

# **Curt 3D Marine Seismic Survey Environment Plan Summary**

**Geotechnical Operations**

Date: June 2012

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## 1. INTRODUCTION

Woodside Energy Ltd (Woodside) will undertake a three dimensional (3D) marine seismic survey (MSS) called the Curt 3D MSS, in the Rowley Sub-Basin in offshore Commonwealth waters Petroleum Exploration Permit Areas WA-462-P, WA-464-P and WA-466-P (see **Figure 1**).

This document provides a summary of the Environment Plan (EP) that was accepted by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) in accordance with Regulation 11(1) of the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 and Amendment Regulations 2011* (Environment Regulations).

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

## 2. LOCATION OF THE ACTIVITY

The Curt 3D MSS survey will occur within an operational area of 20,165 km<sup>2</sup> within Commonwealth waters that overlaps parts of petroleum exploration permit areas WA-462-P, WA-464-P and WA-466-P, exploration permit area WA-447-P, release area W11-8 and vacant acreage (**Figure 1**). The operational area is located approximately 290 km north-west of Broome in Western Australia and 250 km from the Kimberley coastline. Nearest landfall is Cunningham Island, which is part of Imperieuse Reef within the Rowley Shoals.

The area referred to as the 'operational area' (**Figure 1**) includes:

- A 'survey acquisition area' (i.e. the area within which seismic acoustic emissions will occur for the purposes of acquiring data), which is approximately 11,522 km<sup>2</sup> and overlaps with parts of petroleum exploration permit areas WA-462-P, WA-464-P and WA-466-P, and;
- A surrounding 'buffer' area (of approximately 10 km width) in which the seismic source may be discharged at or below full capacity (power) for the purpose of run-outs, source testing and soft starts (in accordance with the Part A Standard Management Procedures (*EPBC Act Policy Statement 2.1 – Interaction between offshore seismic exploration and whales*; DEWHA 2008a).

The survey acquisition area also is divided into two separate areas, or 'tranches': tranche 1 (4,348 km<sup>2</sup>); and tranche 2 (7,174 km<sup>2</sup>). Data will be acquired in tranche 1 first, followed by tranche 2. Water depths in the survey area range from approximately 600 m, to over 2,800 m in the north-west corner (see **Figure 1**).

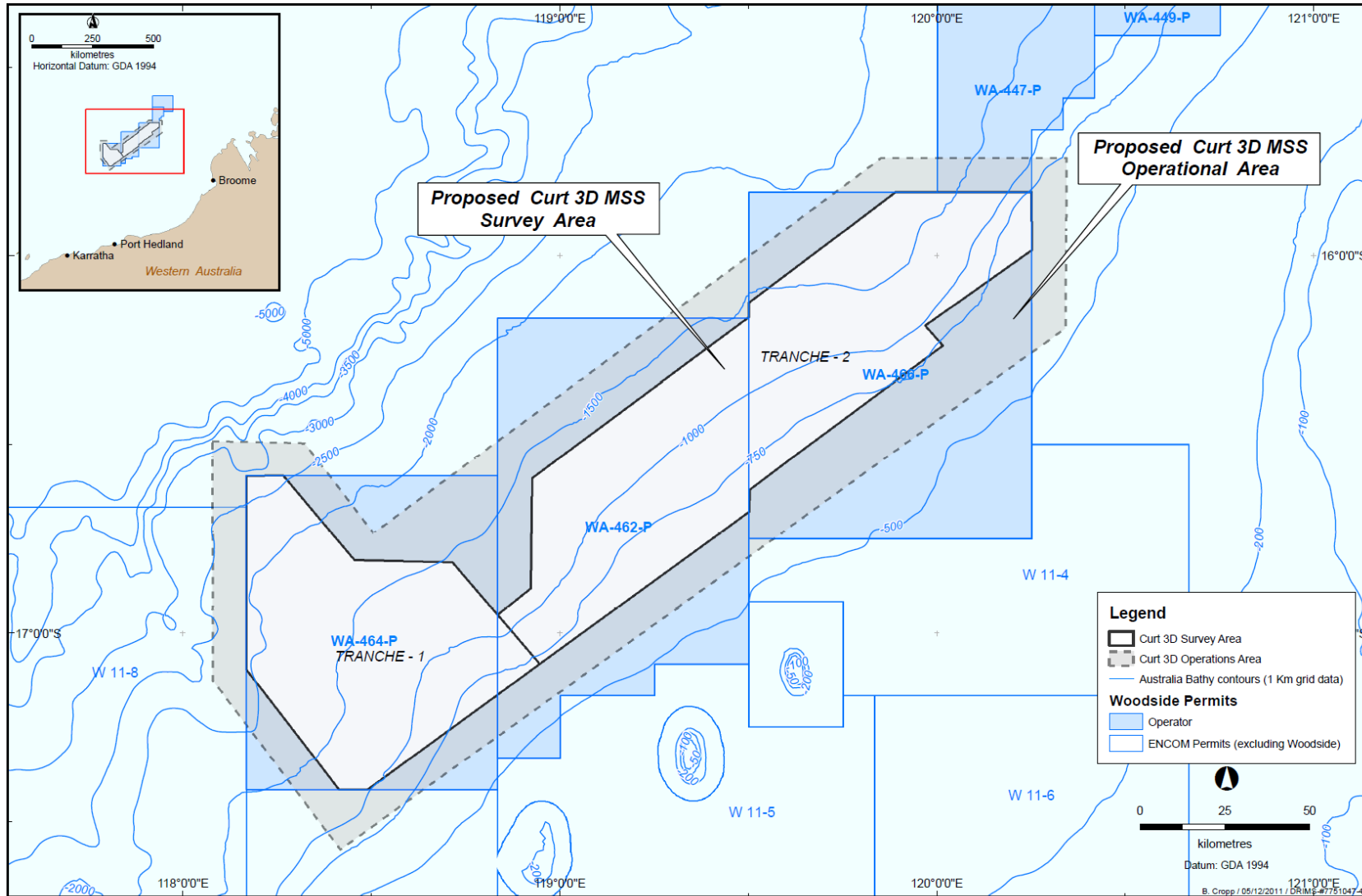
Boundary coordinates for the operational area are provided in **Table 1** below.

**Table 1: Approximate boundary coordinates for the Curt 3D MSS operational area**

Latitude (S)			Longitude (E)		
Degrees	Minutes	Seconds	Degrees	Minutes	Seconds
16	29	25.47	118	04	39.34
16	29	49.19	118	19	25.54
16	43	59.53	118	30	19.25
15	44	33.66	119	51	03.78
15	44	32.30	120	20	38.76
16	11	35.75	120	20	24.59
17	34	26.99	118	25	03.29
17	07	31.15	118	04	43.72
16	29	25.47	118	04	39.34

Datum: GDA94

The Curt 3D MSS will commence in June 2012 and will take approximately 6-7 months to complete. The actual timeframe is dependent on survey logistics and prevailing weather conditions.



**Figure 1: Location of Curt 3D MSS illustrating the operational and survey areas in relation to petroleum exploration permits, release areas and the Rowley Shoals**

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## 3. DESCRIPTION OF ENVIRONMENT

### 3.1 Physical Environment

The Curt 3D MSS operational area is located entirely in offshore Commonwealth marine waters approximately 250 km from the Kimberley coastline within the Northwest Transition Province of the North-west Marine Region (NWMR). The operational area lies on the continental slope in water depths from approximately 600 m, to over 2,800 m in the north-west corner.

Much of the seabed where the survey is located is gently sloping, featureless, sandy-mud sediments ranging from coarse to fine loose sand in the upper part of the area to fine muddy carbonate sediments further down the slope in the deeper parts of the survey area. Topographic features within the adjacent region include areas of rise, ridges, canyons and apron/fans particularly to the north west of the survey operational area.

The nearest significant features to the survey area are Mermaid, Clerke and Imperieuse reefs, which are collectively known as the Rowley Shoals, located approximately 28 km from the closest boundary of the operational area and 38 km from the boundary of the Curt 3D survey acquisition area (to the intertidal edge of Imperieuse Reef) (see **Figure 1**). The Rowley Shoals are a series of isolated, reef-rimmed platforms along a north-south orientation that rise near vertically to the surface from water depths of about 400 m on the continental slope.

### 3.2 Biological Environment

The benthos of the deep ocean survey area is relatively featureless, sandy-mud seabed supporting meiofauna (minute animals living between grains of sediment on the seabed, e.g. nematodes), larger infauna (that burrow into sediments, e.g. polychaete worms and isopods) and sparsely distributed epibenthic communities (that live on the surface of the seabed, e.g. seapens). Mobile benthic species, such as deepwater sea cucumbers, crabs and polychaetes are likely to be associated with the seabed, as well as deepwater fish and cephalopods in low densities.

Over 508 fish species have been identified on the North West Slope, and 64 of these species are endemic. The demersal fish communities of the province have been identified as a Key Ecological Feature (KEF) of the NWMR, as they are characterised by high endemism and species diversity.

A review of the EPBC Act database (Protected Matters Search Tool) held by SEWPaC indicates a total of 101 marine species listed under the provision of protection status (nine listed as Threatened; 22 as Cetaceans; 19 as Migratory; and 51 as Listed marine species) that may occur in, or relate to, the Curt 3D MSS operational area (SEWPaC 2011a). All 101 listed species are protected under the EPBC Act.

There are no EPBC Act-listed threatened ecological communities in the vicinity of the Curt 3D MSS operational area and the area does not contain habitat that is critical to the survival of any listed species.

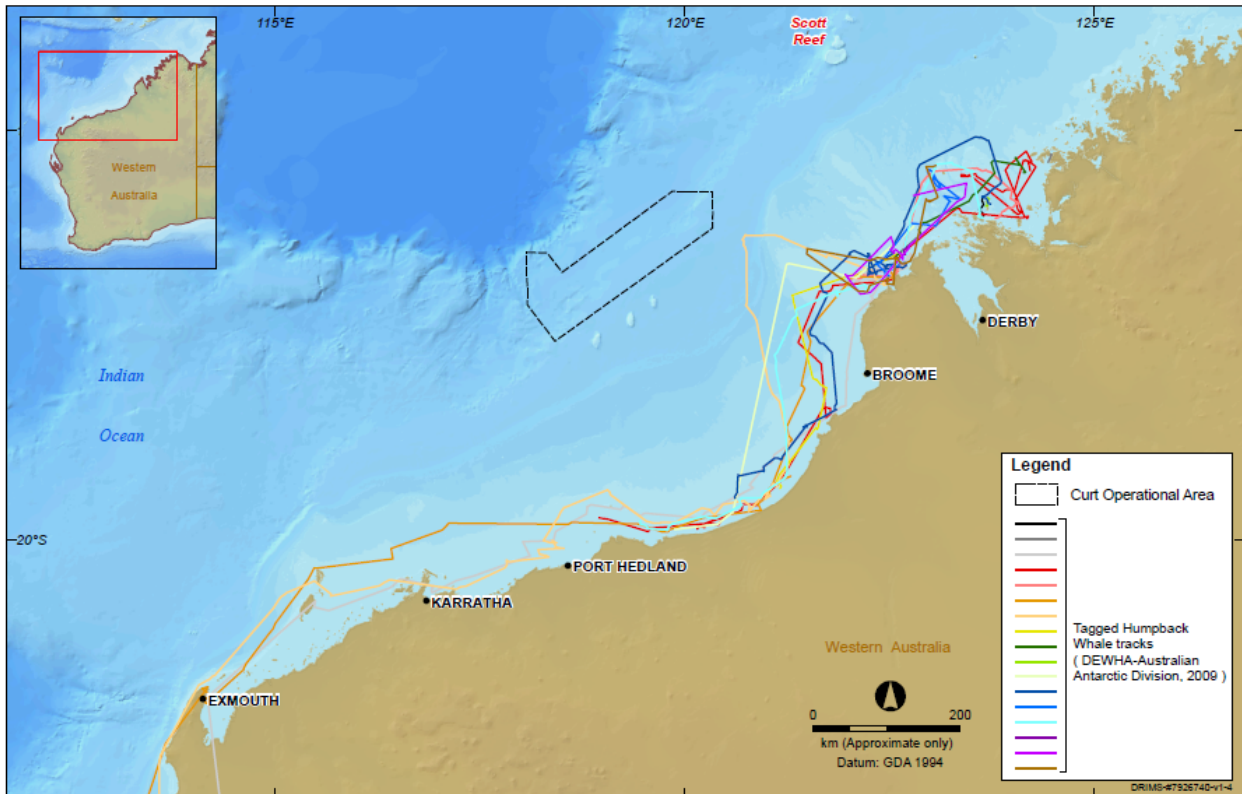
A number of whale species occur in and/or migrate through the NWMR, including the short-finned pilot whale (*Globicephala macrorhynchus*), false killer whale (*Pseudorca crassidens*), tropical Bryde's whale (*Balaenoptera edeni*), southern minke whale (*Balaenoptera acutorostrata*), killer whale (*Orcinus orca*), blue whale (*Balaenoptera musculus*), sperm whale (*Physeter macrocephalus*) and humpback whale (*Megaptera novaeangliae*).

The humpback whale is the most commonly sighted whale in north Western Australian waters. The species has been observed seasonally to complete their northern migration in the Camden Sound area of the west Kimberley, after feeding in Antarctic waters during the summer months. It is likely that the whales follow a predictable migratory path and migrate both north and south within the continental shelf boundary (200 m bathymetry) (see **Figure 2**). However, on the southbound migration it is likely that most individuals, and particularly cow/calf pairs, will stay closer to the coast than the northern migratory path. This is confirmed by recent satellite tracking of southbound female humpback whales in the Kimberley region (see **Figure 2**).

Although the timing and duration of the Curt 3D MSS (starting in June 2012 for 6-7 months) may overlap the migration periods (July - September) for humpback whales in the region, it is unlikely that many humpbacks will be encountered as most pods are found closer to shore, in much shallower water depths (<200 m) than the survey operational area (600 to 2,800 m).

Other species whose broad distributions include the wider region include whales that are infrequently observed, including: the blue and pygmy blue whale, sperm, killer and Bryde's whales. Consequently, individuals of these species may be encountered in the area during the survey, although they are not expected in significant numbers.

There are no known breeding, calving or feeding grounds for any listed threatened or migratory cetacean species within, or in the immediate vicinity of the Curt 3D MSS operational area.



Source: modified from Double *et al.* (2010).

**Figure 2: Tracks from satellite-tagged humpback whales in relation to the Curt 3D MSS.**

Six marine turtle species may occur in the operational area and adjacent waters - the green turtle (*Chelonia mydas*), leatherback turtle (*Dermochelys coriacea*), loggerhead (*Caretta caretta*), hawksbill turtle (*Eretmochelys imbricata*), olive ridley turtle (*Lepidochelys olivacea*), and the flatback turtle (*Natator depressus*). Green, hawksbill, flatback and loggerhead turtles are known to feed and nest in the region. Leatherback and olive ridley turtles also migrate through the region and feed there.

Based on the known distributions for turtles, both green and hawksbill turtles are likely to be present at the Rowley Shoals. However, no turtle feeding areas are likely to be present in the Curt 3D MSS operational area, as the area does not include any shallow shoals or banks.

While the operational area is located approximately 250 km from the nearest mainland coastline, the distributions of many common seabirds and shorebirds overlap the region and may occur in the operational area. Migratory shorebirds are likely to be present in or overfly the region between July and October.

### 3.3 Socio-economic Environment

#### Commercial Fisheries

The Curt 3D MSS operational area is located in waters that constitute part of four Commonwealth managed commercial fisheries (**Figure 3**);

- the North West Slope Trawl Fishery (NWSTF);
- the Southern Bluefin Tuna Fishery (SBTF)
- the Western Skipjack Tuna Fishery (WSTF); and
- the Western Tuna and Billfish Fishery (WTBF).

These fisheries are managed by the Australian Fisheries Management Authority (AFMA). Of these four fisheries, only the NWSTF is active in the deeper continental slope waters off the NWS targeting mainly scampi and deepwater prawns. Activities in the SBTF are largely confined to waters in the Great Australian Bight and north-east of Eden in New South Wales (Woodhams *et al.* 2011). The majority of catch and effort in the WTBF occurs in Commonwealth waters off the central west coast of WA, and there was no activity at all in the WSTF during the 2009-2010 season (Woodhams *et al.* 2011).

While the Curt 3D MSS operational area overlaps the area available to the NWSTF, it is apparent that most of the effort and catch within the fishery in the recent years (2009-2010) occurs in shallower, upper slope waters (350-600 m) to the south of the operational area—especially to the south-west and north-east of the Rowley Shoals.

#### Shipping

The northern part of the Curt 3D MSS operational area is crossed by a major shipping route between the port of Dampier and Lombok Strait (AMSA 2007). This route carries significant traffic comprising bulk carriers and LNG vessels.

#### Marine Conservation Reserves

Together, Imperieuse and Clerke reefs constitute The Rowley Shoals Marine Park, which is an 'A' Class reserve vested in the WA Marine Parks and Reserves Authority (MPRA) and managed by the Department of Environment and Conservation (DEC) on behalf of the MPRA. Clerke and Imperieuse reefs fall under the jurisdiction of the WA State Government because the associated Bedwell and Cunningham Islands lie above the high water mark. State Coastal waters and the marine park boundaries extend out three nautical miles (5.6 km) from the low water mark of the reefs surrounding these islands (i.e. 3 nm from the edges of Clerke and Imperieuse reefs).

Mermaid Reef, the most northerly of the Rowley Shoals, is incorporated into the Mermaid Reef Marine National Nature Reserve—a Commonwealth marine protected area.

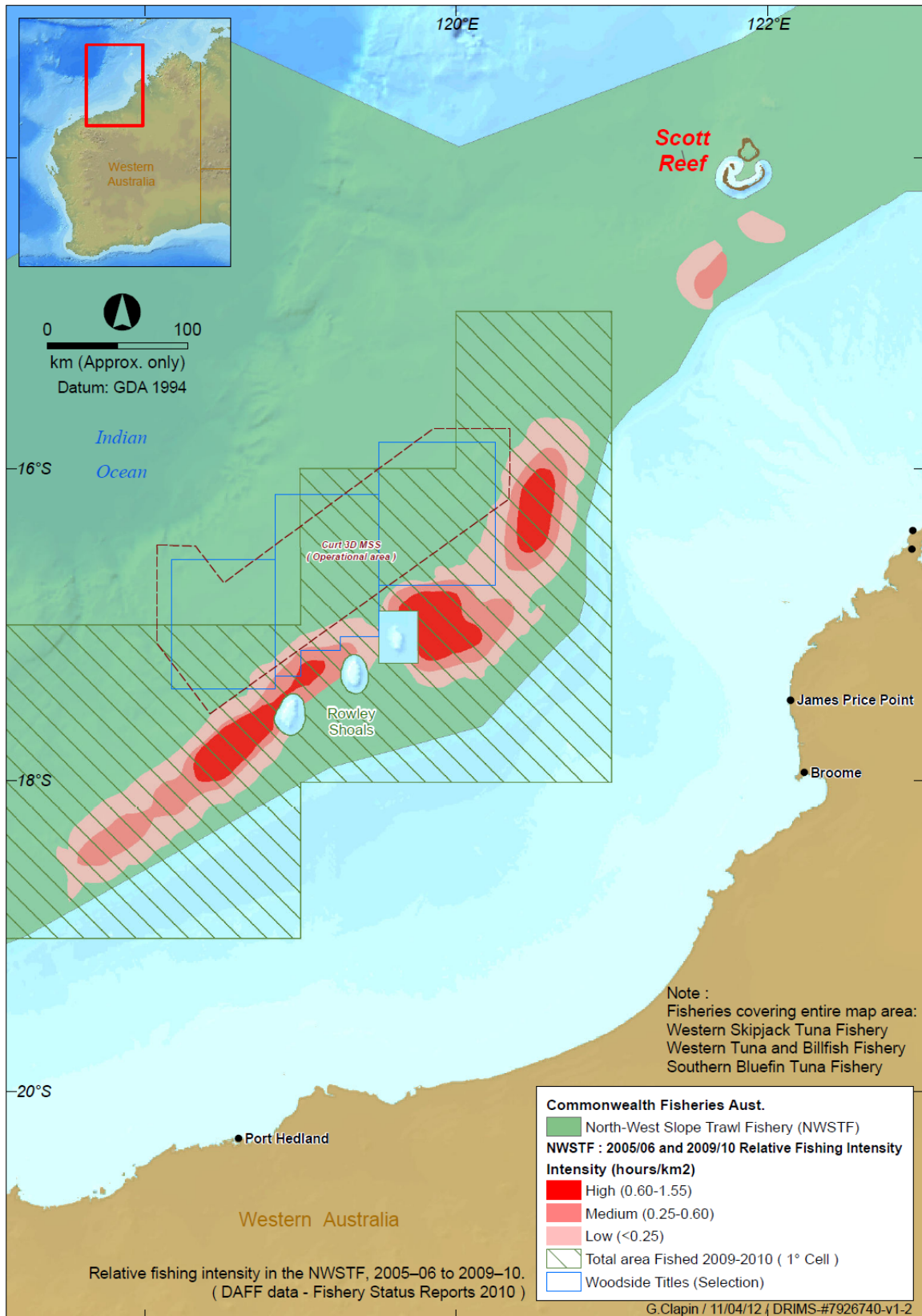
At the closest point, the Curt 3D operational 'buffer' area is located approximately:

- 21 km from the marine park boundary around Imperieuse Reef, and
- 24 km from the marine park boundary around Clerke Reef.
- 17 km from the boundary of the Mermaid Reef Marine National Nature Reserve boundary, and 33 km from the edge of the reef itself.

#### Proposed Marine Conservation Reserves

The Curt 3D MSS operational area also overlays part of the proposed Pilbara Commonwealth marine reserve which covers an area of 145,833 km<sup>2</sup> in water depths of approximately 220-6,000m. The proposed use of this zone is Multiple Use (IUCN category VI) where petroleum exploration and development activities are allowed under appropriate approvals (SEWPaC 2011c).





Source: modified from Fisheries status report 2010 (Woodhams *et al.* 2011).

**Figure 3: Commonwealth Fisheries operating in the Curt 3D MSS Area.**

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## 4. DESCRIPTION OF THE ACTION

The Curt marine seismic survey is a typical 3D survey similar to most others conducted in Australian marine waters (in terms of technical methods and procedures). No unique or unusual equipment or operations are proposed. Seismic data will be collected using a purpose built seismic survey vessel towing dual air-powered acoustic source arrays (airguns) and hydrophone cables (also known as streamers). The acoustic emissions from the airguns will be detected by the streamers and then recorded onboard the seismic vessel. The reflected sound is then processed to provide information about the structure and composition of geological formations below the seabed in an attempt to identify hydrocarbon reservoirs.

The seismic vessel will traverse the survey area in a series of pre-determined lines at a speed of approximately 7–9 km/h. The operating pressure for the source arrays (airguns) will be approximately 13,800 kPa (2,000 psi). The airguns will consist of two sub-arrays, each with a maximum volume of approximately 0.069 m<sup>3</sup> (3,480 cui). Airguns will be towed at a depth of 7 m (+/- 1 m). These sub-arrays will be fired alternately, with a shotpoint interval of 18.75 m horizontal distance.

The vessel will tow 12 hydrophone cables (solid streamers), which will be up to 6 km long and will sit at a depth of 10 m (+/- 1 m).

The noise measure used to characterise the airgun output sound pressure level (SPL) is measured in decibels (dB) relative to 1 micro Pascal: dB re 1µPa (SPL).

The airguns produce sound pulses within a few meters in the order of 265-275 dB re 1µPa (SPL) at frequencies extending up to approximately 100 Hz. These sound pulses decrease to levels in the order of 201 dB re 1µPa (SPL) within 1 km of the source and approximately 181 dB re 1µPa (SPL) within 10 km, dependent on the sound propagation characteristics of the area.

Recent advances in cable technology have led to a new generation of seismic streamers, moving away from the traditional fluid filled cable to a solid cable. Solid cables are constructed from extruded polymer foam where the requirement for fluid or gel fill has been significantly reduced.

## Survey Vessels

The proposed Curt 3D MSS will be conducted by the geophysical contractor Polarcus, using the 3D capable vessel, the Polarcus Alima (**Figure 4**), a primary support vessel, the Sealink 161, and a secondary support vessel, the Empress.



**Figure 4: The Seismic Vessel - Polarcus Alima and Primary Support Vessel - Sealink 161**

The primary support vessel will accompany the seismic survey vessel to maintain a safe distance between the towed array and other vessels, and also to manage interactions with shipping and fishing activities, if required. When the primary support vessel needs to return to port to re-supply, a secondary support vessel will travel to the survey location, to maintain continuous support during operations.

The seismic vessel will likely remain onsite during standard operations for the duration of the survey (i.e. not return to port). The support vessel will be used to re-supply the seismic vessel, including at sea refuelling (of marine diesel). At sea refuelling will be subject to controls (procedural and equipment) and will not take place within a distance of less than 12 nautical miles from any emergent land or shallow water features (e.g. the Rowley Shoals - Clerke, Imperieuse or Mermaid reefs). In addition appropriate oil spill contingency planning, trained personnel and equipment will be available in the unlikely event of a fuel spill.

Crew change transfers will likely be undertaken via helicopter operating out of the Broome heliport and will occur approximately every five weeks for the duration of the survey.

The Curt 3D MSS will be conducted in accordance with all relevant Commonwealth Acts and regulations, with procedures in place to govern the survey activities that involve potential environmental impacts, including cetacean interaction, refuelling operations, streamer handling and maintenance, and vessel encounters.

## 5. MAJOR ENVIRONMENTAL HAZARDS AND CONTROLS

The environmental risks and potential environmental impacts of the Curt 3D MSS have been determined on the basis of Woodside's previous seismic survey experience in the region and the outcomes of an environmental risk assessment.

This environmental risk assessment has been undertaken by Woodside to understand and manage the environmental risks associated with the Curt 3D MSS to ensure that risks are reduced to As Low As Reasonably Practicable (ALARP) and will be of an acceptable level using a method consistent with the *Australian/New Zealand Standard AS/NZS ISO 31000:2009 Risk Management* and *HB 203:2006 Environmental Risk Management – Principles and Process*.

The key environmental hazards and details of control/mitigation measures to be applied to the Curt 3D MSS are shown in **Appendix A**. These are consistent with Woodside corporate and project-specific objectives, standards and criteria. All commitments associated with these hazards will be used to reduce

environmental risk to ALARP and will be of an acceptable level to meet the established performance objectives, standards and measurement criteria specified in the accepted EP.

A summary of the key sources of environmental risk (hazards) for the environmental aspects of the Curt 3D MMS include:

- Physical presence of vessel [Aspect] - noise, movement, anchoring, grounding, lighting, and transport of invasive marine species [Hazard]
- Use of seismic equipment [Aspect] - acoustic noise, loss of streamers, loss of streamer fluid [Hazard]
- Vessel engines and machinery [Aspect] - Atmospheric emissions [Hazard]
- Solid and liquid waste management [Aspect] - non-compliant operational discharge, accidental loss/discharge [Hazard]
- Use of fuel and hazardous chemicals [Aspect] - loss of hydrocarbons/chemicals due to deck spill, spill during refuelling, spill due to breach of vessel hull tanks [Hazard]

## 6. MANAGEMENT APPROACH

The Curt 3D MSS will be managed in compliance with the *Curt 3D MSS Environment Plan* 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 Curt 3D MSS, during both routine and non-routine operations, are identified, and will be reduced to ALARP and will be of an acceptable level.

The Curt 3D MSS EP details for each environmental aspect (identified and assessed in the Environmental Risk Assessment – *Section 5 of the Environment Plan*) specific performance objectives and standards, and identifies the range of controls (controls available in **Appendix A** of this summary) to be implemented (consistent with the standards) to achieve the performance objectives and identifies the specific measurement criteria used to demonstrate that these performance objectives are achieved.

The implementation strategy detailed in the Curt 3D MSS EP identifies the roles/responsibilities and training/competency requirements for all personnel (Woodside and its contractors) in relation to implementing controls, managing non-compliance, emergency response and meeting monitoring, auditing, and reporting requirements during the activity. The Curt 3D MSS EP details the types of monitoring and auditing that will be undertaken, the reporting requirements for environmental incidents and reporting on overall compliance of the survey with the EP.

## 7. CONSULTATION

Consultation and stakeholder engagement activities conducted for the Curt 3D Marine Seismic Survey builds upon the extensive and ongoing program of stakeholder engagement undertaken throughout Woodside's long history of working in the region.

Prior to submitting the Curt 3D MSS EP to NOPSEMA for assessment and approval a number of groups and organisations were consulted on the Curt 3D MSS. These groups and organisations were selected based on the potential for impact or their high level of interest in the survey activity.

Consultation did not identify any material issues that would impact the completion of the survey. Woodside will continue to accept feedback from stakeholders during the seismic survey program.

## 8. CONTACT DETAILS

For further information about this activity, please contact:

Stephen Munday  
Stakeholder Relations  
T: +61 08 9348 3719  
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## 9. REFERENCES

AMSA 2007, Australian Maritime Safety Authority, Australian Ship Reporting System.

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## APPENDIX A: Summary of Major Environmental Hazards and Control Measures to be applied to the Curt 3D Marine Seismic Survey

Source of Risk (Hazard)	Potential Environmental Impact	Control/Mitigation Measures
<b>Physical Presence of Survey Vessels</b> Timing and location of survey activity	Disturbance to marine fauna in critical habitat	<ul style="list-style-type: none"> <li>Seismic survey acquisition will not be undertaken outside the accepted boundaries of the 'survey area' and 'operational area', or outside the accepted time period for the survey (See <b>Section 2</b> and <b>Figure 1</b>).</li> <li>Adherence to the Australian National Guidelines for Whale and Dolphin Watching (DEWHA 2005).</li> <li>The interaction of the survey/support vessels and helicopters with cetaceans will be consistent with <i>Part 8 of the EPBC Regulations (2000)</i> which:                             <ul style="list-style-type: none"> <li>requires that a vessel will not travel greater than 6 knots within 300 m of a whale (caution zone) and not allow the vessel to approach closer than 100m of a whale; and</li> <li>requires that helicopters shall not operate lower than 1 650 ft (&lt;500 m) or within the horizontal radius of 500 m of a cetacean known to be present in the area.</li> </ul> </li> <li>All members of crew will be briefed on environmental requirements and particularly crew responsible for vessel or helicopter operation and navigation will be aware of cetacean interaction regulations/ guidelines</li> </ul>
	Interference with fishing operations	<ul style="list-style-type: none"> <li>Notification of activity details as required to relevant commercial fisheries organisations prior to commencement of the survey (Survey fact sheet distributed to stakeholders).</li> <li>Issue Notice to Mariners (NTM) via the Australian Hydrographic Office. Australian Maritime Safety Authority (AMSA) Maritime Safety Information (MSI) notifications (coastal warnings and NAVAERA X).</li> <li>The use of standard maritime safety procedures (radio contact, display of appropriate navigational beacons and lights) and adherence to Australian Maritime Safety Authority, Marine Orders Part 30: (<i>Prevention of collisions, Issue 8</i>).</li> </ul>
	Interference with commercial shipping	<ul style="list-style-type: none"> <li>Strict adherence to contractor's equipment handling and acquisition procedures – these procedures will be reviewed and approved by Woodside prior to commencement of the activity.</li> <li>Vessels with experienced operators and crew will be used to minimise the risk of equipment dragging or loss.</li> <li>Where possible in-water equipment lost will be recovered and when unable to be recovered detailed records of equipment lost overboard will be maintained.</li> </ul>
	Impacts to Marine Conservation Reserves or Heritage listed places	<ul style="list-style-type: none"> <li>No access of survey or support vessels under normal operations will be permitted within the Rowley Shoals Marine Park and Mermaid Reef Marine National Nature Reserve.</li> <li>Boundaries of the Rowley Shoals Marine Park and Mermaid Reef Marine National Nature Reserve are included on vessel navigation systems.</li> </ul>
<b>Physical Presence of Survey Vessels</b> Vessel movement and noise	Acoustic disturbance to marine fauna – behavioural Injury/mortality of marine fauna	<ul style="list-style-type: none"> <li>Adherence to the Australian National Guidelines for Whale and Dolphin Watching (DEWHA 2005).</li> <li>The interaction of the survey/support vessels and helicopters with cetaceans will be consistent with Part 8 of the EPBC Regulations (2000) which:                             <ul style="list-style-type: none"> <li>requires that a vessel will not travel greater than 6 knots within 300 m of a whale (caution zone) and not allow the</li> </ul> </li> </ul>

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		<p>vessel to approach closer than 100m of a whale; and</p> <ul style="list-style-type: none"> <li>- requires that helicopters shall not operate lower than 1 650 ft (&lt;500 m) or within the horizontal radius of 500 m of a cetacean known to be present in the area.</li> <li>• All members of crew will be briefed on environmental requirements and particularly crew responsible for vessel or helicopter operation and navigation will be aware of cetacean interaction regulations/ guidelines.</li> <li>• Dedicated Marine Fauna Observer (MFO) will be present on seismic vessel.</li> <li>• Detailed reports of all cetacean sightings will be recorded using the SEWPaC Cetacean Sightings Application (CSA - Version 3 - BETA)</li> <li>• Reports of all turtle and whale shark sightings will be recorded and reported within the final survey compliance report (<i>Section 8.2.1 of Environment Plan</i>).</li> </ul>
	Vessel Anchoring – damage to subsea habitat	<p>Survey vessels are not operationally required or able to anchor in the 600-2800 m water depth at the Curt 3D MSS site and on this basis there will be no impacts/risks to benthic habitat from anchoring.</p> <p>Mitigation measures are not considered to be required.</p>
	Vessel Grounding – damage to subsea habitat	<ul style="list-style-type: none"> <li>• Support vessels will transit along pre-planned routes between the survey site and port where possible to avoid navigation hazards.</li> <li>• Vessels will use approved navigations systems and depth sounders.</li> <li>• Adherence to standard maritime safety/navigation procedures.</li> <li>• Navigation aids i.e. navigation aids, radar, vessel GPS tracking and management systems (VMS), depth sounders and competent crew (including fatigue management).</li> <li>• Vessels will not access the Rowley Shoals Marine Park and Mermaid Reef Marine National Nature Reserve (ie 12nm exclusion zone – unless in an emergency).</li> <li>• Seismic and support vessel will undertake a tow test during mobilisation to ensure the support vessel has the capacity to pull the survey vessel in a loss of power event.</li> </ul>
	Vessel Lighting – disturbance to fauna	<p>The closest edge of the Curt 3D MSS operational area is located approximately 28 km from the edge of the nearest reef (intertidal edge of Imperieuse Reef) and 31 km away from the nearest emergent land that could be used as turtle breeding habitat (Bedwell Island in Clerke Reef).</p> <p>There are no identified applicable environmental performance standards in regards to the seismic and support vessel lighting for offshore waters. All vessel lighting will be maintained as required to for vessel navigation, vessel safety and safety of deck operations.</p>
<b>Introduction of Invasive Marine Species</b>	Transport/introduction of invasive marine species in vessel ballast water	<ul style="list-style-type: none"> <li>• Adherence the <i>Australian Ballast Water Management Requirements</i>: <ul style="list-style-type: none"> <li>- As a minimum, all vessels mobilised from outside of Australia must undertake ballast water exchange &gt;50 nm from land and &gt;200m water depth; and</li> <li>- Ballast water exchange records will be maintained.</li> </ul> </li> </ul>
	Transport/introduction of invasive marine species on hull, internal niches and in-water equipment	<ul style="list-style-type: none"> <li>• Woodside’s IMS risk assessment process will be applied to all vessels and submersible equipment planning to enter and operate within nearshore waters around Australia. Nearshore areas include all waters within 12 nautical miles of land and in all waters less than 50 m deep at LAT.</li> <li>• Based on the outcomes of each IMS risk assessment, management measures commensurate with the risk will be implemented to minimise the likelihood of new IMS being introduced, or established IMS being spread within Australian waters.</li> </ul>

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		<ul style="list-style-type: none"> <li>• Vessels can be assessed as: <ul style="list-style-type: none"> <li>- being exempt under the WEL IMS Management Plan;</li> <li>- low risk with no management response required; or</li> <li>- low risk following the implementation of management measures (see below).</li> </ul> </li> <li>• Vessels assessed as being uncertain or high risk are subject to one of the following management measures: <ul style="list-style-type: none"> <li>- Inspections; Cleaning; Treatment; or Rejection.</li> </ul> </li> </ul>
<p><b>Use of Seismic Equipment</b> Generation of acoustic signals</p>	<p>Acoustic disturbance to marine fauna – behavioural or physiological</p> <p>Disturbance to marine fauna in critical habitat “breeding, feeding, resting, migratory corridors</p>	<ul style="list-style-type: none"> <li>• Adherence to EPBC Act Policy Statement 2.1 – Interaction between offshore seismic exploration and whales (DEWHA 2008a) and the following (additional) mitigation measures: <ul style="list-style-type: none"> <li>- Pre start observation procedures;</li> <li>- Precaution zones including to the following: <ul style="list-style-type: none"> <li>- Observation zone: 3km + horizontal radius from the acoustic source.</li> <li>- Low power zone: 2 km horizontal radius from the acoustic source.</li> <li>- Shut-down zone: 500 m horizontal radius from the acoustic source.</li> </ul> </li> <li>- Start-up Procedure will comply with EPBC Act Policy Statement 2.1 including <ul style="list-style-type: none"> <li>- Soft start-up procedure</li> <li>- Start-up delay procedure</li> <li>- Stop work procedure</li> <li>- Regular observations</li> <li>- Sightings of marine fauna and interactions recorded</li> </ul> </li> <li>- Dedicated Survey Environmental Adviser (SEA) (whose duties will involve the tasks of a Marine Fauna Observer (MFO) and additional environmental management (Table 7-4 of the Environment Plan) or suitably trained crew member on seismic vessel to conduct observations on the seismic vessel; and</li> <li>- Survey personnel (marine and seismic) provided with pre-survey induction on EPBC Act Policy Statement 2.1.</li> </ul> </li> <li>• Detailed reports of all cetacean sightings will be recorded using the SEWPaC Cetacean Sightings Application (CSA - Version 3 - BETA).</li> <li>• In conjunction with the marine mammal mitigation measures the MFO will (during daylight hours): <ul style="list-style-type: none"> <li>- maintain continuous visual observations for marine turtles and whale sharks within a 500 m horizontal radius of the source;</li> <li>- if marine turtles and whale sharks are sighted within 500 m horizontal radius of source, the acoustic source will be shut down; and</li> <li>- undertake visual observations for marine turtles and whale sharks for at least 10 minutes prior to the commencement of soft start, focusing on a 500 m horizontal radius of the source.</li> </ul> </li> <li>• Detailed reports of all turtle and whale shark sightings will be recorded and reported.</li> </ul>
Physical Loss of Streamers	Damage to subsea habitat	<ul style="list-style-type: none"> <li>• Strict adherence to contractor’s equipment handling and acquisition procedures – these procedures will be reviewed and approved by Woodside prior to commencement of the activity.</li> <li>• Where possible in-water equipment lost will be recovered, where recovery does not occur records of equipment lost overboard will be maintained.</li> </ul>
<p><b>Atmospheric Emissions</b> Use of Vessel and</p>	Reduced localised air quality from atmospheric emissions	<ul style="list-style-type: none"> <li>• Compliance with MARPOL 73/78 Annex VI (as implemented in Commonwealth waters by the <i>Commonwealth Protection of the Sea (Prevention of Pollution from Ships) Act 1983</i>); AMSA Marine Orders – <i>Part 97 Marine Pollution</i></li> </ul>



Machinery Engines		<p><i>Prevention – Air Pollution.</i> In particular:</p> <ul style="list-style-type: none"> <li>- use of low sulphur fuel when it is available to minimise emissions from combustible sources; and</li> <li>- emissions managed by the implementation of a preventive maintenance system.</li> </ul>
Solid and Liquid Waste Management	<p>Routine Discharge of Sewage, Putrescible Waste and Bilge Water to the Marine Environment Non-compliant operational discharge of waste to marine environment</p>	<ul style="list-style-type: none"> <li>• All sewage and putrescible wastes will be managed and disposed of in accordance with MARPOL 73/78 (as implemented in Commonwealth waters by the <i>Protection of the Sea (Prevention of Pollution from Ships) Act 1983</i>); AMSA Marine Orders - Part 96: Marine Pollution Prevention – Sewage and Part 91 Marine Pollution Prevention – Oil, including:             <ul style="list-style-type: none"> <li>- discharge of sewage and putrescibles waste will be of short duration with high dispersion and biodegradability;</li> <li>- all sewage and putrescible waste treatment systems and holding tanks are to be fully operational prior to survey commencement; and</li> <li>- operational onboard sewage treatment plant approved by the International Maritime Organisation (IMO).</li> </ul> </li> <li>• Sewage and putrescible wastes macerated where possible prior to disposal.</li> <li>• Discharge of sewage which is not comminuted or disinfected will only occur at a distance of more than 12 nautical miles (nm) from the nearest land.</li> <li>• Discharge of sewage which is comminuted or disinfected using a certified approved sewage treatment plant will only occur at a distance of more than 3 nm from the nearest land.</li> <li>• Discharge will occur at a moderate rate while vessel is proceeding, with no visible floating solids or discolouration of the surrounding water</li> <li>• Vessels unable to treat/store grey water (i.e. wastewater from sinks and showers) will where possible use biodegradable soaps and detergents.</li> <li>• A Vessel Waste Log will be maintained to record waste management practices.</li> <li>• Bilge water will be treated and disposed in accordance with MARPOL 73/78 (as implemented in Commonwealth Waters by the <i>Protection of the Sea (Prevention of Pollution from Ships) Act 1983</i>).</li> <li>• Bilge water contaminated with hydrocarbons must be contained and disposed of onshore, except if the oil content of the effluent without dilution does not exceed 15 ppm or an IMO approved oil/water separator is used to treat the bilge water.             <ul style="list-style-type: none"> <li>- Bilge water contaminated with chemicals must be contained and disposed of onshore, except if the chemical is demonstrated to have a low toxicity (as determined by the relevant Material Safety Data Sheet (MSDS) and the Woodside Environmental Adviser).</li> <li>- Discharge of treated bilge water (&lt;15 ppm oil) only at a distance of more than 12 nm from land or the Rowley Shoals.</li> </ul> </li> </ul>
	<p>Non- routine discharge of waste to marine environment</p>	<ul style="list-style-type: none"> <li>• No discharge of plastics or plastic products of any kind from vessels in accordance with MARPOL requirements.</li> <li>• No discharge of domestic wastes (i.e. cans, glass, paper or other wastes from living areas) and no maintenance wastes (i.e. paint sweepings, rags, deck sweepings, oil soaks, machinery deposits, will be disposed of overboard) from vessels.</li> <li>• All solid, liquid and hazardous wastes (other than sewage, grey water and putrescible wastes) will be incinerated or compacted (if possible) and stored in designated areas and sent ashore for recycling, disposal or treatment.</li> <li>• Correct segregation of solid and hazardous wastes.</li> <li>• All waste receptacles aboard the survey and support vessels will be covered with tightly fitting, secure lids to prevent any solid wastes from blowing overboard.</li> <li>• Incinerators used are compliant with MARPOL and IMO requirements.</li> </ul>

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		<ul style="list-style-type: none"> <li>• Incinerators will be operated in accordance with established operating procedures that align with manufacturers specifications by trained personnel.</li> <li>• Vessel Waste Management Plan in place detailing wastes generated and disposal requirements.</li> <li>• All storage facilities and handling equipment will be in good working order and designed in such a way as to prevent and contain any spillage as far as practicable.</li> <li>• A Vessel Waste Log or Garbage Log will be created and maintained to record quantities of wastes transported to shore.</li> <li>• Detailed records of waste accidentally discharged will be maintained.</li> </ul>
<p>Use of fuel and hazardous chemicals</p>	<p>Loss of hydrocarbons/chemicals to marine environment from deck spills potentially leading to:</p> <ul style="list-style-type: none"> <li>- Toxic effects to marine biota</li> <li>- Oiling of marine mammals, reptiles and seabirds</li> <li>- Oiling of coastlines/islands/coral reefs</li> </ul>	<ul style="list-style-type: none"> <li>• Woodside approved Vessel Waste Management Plan in place detailing wastes generated and disposal requirements.</li> <li>• All chemical and hazardous wastes will be segregated into clearly marked containers prior to onshore disposal</li> <li>• All storage facilities and handling equipment will be in good working order and designed in such a way as to prevent and contain any spillage as far as practicable.</li> <li>• Hydrocarbons located above deck will be stored with the adoption of secondary containment measures to contain leaks or spills e.g. bund, containment pallet, transport packs etc.</li> <li>• Shipboard Oil Pollution Emergency Plan (SOPEP) will be prepared and kept onboard the vessels.</li> <li>• Chemical spill risks will be managed in accordance with Woodside's Corporate Oil Spill Response Plan (OSRP) (WEL Doc No. W0000AV0003.0001) and the Curt 3D Marine Seismic Survey Oil Spill Action Plan (<i>Appendix E of the Environment Plan</i>).</li> <li>• All hazardous substances (as defined in NOHSC: 1008 (2004) – Approved Criteria for Classifying Hazardous Substances) will have an Material Safety Data Sheet (MSDS) in place that is readily available on board.</li> <li>• Spill response bins/kits will be located in close proximity to hazardous material storage areas for prompt response in the event of a spill or leak. The kits will be checked for their adequacy and replenished as necessary prior to the commencement of activities and on a regular basis thereafter. Identified personnel will be trained in use of this equipment.</li> </ul>
	<p>Loss of hydrocarbons/chemicals to marine environment from bunkering potentially leading to:</p> <ul style="list-style-type: none"> <li>- Toxic effects to marine biota</li> <li>- Oiling of marine mammals, reptiles and seabirds</li> <li>- Oiling of coastlines/islands/coral reefs</li> </ul>	<p><i>Preventative measures</i></p> <ul style="list-style-type: none"> <li>• Bunkering will be restricted to locations on the north western side of the survey acquisition area during normal activities.</li> <li>• Bunkering at sea must be undertaken in accordance with a Vessel Bunkering Procedure, which has been developed and approved by Woodside prior to use. This procedure will be subject to the following requirements, as a minimum:             <ul style="list-style-type: none"> <li>- Bunkering at sea will not take place within a distance of less than 12nm from any emergent land or shallow water features (e.g. the Rowley Shoals - Clerke, Imperieuse or Mermaid Reefs);</li> <li>- bunkering will occur during daylight hours only and when sea conditions are appropriate -                 <ul style="list-style-type: none"> <li>▪ Swells &lt;2 m : Bunkering permitted;</li> <li>▪ Swells &gt;2 m and &lt;4 m : Decision to be discussed between Vessel Master and Party Manager;</li> <li>▪ Swells &gt;4 m : Bunkering not permitted;</li> <li>▪ Wind speed &gt;30 knots : Vessel Master must be in agreement with Party Manager ;</li> </ul> </li> <li>- JHA in place and reviewed before each fuel transfer;</li> <li>- bunkering procedure approved by Woodside;</li> <li>- crew undertaking bunkering will be suitably trained;</li> <li>- spill kits will be well stocked and readily available with personnel trained in their use;</li> <li>- bunkering is a manned operation with constant visual monitoring of gauges, hoses, fittings and sea surface;</li> <li>- radio communication between seismic and support vessel; all valves and flexible transfer hoses checked for</li> </ul> </li> </ul>

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		<p>integrity prior to use; and</p> <ul style="list-style-type: none"> <li>- dry break couplings (or similar) in place for all flexible hydrocarbon transfer hoses.</li> </ul> <p><i>Mitigation Measures</i></p> <ul style="list-style-type: none"> <li>• Shipboard Oil Pollution Emergency Plan (SOPEP) will be prepared and kept onboard the vessels (as per MARPOL 73/78 Annex 1) for managing spills aboard.</li> <li>• Hydrocarbon spill risks will be managed in accordance with Woodside’s Corporate Oil Spill Response Plan (OSRP) (WEL Doc No. W0000AV0003.0001) (Rev 2) and the Curt 3D Marine Seismic Survey Oil Spill Action Plan (<i>Appendix E of Environment Plan</i>).</li> </ul>
	<p>Loss of hydrocarbons/chemicals to marine environment from vessel grounding or collision potentially leading to:</p> <ul style="list-style-type: none"> <li>- Toxic effects to marine biota</li> <li>- Oiling of marine mammals, reptiles and seabirds</li> <li>Oiling of coastlines/islands/coral reefs</li> </ul>	<ul style="list-style-type: none"> <li>• Activities where the seismic and support vessel are in close proximity such as bunkering and vessel transfers will be restricted to locations on the north western side of the survey acquisition area during normal activities.</li> <li>• In accordance with good marine practices seismic and support vessels are equipped with navigation aids, radar, vessel GPS tracking and management systems (VMS), depth sounders and competent crew maintaining 24 hour visual, radio and radar watch for other vessels.</li> <li>• Bunkering and vessel transfers to follow procedures and to only occur when sea conditions are appropriate as determined by the vessel master to prevent vessel collisions.</li> <li>• Adherence to standard maritime safety / navigation procedures i.e. Australian Maritime Safety Authority, Marine Orders Part 30: Prevention of collisions, (Issue 8).</li> <li>• Seismic and support vessels will transit along pre-planned routes both within the survey operational area and between the survey location and port where possible to avoid navigation hazards.</li> <li>• Spills will be managed in accordance with Woodside’s Corporate Oil Spill Response Plan (OSRP) (WEL Doc No. W0000AV0003.0001) (Rev 2), Table 7-6 and the Curt 3D Marine Seismic Survey Oil Spill Action Plan (<i>Appendix E of Environment Plan</i>).</li> <li>• A Shipboard Oil Pollution Emergency Plan (SOPEP) will be in place in accordance with Australian legislation. <ul style="list-style-type: none"> <li>- In the event of a hull breach the vessel master would implement the SOPEP which outlines procedures to be followed, including pumping hydrocarbons from the breached tank to other locations around the vessel, or water being added to the leaking tank so oil is pushed above the penetration and can no longer flow reducing the total volume lost.</li> </ul> </li> <li>• Yokohama fenders on seismic and support vessels gunwales that are shock absorbing to reduce/ buffer vessel impacts.</li> <li>• Vessel operating at slow speeds (&lt;6 knots) when in proximity.</li> <li>• Seismic and support vessel will undertake a tow test during mobilisation to ensure the support vessel has the capacity to pull the survey vessel in a loss of power event.</li> </ul>

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