

Goodwyn Alpha (GWA) Facility Operations Environment Plan Summary

May 2013

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1. INTRODUCTION

Woodside Energy Ltd (Woodside) is the nominated operator of the North West Shelf Project's (NWS Project's) Goodwyn Alpha (GWA) Production Facility, located in Commonwealth waters in Production Licence WA-5-L, approximately 135 km north west of Karratha.

The GWA facility was commissioned in 1995 and processes dry gas and condensate from the Goodwyn area reservoirs and associated subsea developments. The facility processes the production fluids supplied by the platform and subsea wells via a series of cooling, separation, compression and dehydration processes before being exported onshore to the Karratha Gas Plant (KGP).

The revised GWA Operations Environment Plan (EP) has been prepared in accordance with the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009* (Environment Regulations). The EP has been reviewed and accepted by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA).

This EP summary document has been prepared as per the requirements of Regulations 11(7) and 11(8) of the Environment Regulations.

2. LOCATION OF THE ACTIVITY

The GWA facility is located in Commonwealth waters on the North West Shelf (NWS) of Western Australia in Production Licence Area WA-5-L, approximately 135 km north-west of Karratha and 23 km south west of the Woodside operated North Rankin Complex (NRC) (Figure 2-1). The facility stands in approximately 130 m of water.

Gas and condensate produced from the facility is exported from GWA via the 23 km interfield pipeline (IFL). Production fluids can be routed via the first (TL1) or second trunkline (TL2), which are tied in to the IFL approximately 350 m from NRC, where it is then transported onshore for processing.

Associated subsea infrastructure includes the Echo Yodel pipeline, which extends 23 km south west of GWA to the Echo Yodel field. The Perseus over Goodwyn (PoG) pipeline extends to a pipeline end manifold located approximately 24 km east north east of the GWA facility where four wells are located.

A new pipeline is being installed for the Greater Western Flank (GWF) Phase 1 Project (GWF-1), about 10 km south west of the GWA facility. The subsea drilling, installation, hook-up and commissioning activities associated with this Project are to be the subject of separate Environment Plan(s). However, following commissioning, the routine operation, inspection, maintenance and repair of the associated GWF subsea infrastructure is covered under the scope of the GWA facility EP

The closest nearshore sensitive receptors to the GWA facility are the Montebello Islands, located approximately 65 km to the south west. The closest offshore sensitive receptors are the Glomar Shoals and Rankin Bank, located approximately 90 km east and 35 km south west respectively. The facility is also situated west of the northern and southern humpback whale migratory pathways. A description of the surrounding environment is provided in Section 3.

The coordinates and permit areas of the GWA facility and associated infrastructure are outlined in Table 2-1.

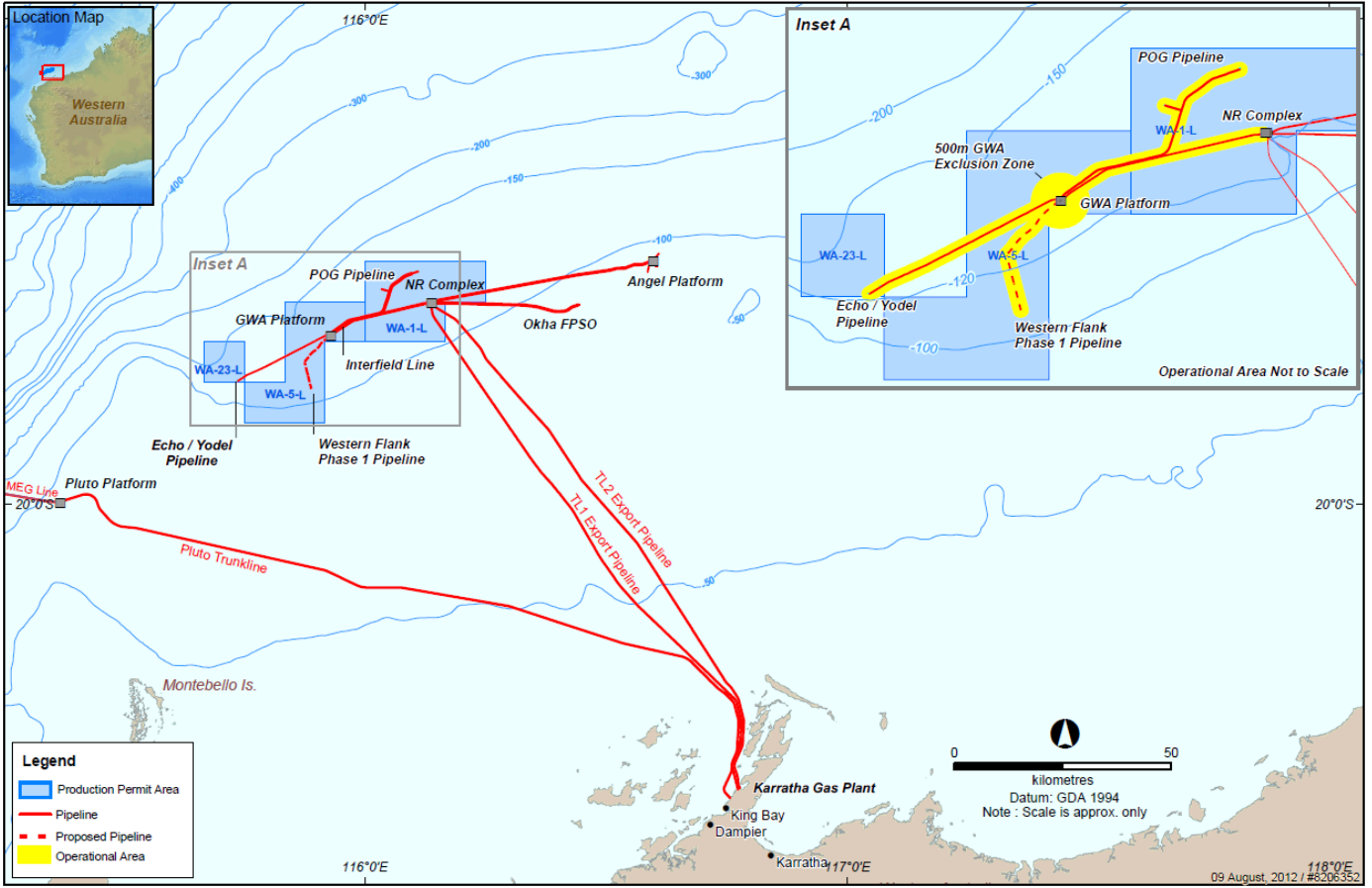


Figure 2-1: Location of GWA Facility and Operational Area

Table 2-1: GWA and Associated Infrastructure Locations and Permit Area

Location	Eastings*	Northings*	Title
GWA Platform	19° 39' 07.936"S	115° 55' 47.028"E	WA-5-L
Per 01 Well	19° 33' 22.460"S	116° 02' 06.799"E	WA-1-L
Per 02 Well	19° 31' 11.700"S	116° 06' 39.350"E	WA-1-L
Per 03 Well	19° 35' 29.270"S	116° 02' 33.259"E	WA-1-L
Per 04 Well	19° 31' 06.500"S	116° 05' 53.639"E	WA-1-L
Yodel 03 Well	19° 44' 21.841"S	115° 44' 49.063"E	WA-23-L
Yodel 04 Well	19° 44' 48.040"S	115° 44' 06.603"E	WA-23-L
GDA 01 Well	19° 42' 24.097"S	115° 52' 33.203"E	WA-5-L
GDA 02 Well	19° 42' 24.097"S	115° 52' 33.203"E	WA-5-L
Interfield Line	-	-	WA-2-PL
Echo Yodel Pipeline	-	-	WA-9-PL
PoG Pipeline	-	-	WA-13-PL
GWF-1 Pipeline	-	-	WA-24-PL

*MGA Zone 54 (GDA94 datum)

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3. DESCRIPTION OF THE ENVIRONMENT

3.1 Regional Setting

The GWA facility operational area is located in the North West Shelf (NWS) province of the North-West Marine Region (NWMR) within Commonwealth waters, approximately 135 km from Karratha and in water depths of approximately 130 m. The NWMR is characterised by low salinity and nutrient poor tropical waters. As such, the NWMR is considered to have a low level of productivity, however, upwelling events are recorded and associated with higher productivity due to seasonal changes in the strength and direction of surface flows (DSEWPaC 2012a).

3.2 Physical Environment

The climate within the region is dry tropical, exhibiting a hot summer season from October to April and a milder winter season between May and September (BoM 2012). There are often distinct transition periods between the summer and winter regimes, which are characterised by periods of relatively low winds (Pearce *et al.* 2003).

Sea water temperature on the NWS primarily varies with depth and season. Surface waters are warm year-round due to the tropical water supplied by the Indonesian Throughflow and the Leeuwin Current, with temperatures reaching 30°C in summer and dropping to 22°C in winter (Pearce *et al.* 2003). Nearshore coastal waters are typically warmer than offshore waters in the summer months, while offshore waters don't cool as much during winter as nearshore waters, with offshore seasonal temperature changes lagging behind inshore by around one month (Pearce *et al.* 2003).

Offshore waters, such as those around the GWA facility, are generally very clear. Turbidity is primarily influenced by sediment transport by oceanic swells and primary productivity (Semeniuk *et al.* 1982; Pearce *et al.* 2003). Upwelling of nutrient-rich waters may increase phytoplankton productivity in the photic zone, which may increase local turbidity (Semeniuk *et al.* 1982; Wilson *et al.* 2003). In nearshore areas, turbidity is highly variable due to storm runoff, wind generated waves and large tidal ranges (Pearce *et al.* 2003). Periodic events, such as major sediment transport associated with tropical cyclones, may influence turbidity on a regional scale (CSIRO 2007).

Broad-scale surveys within the general area conducted by Woodside have confirmed the seabed as homogenous and featureless, similar to the wider-scale NWS area (as recorded from side scan sonar). Seabed sediment sampling (RPS 2011) of the surrounding area revealed soft sediment composition typical of the NWS comprising coarse sand, gravel and silt, low metal contamination, low nutrient concentrations (TN and TP), and no detection of hydrocarbons or Naturally Occurring Radioactive Materials (NORMs).

3.3 Biological Environment

No Critical Habitats or Threatened Ecological Communities, as listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), occur within the GWA Operational Area, as indicated by the EPBC Act Protected Matters Search Report undertaken for the GWA Operational Area.

3.3.1 Benthic Communities

Studies have revealed that the infauna associated with soft unconsolidated sediment habitat in the NWS area is widespread and homogenous along the continental shelf and upper slopes (Rainer 1991; Bowman Bishaw Gorham 2000; LeProvost, Dames & Moore 2000; Woodside 2004; SKM 2006; Brewer *et al.* 2007; RPS 2011). Benthic grab sampling around the GWA facility revealed a low abundance, high variability and diversity of infauna dominated by polychaetes and crustaceans. More recent sampling for the GWF-1 Project (RPS 2011) showed that the area supports a highly diverse invertebrate fauna, dominated by burrowing polychaete worms (Phylum *Annelida*) and crustaceans (Phylum *Crustacea*) (RPS 2011). Epifauna of the offshore, deeper region is typically sparse, patchy and associated with areas of hard substrate.

Sedimentary infauna associated with soft unconsolidated sediments around the GWA Operational Area is widespread and well represented along the continental shelf and upper slopes in the NWS region (Woodside 2004; SKM 2007; Brewer *et al.* 2007; RPS 2011). Consequently, benthic habitat within the GWA Operational Area, which consists of soft unconsolidated sediments, is considered to be of relatively low environmental sensitivity.

3.3.2 Marine Mammals

Cetacean species identified as potentially occurring within the GWA Operational Area by the EPBC Protected Matters Database included seven cetacean species listed as Endangered, Vulnerable or Migratory under the EPBC Act.

The most common whale species in the Pilbara region in winter months is the humpback whale (*Megaptera novaeangliae*), which is listed under the EPBC Act as Vulnerable and Migratory (DSEWPaC 2012c). Southern Hemisphere Group IV humpback whales migrate from Antarctic waters to calving grounds located in inshore northern WA waters, between the Lacepede Islands and Camden Sound (DSEWPaC 2012c, Jenner *et al.* 2001). Humpback whales are most likely to occur in the GWA Operational Area between July and September during the migration period and are most likely to be transiting through the area, rather than resting, breeding or feeding.

Other species given a high level of protection which may occur in the area include the blue whale (*Balaenoptera musculus*), bryde's whale (*Balaenoptera edeni*), killer whale (*Orcinus orca*), Antarctic minke whale (*Balaenoptera bonaerensis*), sperm whale (*Physeter macrocephalus*) and the Indo-Pacific bottlenose dolphin (also called Indian Ocean or spotted bottlenose dolphin) (*Tursiops aduncus*).

3.4 Socio-economic Environment

A number of Commonwealth (beyond 200 m isobath) and State (within 200 m isobath) managed fisheries occur in the region. The GWA Operational Area is situated within State managed fisheries areas, however, none have significant catches beyond the 50 m isobath, with the exception of the North West Slope Trawl Fishery.

State-regulated fishing activity within the GWA Operational Area is most likely to be associated with the North Coast Demersal Scalefish Fishery. The fishery consists of several management units targeting a range of species using several gear types (trawl, trap and line). The Pilbara Trawl Fishery lands the largest component of the catch and operates in waters between 50 and 200 m water depth (DoF 2011). The Pilbara Trawl Fishery is a high intensity fishery divided into two zones (DoF 2010) and the GWA operational area is located in the trap fishing area situated between zones 1 and 2 (zones that permit trap and trawl fishing).

Due to water depths and distance offshore, recreational fishing is unlikely to occur in the GWA Operational Area and recreational fishing vessels are subject to a 500 m exclusion zone around the GWA facility

The GWA Operational Area is shown to be outside the main shipping fairways in the area. Whilst the fairways are not mandatory, Australian Maritime Safety Authority (AMSA) strongly recommends commercial vessels remain within the fairway when transiting the region.

3.5 Marine Conservation Reserves

The Western Australian State government is working to establish a comprehensive, adequate and representative network of marine protected areas (MPAs) in the state waters of North Western Australia. The network includes a number of existing State and Commonwealth MPAs and a number of proposed State MPAs that contain environmental assets of high value or sensitivity, from a regional, State or national perspective. These values and sensitivities include habitats or species that are particularly vulnerable or that provide valuable ecological services such as coral reefs, mangroves, seagrass meadows and macroalgae.

There are four State MPAs, four gazetted Commonwealth MPAs and the Ningaloo Coast World Heritage Area (WHA) within the region. The GWA operational area does not overlap with any established or proposed marine protected areas. The marine protected areas within close proximity to the operational area are the Ningaloo World Heritage Area, Ningaloo Commonwealth Marine Reserve and Marine Park, and the Gascoyne Commonwealth Marine Reserve. The operational area is approximately 45 km from the Montebellow Commonwealth Marine Reserve and approximately 65 km from the jointly managed Montebellow Islands Marine Park / Barrow Island Marine Management Area (West Australian waters). The operational area is also approximately 103 km away from the Dampier Archipelago Marine Park and 120 km away from the Dampier Commonwealth Marine Reserve.

4. DESCRIPTION OF THE ACTION

The main operations associated with the GWA facility are summarised below:

4.1.1 Operational Area

The operational area applicable to the scope of the GWA EP is shown in Figure 2-1. The area includes:

- GWA and the area within a 500 m exclusion zone around the facility;
- The IFL from GWA to NRC covered by Pipeline Licence WA-2-PL and an area within 500m around the infrastructure;
- Echo Yodel subsea facilities, including the pipeline covered by Pipeline Licence WA-9-PL and an area within 500m around the infrastructure;
- Perseus over Goodwyn subsea facilities, including the pipeline covered by Pipeline Licence WA-13-PL and an area within 500m around the infrastructure; and
- The proposed GWF-1 subsea facilities, including the proposed pipeline back to GWA and an area within 500m around the infrastructure.

Vessel related activities within the Operational Area will comply with the EP. Vessels supporting the GWA facility when outside the Operational Area will adhere to all applicable maritime regulations.

4.1.2 Operational Details

The GWA facility commenced production in 1995. The facility operates 24 hours a day, 365 days a year with a total overnight Personnel on Board (PoB) capacity of 113 persons. Supporting operations, such as maintenance activities, take place as required.

Normal operations at GWA fall under any one of the following modes of operation:

- production and maintenance, including subsea inspection, maintenance and repair activities;
- production and well maintenance;
- production and major projects; and
- remote operations (only in the event of a severe cyclone).

The GWA facility receives well fluids from the platform and subsea production wells for topside processing via gas dehydration and condensate dewatering. The facility then exports the processed gas and condensate onshore to the KGP.

Key operational activities related to the production of gas and condensate include:

- Operational and emergency flaring; and
- Treatment and discharge of Produced Formation Water (PFW).

A number of activities also support the overall operation of the facility, these include:

- Utility systems such as lighting, heating, ventilation and air conditioning, seawater treatment for cooling water and potable water and power generation;
- Collection, treatment and disposal of sewage and putrescible wastes;
- Lifting operations;

- Transfer of supplies from vessels including food, equipment and fuel;
- Helicopter operations for transporting personnel and urgent freight; and
- Subsea inspection, maintenance and repair activities.

5. MAJOR ENVIRONMENTAL HAZARDS AND CONTROLS

Woodside has undertaken an environmental risk assessment to understand the potential environmental risks associated with the operation of the GWA facility to ensure they are reduced to As Low As Reasonably Practicable (ALARP) and will be of an acceptable level using a method consistent with Woodside standards.

The environmental risk assessment for the GWA facility identified 28 sources of environmental risk. These risks are divided into two broad categories: Planned (routine and non-routine); and Unplanned (accidents/incidents) activities.

5.1.1 Planned (Routine and Non-Routine) Activities

The majority of the sources of environmental risk identified for the GWA facility relate to those activities which are planned and either undertaken on a routine or non-routine basis. Examples of these sources of risk include:

- Physical presence of the facility generating light and noise emissions;
- Routine atmospheric emissions from gas flaring and fuel combustion;
- Routine discharges to the marine environment, including cooling water and PFW; and
- Storage, handling and disposal of waste.

Generally, the sources of risk from planned activities present a lower environmental consequence compared to the potential impact from unplanned accident or incident events. However, as these sources of risk relate to planned activities which occur routinely or more frequently, the EP contains a variety of mitigation and control measures which ensure potential impacts and risks will be reduced to ALARP and will be of an acceptable level.

For example, the routine discharge of PFW is measured to ensure the oil in water content meets Regulatory requirements prior to discharge. In addition, a comprehensive PFW monitoring program is in place to manage potential impacts and risks from this activity on an ongoing basis.

5.1.2 Unplanned (Accidents/Incidents) Activities

During the risk assessment process a number of potential environmental impacts which may occur from unplanned activities were also identified. These sources of risk range from small scale chemical spills with a low environmental consequence to large scale hydrocarbon spill events with high environmental consequence.

The risk assessment for GWA facility identified that of these unplanned activities, there are six which would be considered a Major Environment Event (MEE). The classification of a MEE is based on the potential for a higher level of environmental consequence if a credible worst case scenario were to occur.

Due to the potential consequence of a MEE a further level of rigour is applied to the assessment, including analysis using the 'Bowtie Technique'. This process assists in identifying the critical barriers to prevent the event occurring as well as mitigation measures to limit the potential consequence.

The MEEs identified for the GWA facility are:

- Hydrocarbon release caused by a well loss of containment;
- Hydrocarbon release caused by a subsea loss of containment;
- Hydrocarbon release caused by a topsides loss of containment;
- Hydrocarbon release caused by a loss of structural integrity;
- Hydrocarbon release caused by loss of marine vessel separation; and

- Hydrocarbon release caused by loss of control of suspended load.

A summary of the key environmental hazards and control measures for the MEEs identified for the GWA facility is presented in Appendix A.

6. MANAGEMENT APPROACH

The GWA facility will be managed in compliance with the EP accepted by NOPSEMA under the Environment Regulations, other relevant environmental legislation and Woodside's Management System (e.g. Woodside Environment Policy).

The objective of the EP is to ensure that potential adverse impacts on the environment associated with the GWA facility, during both planned and unplanned activities, are identified, and will be reduced to ALARP and will be of an acceptable level.

The EP details each environmental aspect (identified and assessed in the Environmental Risk Assessment), specific performance objectives, and identifies the range of controls (summarised in Appendix A for the identified MEEs) to be implemented to achieve the performance objectives. It also identifies the specific measurement criteria used to demonstrate that the performance objectives are achieved.

The implementation strategy detailed in the EP identifies the roles and responsibilities and training and competency requirements for all personnel (Woodside and its contractors) in relation to implementing controls, managing non-conformance, emergency response and meeting monitoring, auditing, and reporting requirements during the activity. The EP details the types of monitoring and auditing that will be undertaken, the reporting requirements for environmental incidents and reporting on overall compliance with the EP.

7. CONSULTATION

Woodside conducted a stakeholder assessment for the proposed activity to identify relevant and interested stakeholders. A consultation fact sheet was sent electronically to all identified stakeholders prior to lodgement of the EP with NOPSEMA for assessment and acceptance.

Woodside received feedback on the proposed activity from a range of stakeholders, including government agencies and commercial fishing representatives. Issues of interest included:

- the location of the project in relation to shipping fairways;
- the roles and responsibilities associated with a hydrocarbon spill incident;
- costs recovery of expenses incurred in providing assistance during a hydrocarbon oil spill;
- the revision of oil spill modelling for State waters; and
- commercial fishing areas.

Woodside considered this feedback in its development of management measures specific to the GWA facility. Woodside will continue to accept and assess stakeholder feedback throughout the duration of the life of the facility. In the event there is material change to the approved activities, Woodside will undertake additional consultation with all relevant stakeholders.

8. CONTACT DETAILS

For further information about this activity, please contact:

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APPENDIX A: KEY ENVIRONMENTAL HAZARDS AND CONTROL MEASURES FOR THE MEEs IDENTIFIED FOR THE GWA FACILITY

Source of Risk (Hazard)	Potential Environmental Impact	Control / Mitigation Measures
<ul style="list-style-type: none"> • Hydrocarbon release caused by a well loss of containment; • Hydrocarbon release caused by a subsea loss of containment; • Hydrocarbon release caused by a topsides loss of containment; • Hydrocarbon release caused by a loss of structural integrity; • Hydrocarbon release caused by loss of marine vessel separation; and • Hydrocarbon release caused by loss of control of suspended load. 	<p>Biological and ecological impacts to megafauna, plankton, deepwater benthic communities, offshore fish species, fisheries, coral reefs, mangroves, subtidal flats and sandy beaches and seagrass communities.</p>	<p>Many of the critical barriers in place to prevent a MEE from occurring are relevant across all MEEs identified for the GWA facility, a summary of which is provided below:</p> <ul style="list-style-type: none"> • Critical communication systems will facilitate prevention and response to accidents and emergencies. • Satellite tracking drifter buoy will monitor the movement of significant hydrocarbon spills to sea. • Fire and gas detection systems will facilitate prevention and response to fire or gas hazards. • ESD valves and systems will isolate hazardous inventories within pipework and riser systems and shut down plant and equipment. • Reservoir isolation valves will isolate the reservoir from the facility. • Critical blowdown valves will safely depressurise inventories to avoid, or prevent the escalation of a loss of containment. • Facility drain systems will contain leaks and spills of hazardous liquids. • Structural integrity of topsides and surface structures will be maintained to ensure availability of critical systems during a major accident or environment event. • All primary and secondary barriers within the wells will isolate hydrocarbons from the reservoir. • Crane lifting operations will be safely performed to minimise potential for dropped objects. • Navigational aids and warning lights will alert marine vessels and aircraft of the position of the facility. • Ship Intrusion Detection Systems Systems and equipment will detect and alert facility personnel of a potential collision with the facility and respond to a potential collision with the facility.

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Source of Risk (Hazard)	Potential Environmental Impact	Control / Mitigation Measures
		<p>Oil Spill Response Framework</p> <p>Woodside maintains a detailed spill response framework to be implemented in the event of a major hydrocarbon spill incident. This framework includes the Woodside Corporate Oil Spill Response Plan, which is supported by North West Shelf Project (NWSP) Facilities (Level 1) Oil Spill Response Plan.</p> <p>The purpose of the Corporate Oil Spill Response Plan is to demonstrate Woodside's ability to competently respond to an oil spill. The plan is also used to support assessment of the GWA EP.</p> <p>The North West Shelf Project (NWSP) Facilities (Level 1) Oil Spill Response Plan supports the Corporate Oil Spill Plan, and provides a concise outline of Woodside's proposed operational response strategies for hydrocarbon spills to the marine environment. This plan includes the GWA First Strike Action Plan, which outlines specific guidance for immediately responding to a spill from the GWA facility.</p>

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