near the waters of the Ningaloo Marine Park during March/April (CALM/MPRA, 2005). Although most common at Ningaloo Marine Park, whale sharks have also been recorded from Commonwealth waters between Australia and Indonesia. The main period of the whale shark aggregation off Ningaloo Reef is late March to June, with the largest numbers generally recorded in April (Wilson *et al.*, 2001). It is possible that some individuals may be sighted at or near the operational area as they migrate from the aggregation areas at Ningaloo Reef.

Similar to that of the Stag Facility and surrounds, the fish fauna of Barrow/Lowendal/Montebello islands are widespread throughout the Indo-west Pacific region.

Five EPBC Act-listed threatened marine turtles occur in the waters and nest on sandy beaches of the NWS (Apache, 2010; Woodside, 2006), including Hawksbill turtle (*Eremochelys imbricate*) – vulnerable; Flatback turtle (*Natator depressus*) – vulnerable; Green turtle (*Chelonia mydas*) – vulnerable; Loggerhead turtle (*Caretta caretta*) – endangered; and Leatherback turtle (*Dermochelys coriacea*) – endangered.The nearest turtle nesting sites are located about 35 km to the east (Dampier Archipelago) and approximately 69 km to the south-west (Barrow, Montebello and Lowendal islands) from the activity. The peak turtle nesting and hatching period occurs from November to January (Prince, 1994).

The short-nosed sea snake is listed as critically endangered under the EPBC Act and may occur within the operational area. However, the majority of specimens have been collected from Ashmore and Hibernia Reefs (Minton and Heatwole, 1975).

The southern giant petrel (*Macronectes giganteus*) is listed as threatened under the EPBC Act and may occur within the operational area and surrounds. This species is highly migratory and is widely distributed. While they may over-fly the operational area and surrounds from time-to-time in transit or for foraging, they do not use the area for breeding or resting. There is no critical nesting or feeding area located near the operational area (Apache, 2011).

3.3 Socio-Economic Environment

The Stag Facility is located approximately 60 km offshore from the Port of Dampier in Western Australia. Smaller coastal fishing and tourism settlements occur at Onslow approximately 200 km to the south, and Point Samson approximately 100 km to the southeast. Dampier, Karratha and Port Hedland are the main service and population centres for the region.

Oil exploration and production and commercial fisheries are the two main activities operating in the NWS region. Tourism and defence-related activities are other key commercial activities within the region.

A valuable and diverse commercial fishing industry is supported by both the offshore and coastal waters in the NWS region, mainly dominated by the Pilbara fisheries. The major fisheries in the region target tropical finfish, large pelagic fish species, crustaceans (prawns and scampi) and pearl oysters (Apache, 2010; Woodside, 2006). Fisheries are managed by either the State Department of Fisheries (DoF) or the Commonwealth Australian Fisheries Management Authority (AFMA).

There is no reported current fishing effort in the North-west Marine Region for the three Commonwealth fisheries that intersect the operational area (AFMA, 2011) (i.e Western Tuna and Billfish Fishery (North of 34° South), Southern Bluefin Tuna, and Skipjack Tuna Fishery). State-

managed fisheries boundaries that overlie or are in close proximity to the operational area include Beche-de-mer Fishery (sea cucumber); Mackerel Fishery; Marine Aquarium Fishery; Northern Coast Shark (closed indefinitely); Northern Coast Crab Fishery; Onslow Prawn Managed Fishery; Pearl Oyster Managed Fishery; Pilbara Demersal Scalefish Fisheries (comprising Pilbara Fish Trawl (Interim) Managed Fishery); Pilbara Line Fishery; and Pilbara Trap Managed Fishery); and Specimen Shell Managed Fishery.

In addition to commercial fisheries, recreational fishing is a very popular activity in the region, occurring along the majority of the coastline along the eastern and western side of NWS, especially from Onslow to Broome in winter (Apache, 2010; Woodside, 2006). Given the distance offshore and proximity of the operating Stag Facility, it is unlikely that significant recreational fishing occurs near the operational area.

Water-based tourism activities undertaken across the NWS include whale watching, recreational boating and fishing, charter boat fishing, snorkeling and diving, and surfing. Given the distance of the operational area from nearest population centre at Dampier (approximately 60 km away) and the nearest shoreline at Montebello Islands (approximately 69 km away) there is unlikely to be any tourism based activities in the operational area.

NWS waters are used for petroleum exploration and development. The nearest production activities to the operational area are the Apache operated Stag Facility located in permit area WA-15-L, approximately 3.2 km east of the water injection wells; Wandoo Facility located in permit area WA-14-L, approximately 20 km northeast of the water injection wells, and two gas pipelines approximately 6 km east and 10 km north of the water injection wells.

There are no recognised shipping routes through the operational area; however, commercial vessels are monitored and recorded in the area.

There are no World Heritage properties or National Heritage places near the operational area.

The National Shipwrecks Database lists seven shipwrecks in the ‘Montebellos Area’ (DSEWPaC, 2012c). None are report to occur, and there is no evidence from seabed surveys that shipwreck sites exist, within the operational area.

4. Stakeholder Consultation

Apache maintains a comprehensive stakeholder database containing fishing interest groups, government and non-government authorities and other stakeholder parties including the community. This database was used to identify stakeholders located, or operating, in the proximity of the activity. 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 activities were identified on the basis of the operational area. Stakeholders identified are listed in **Table 4-1.**

Table 4-1: Summary of stakeholders consulted for Stag Operations and associated water injection modifications

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	• Department of Sustainability, Environment, Water, Population and Communities (DSWEPaC). • Department of Environment and Conservation (DEC).
Shipping Safety and Security	• Australian Maritime Safety Authority (AMSA). • Department of Defence.
Hydrocarbon Spill Response	• Department of Transport (DoT). • Australian Marine Oil Spill Centre (AMOSC).
Adjacent Regulators	• Department of Mines and Petroleum (DMP);

4.1 Consulation Summary

Relevant stakeholders were emailed a summary of the Stag Facility operations on 2 July 2012. The summary included an overview of four water injection flowlines and wells to assist reservoir fluid recovery. An updated summary was emailed on the 10 July 2012. Phone discussions were held where necessary to provide further information, where a conversation was preferred by the individual rather than an email or to address a specific consideration of that individual.

Further consultation was undertaken in October 2012 within the Apache Energy Quarterly Project Update, which highlighted the Stag Facility and the Water Injection operational activity specifically with its location. The quarterly update has been progressively developed in consultation with interested stakeholders, and includes a summary of Apache's activities for the next six to nine months. The quarterly update is intended to trigger feedback, comments and requests for additional information or consultation opportunities for future activities, and provides an update of the activities that are underway or have previously been consulted on. All feedback and enquiries received regarding the above information have been responded to, addressed and closed off with the stakeholder in question. Apache will remain available before, during and after completion of the activity to listen to the concerns of stakeholders, as contact details of the relevant project personnel are provided in consultation material.

5. Environmental Hazards and Controls

Identification of hazards and assessment of risks was determined using a qualitative assessment process defined by the *Apache Environmental Risk Identification Procedure (EA-91-IG-004)*. The Environmental Risk Assessment (ERA) identifies potential and expected hazards and environmental impacts and determines the risk of the impact occurring.

For each impact the risk is determined prior to implementation of proposed management controls (inherent risk), and again after management controls have been implemented (residual risk). The control measures adopted are designed to eliminate the risk, or reduce the risk to a level that is tolerable or as low as reasonably practicable (ALARP).

This assessment process was undertaken at a risk assessment workshop, which identified eight planned environmental risks and four unplanned environmental risks. The key environmental hazards and control measures to be applied are summarised in **Section 8**. 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 activities will be managed in compliance with the *Stag Water Injection Modifications Environment Plan (EA-62-RI-044.01)* 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 activity during both planned 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) 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 primary goal of the implementation strategy is 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 Stag Facility Water Injection Modification operations. It includes the following:

1. Systems, practices and procedures;
2. Key roles and responsibilities;
3. Training, competencies and on-going awareness;
4. Monitoring, auditing, management of non-conformance and review;
5. Records management;
6. Incident response and preparedness including oil spill contingency planning; and
7. 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 completion), are also detailed.

7. CONTACT DETAILS

Further information about the Stag Water Injection Modification activities can be obtained from:

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8. Environmental Impacts and Controls

The following tables (**Table 8-1** and **Table 8-2**) provide a summary of potential environmental impacts that could be expected from the activity. 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 8-1: Environmental risk assessment summary for planned events.

Hazard	Cause	Potential Impacts	Risk Treatment Avoidance, Mitigation & Management Controls
Artificial light	• Deck and navigational lighting on vessels	• Disorientation or mis-orientation caused by direct attraction to the light; • Increased vessel interactions with animals attracted to the light; and • Altered feeding behaviours, including increased predation risks.	• Deck lighting configuration reviewed prior to mobilisation and practicable opportunities to reduce direct light spill to marine waters implemented. • The duration of the activity is short (7-10 days), • Given the remote location of the activity, more sensitive fauna species such as turtles are not likely to frequent the operational area in significant numbers. • Lighting will only be emitted from the DSV for a limited period of time. Once activities are complete, any impact from artificial lighting will cease. • In Australian waters, lighting is required for navigational and safety purposes under the Commonwealth Navigational Act 2012 and associated Marine Orders.
Noise emissions	• Vessel thrusters and propellers . • Vessel equipment, e.g. generators. • Marine Operations (e.g. ROVs)	• Physiological or behavioural effects to fauna.	• Noise emissions minimised by maintaining vessel machinery in accordance with manufacturer specifications. • Noise emissions from the DSV will be at low levels and energy frequency. The activity is expected to create surface and underwater noise. Marine fauna are expected to avoid noise levels of sufficient magnitude to cause physiological damage. • It is likely that noise levels would reduce to background levels within kilometres to tens of kilometres of the vessel; hence, any behavioural changes are likely to be within close proximity to the vessel. • The majority of marine fauna that may occur within the operational area are likely to be transitory, and unlikely to remain in the area during the activity. • In accordance with EPBC Regulations Part 8, the vessel will not: - Travel at greater than 6 knots within 300 m (caution zone) of a cetacean known to be in the operational area. - Approach closer than 100 m of a cetacean known to be in the operational area. - 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. - Marine fauna interactions recorded in the vessel log. • Apache Marine Fauna Sighting Datasheets are completed and submitted to DSEWPaC.

Planned discharges	Sources of planned discharges from vessel and marine operations include: • Oily Water (including Vessel drainage (e.g. bilge water, machinery space) • Sewage. • Deck drainage from rainfall or wash-down operations. • Cooling water • Brine from the potable water supply system. • Injection water (Seawater treated with oxygen scavenger OSW24514) • Putrescible food waste.	• Discharges could affect temporary and localised changes in water quality (e.g water column turbidity, localised nutrient enrichment and toxicity of water) • Potential for toxicological impacts to marine flora and fauna.	• **General – Planned Discharges:** - Localised, as relatively small volumes of standard vessel operational discharges to surface. All discharges within the operational area. - Temporary, as various discharges will occur on a 24-hour basis for the period of the activities, approximately 7-10 days. • **Oily Water** - Oily water discharged to marine waters through filtering equipment in accordance with Regulation 15 of MARPOL Annex I: - Vessel(s) has current International Oil Pollution Prevention (IOPP) Certificate - Oily water discharged to sea after passing through filtering equipment has an oil content not exceeding 15 parts per million (ppm). - Oily water discharged while proceeding en route. - Vessel fitted with oil filtering equipment in accordance with Regulation 14 of MARPOL Annex I. - Oil filtering equipment maintained and calibrated in accordance with manufacture's specifications to ensure oil content is not exceeding 15 parts per million (ppm). • **Sewage** - Sewage discharge procedures compliant with Regulation 11 of MARPOL Annex IV. - Sewage treatment system compliant with Regulation 9 of MARPOL Annex IV. - Sewage treatment system maintained in accordance with manufacture's specifications. - Maximum carrying capacity of the sewage system is not exceeded. - Vessel has current International Sewage Pollution Prevention (ISPP) Certificate • **Deck Drainage** - Cleaning agents or additives that will be released to the sea are not 'harmful substances' as defined by MARPOL Annex III. • **Brine/Cooling water** - Water treatment system and machinery maintained in accordance with manufacture's specifications. • **Injection Water** - Injection Water Injection water would only be released upon pipework disconnection. • **Food wastes:** - Food waste collected, stored, processed and disposed of in accordance with a Garbage Management Plan as required under Regulation 9 of MARPOL. - Food waste disposal procedures compliant with Regulation 3 of MARPOL Annex V. - Macerator capable of reducing food to 25 mm or less is installed and maintained in accordance with manufacture's specifications

Air Emissions	• Operation of machinery and vessels by combustion engines • Incinerator • Refrigeration equipment (Ozone Depleting Substances, ODS)	Temporary and localised reduction in air quality, contribution to greenhouse gas loadings.	• Atmospheric emissions are permitted at sea in accordance with MARPOL Annex VI. • Vessel machinery maintained in accordance with manufacturers specification and vessels planned maintenance system. • Waste Incinerator meets the requirements of, and is operated in accordance with, Regulation 16 of MARPOL Annex VI., • Vessel engines meet NOx emission levels as required by Regulation 13 of MARPOL Annex VI. • Sulphur content of fuel oil complies with Regulation 14 of MARPOL Annex VI. • **Ozone Depleting Substances** - The deliberate release of ODS to the atmosphere is prohibited under the Commonwealth Ozone Protection and Synthetic Greenhouse Gas Management Act 1989 and Regulation 12 of MARPOL Annex VI. - ODS managed in accordance with Regulation 13 of MARPOL Annex VI. - ODS to be licensed under the Ozone Protection and Synthetic GHG Regulations - ODS only handled by a qualified or experienced tradesperson.
Interference with other marine users (Activity/Vessel presence)	The physical presence of project vessels within the operational area (a 500-m safety exclusion zone around the DSV)	• Exclusion zone may interfere with other marine users include commercial fishers and shipping traffic • If commercial vessels need to deviate from planned routes; may slightly increase transit times and fuel consumption. • Potential impacts to commercial fisheries are reduced access to fishing grounds, which could potentially result in reduced catches and income.	• As required under Chapter 6 of the Commonwealth Offshore Petroleum and Greenhouse Gas Storage Act 2006, a 500-m safety exclusion zone will be requested around the DSV while undertaking 'work'. This will be localised, to a 500-m radius around the DSV, and temporary, being on a 24-hour basis for the period of the activities, approximately 7-10 days. • Australian Hydrographic Office (AHO) notified of operational area, activities and durations at least six weeks prior to the activity, which triggers AHO to issue a Notice to Mariners. • Australian Maritime Safety Authority (AMSA) Rescue Coordination Centre (RCC) notified of operational area, activities and durations two weeks prior to the activities, which triggered RCC to issue an AusCoast Warning.

Marine Pest Species (including Ballast Water and Biofouling)	Bringing project vessels into operational area (from international waters).	• Establishment of non-native or marine pests. • Marine pest species can be introduced to the environment via a bio-fouled vessel hull or equipment, and through ballast water. • If they become established, invasive marine pest species have the potential to cause a range of ecological effects including increased competition with native species and changes in ecosystem function (i.e., the food chain in that area).	• Quarantine Pre-arrival Report (QPAR) completed and submitted as required by the Australian Quarantine and Inspection Service (AQIS). • **Ballast Water** - The entry of international vessels into Australian waters is permissible under the Commonwealth Quarantine Act 1908, providing adequate measures with respect to ballast water management are implemented. - Vessel shall exchange 'high-risk' ballast water, as defined in Australian Ballast Water Management Requirements (DAFF, 2009), outside Australian territorial seas and in water at least 200 m deep. - Onboard ballast water log completed. • **Biofouling** - No legislation regulates vessel biofouling in Commonwealth waters at this time; the Australian Ballast Water Management Requirements (DAFF, 2011), National Biofouling Management Guidance for the Petroleum Production and Exploration Industry (DAFF, 2009) and the Western Australian Department of Fisheries marine pest management guidelines (DoF, 2013) will be adopted as good industry practice. - International Maritime Organisation (IMO)-compliant antifouling paint valid as prescribed by the manufacturer. - Vessel biofouling risk assessment conducted in accordance with the National Biofouling Management Guidance for the Petroleum Production and Exploration Industry (Commonwealth Government, 2009) and actions implement as required to achieve a risk score of 'low' prior to entering the operational area.
Vessel Movements (Interference with marine fauna)	The physical presence of the vessel in the operational area is a potential hazard to marine fauna, especially while moving.	Behavioural and physiological effects to marine fauna.	• Localised, to marine fauna within the operational area, and temporary, being the period of the activities, approximately 7-10 days. • Binoculars and fauna observation recording sheets available on all vessels.Marine fauna interactions recorded in the vessel log. • Apache Marine Fauna Sighting Datasheets are completed and submitted to DSEWPaC. • Any vessel collision with an EPBC-listed marine fauna reported to DSEWPaC • Marine fauna in operational area are likely to be transitory, and unlikely to remain in the area during the activity. • In accordance with EPBC Regulations Part 8, the vessel will not: - Travel at greater than 6 knots within 300 m (caution zone) of a cetacean known to be in the operational area. - Approach closer than 100 m of a cetacean known to be in the operational area. - 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	Objects placed on the seafloor (e.g. vertical installation support) and seabed disturbance caused by diving/ROV operations. .	Disturbance to benthic fauna and habitat	• Seabed disturbance will be localised, within the operational area. • Operational activity disturbance will be temporary, being the period of the activities, approximately 7-10 days • No known sensitive seabed features (e.g., reefs, canyons, shipwrecks) are known within the operational area, with the activity occurring over soft sediments. Benthic biota is comparable to that found over similar substratum and at similar depths over the wider region. • Activity executed in accordance with Apache-endorsed installation procedure.

Table 8-2: Environmental risk assessment summary for unplanned events

Hazard	Cause	Potential Impacts	Risk Treatment Avoidance, Mitigation & Management Controls
Dropped Objects	Objects dropped from the vessel or during lifting operations to and from the seabed	Dropped objects could damage the seabed or water injection wells.	• Activity and therefore potential window for impacts are temporary (period of activity, approx.. 7-10days) and localised, within the operational area. • Lifting devices and equipment tested and certified to Australian Standards. • Lifting devices and equipment maintained in accordance with manufacturers specifications. • Vessel equipment and load sea-fastened during vessel transit. • Activities conducted in accordance with Apache-endorsed vessel lifting procedure. • Stag 29H and 32 water injection flow line depressurised prior to lifting activities. • Activities conducted in accordance with an Apache-endorsed injection water isolation procedure. • Dropped objects reported and investigated, and corrective actions implemented.
Discharge of Solid Waste	Solid waste may unintentionally enter the marine environment if not appropriately secured and handled on-board vessel.	• Marine pollution: Potential to damage benthic habitats and/or change in water quality • Injury or death of marine fauna through ingestion or entanglement	• Any (unplanned) discharge would be limited to the operational area (although some waste may be carried by ocean currents beyond this boundary) and to the period of the activity (approximately 7-10 days); however, non-biodegradable waste may persist in the environment for an extended time e.g. plastic. • Risk of significant impact is low given the benthic habitat in the operational area is primarily bare sediments. • Any hazardous wastes potential released (unplanned event) are likely to be in small quantities (e.g. batteries, chemical containers, oily rags). • Solid wastes collected, labeled, segregated, stored, processed and disposed of in accordance with the project vessel's: • Garbage Management Plan as required under Regulation 9 of MARPOL Annex V. • Hazardous wastes documented, tracked, segregated, labelled and stored on-board with secondary containment. • Incinerator meets the requirements of Regulation 16 of MARPOL Annex VI. • Incinerator operated in accordance with Regulation 16 of MARPOL Annex VI. • All crew must attend an environmental induction containing basic information on waste management. • Accidental release of waste to the marine environment is reported and investigated, and corrective actions are implemented.

Discharge of environmentally hazardous chemicals	Potential for unplanned release (e.g leak or spill) of chemicals on-board vessel or during diver/ROV deployment Environmentally hazardous chemicals may include: diesel fuel for auxiliary, oils and greases, hydraulic and lubricating fluids, cleaning products, solvents and paints.	Reduction in water quality Physical and physical and/or physiological impacts to marine fauna	• The carriage of environmentally hazardous chemicals and hydrocarbons (also termed dangerous goods and harmful substances) in Australian waters is permissible and regulated under the Commonwealth Navigation Act 2012 and Protection of the Sea (Prevention of Pollution from Ships) Act 1983 and associated AMSA Marine Orders (which give effect to all or part of MARPOL Annex III). • The maximum potential release volume from a single spill or leak event would be limited to the volume of containers, tanks, hoses and pipework. For a spill or leak to enter the marine environment it would need to occur on deck or during diver/ROV deployment. If the spill/leak occurred elsewhere on the vessel the chemical would be contained within the drainage system and direct to the wastewater or oily water/bilge treatment system. • Potential discharge and impact would be localised (within the operational area at sea surface or during diving/ROV activities at a depth of approximately 49 m) and temporary (given only finite volumes could be released to the marine environment during the 7 to 10 days) . • **Machinery and vessel maintenance** - Vessel machinery maintained in accordance with the manufacturer's specifications and the vessels planned maintenance system. • **ROV operations and maintenance** - ROV hydraulic system maintained in accordance with manufacturer's specifications, and ROV hydraulic hoses and fittings checked prior to deployment. • **Materials storage and management** - Environmentally hazardous chemicals packaged, marked, labeled and stowed in accordance with MARPOL Annex III regulations. - Vessel shall maintain a manifest setting forth the environmentally hazardous chemicals on-board and the location thereof. - Material Safety Data Sheet (MSDS) available for environmentally hazardous chemicals on-board. - Chemical storage areas inspected weekly • **Clean-up and Spill/Leak response equipment** - Clean-up equipment located where environmental hazardous chemicals and hydrocarbons are stored and frequently handled. - Scupper plugs or equivalent deck drainage control measures available where environmentally hazardous chemicals and hydrocarbons are stored and frequently handled on deck. - Environmentally hazardous chemical and hydrocarbon leaks and spills on the vessel immediately cleaned up (including in deck bunds), and contaminated material contained securely onboard. - Shipboard spills and leaks managed in accordance with a SOPEP or SMPEP. • **Crew preparedness and training** - All crew must attend an environmental induction containing basic information on chemical and hydrocarbon management, as well as spill prevention and response measures. - SOPEP/SMPEP spill response exercise conducted prior to the commencement of the activity.

Hydrocarbon Spill from Vessel collision	Significant vessel collision capable of rupturing fuel tanks.	Chemical and physical impacts to marine species; and changes to water quality .	• An exclusion zone will be enacted during the period of activity (around the operational area), to prevent non-activity vessels from entering area during activity. • Navigational equipment and vessel operations compliant to AMSA, including Marine Orders Part 21: Safety of Navigation and Emergency Procedures and Marine Order Part 30: Prevention of Collisions. • An International Marine Contractors Association (IMCA) Common Marine Inspection Document (CMID) (or equivalent vessel audit covering navigation equipment and procedures) completed or updated prior to mobilisation. • Vessels equipped with an automatic radar plotting aid (ARPA) system. • Visual vessel bridge-watch 24 hours per day by crew qualified by an accredited trainer. • Australian Hydrographic Office (AHO) notified of operational areas, activities and durations at least six weeks prior to the activity, which triggers AHO to issue a Notice to Mariners. • Australian Maritime Safety Authority (AMSA) Rescue Coordination Centre (RCC) notified of operational areas, activities and durations two weeks prior, which triggers RCC to issue an AusCoast Warning. • Shipboard Oil Pollution Emergency Plan (SOPEP or SMPEP) spill response exercise conducted prior to the commencement of the activity. • Oil spill response executed in accordance with Apache Oil spill response executed in accordance with Apache *Stag Facilities Water Injection Modifications Oil Spill Contingency Plan* (EA-62-RI-044.02). • Vessel Design and Operation: - The 'clean design' of the vessel means there are no exposed fuel tanks i.e. fuel tanks are protected by ballast water tanks preventing or reducing the spill in the event of a collision; - Fuel tank working volumes are less than fuel tank design volumes; - Fuel will be consumed during mobilisation to the operational area and then during the activity. - There are multiple tanks capable of storing fuel; and - Position of fuel tanks in relation to the plimsoll line and associated hydrostatic head of fuel in the ruptured tank. • The largest tank having a design capacity of 100 m3 and assuming 85% of tank design volume used combined with fuel consumption during mobilisation, then the largest volume of diesel in any tank on entry to the operational area is 80 m3.
Hydrocarbon Spill Response	Implementation of hydrocarbon spill response strategies.	Hydrocarbon spill, response activities can exacerbate or cause further environmental harm.	The aim of the net environmental benefit assessment (NEBA) is to inform response strategies that have the greatest net benefit to the overall environment and reduce impacts associated with the response strategies to ALARP. Based on the pre-planning NEB), the preferred response strategy for the modelled spill scenarios identified in the EP and OSCP are: - Source control; - Surveillance – including aerial and vessel surveillance, tracking buoys, spill fate modelling; - Shoreline or nearshore protect and deflect activities; - Shoreline clean-up - Oiled wildlife response activities; and - Scientific monitoring. Chemical dispersants do not form part of the response strategy.

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