

Dancer-1 Exploration Drilling Environment Plan

1. Purpose of this report

NOPSEMA accepted the Dancer-1 Exploration Drilling Environment Plan (the EP) submitted by Santos WA Northwest Pty Ltd (the titleholder) for an exploratory drilling activity in the North West Shelf.

As required by the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (the Environment Regulations), the public was provided with an opportunity to comment on the EP. After this period, Santos WA Northwest Pty Ltd took into account the public comment and prepared a Report on Public Comment which is published on NOPSEMA's website.

Following the public comment period, the titleholder submitted the EP for assessment by NOPSEMA on 23 March 2021. NOPSEMA has since completed its assessment of the EP and has determined that it is satisfied that the EP meets the criteria for acceptance¹.

This report explains how NOPSEMA took into account comment received from the public during the public comment period in making its decision². This report also contains other key matters that may be of interest to the public.

This report accompanies the accepted Dancer-1 Exploration Drilling Environment Plan, Revision 2 submitted by Santos WA Northwest Pty Ltd, which is available on the NOPSEMA website and should be referred to for further information.

1.1. Information relevant to NOPSEMA's decision:

In making the decision to accept this EP, some of the key documentation NOPSEMA took into account included:

- the Environment Regulations;
- NOPSEMA Assessment Policy (PL0050), Environment Plan Assessment Policy (PL1347) and Environment Plan Decision Making Guidelines (GL1721);
- the Dancer-1 Exploration Drilling Environment Plan which includes the titleholder's Oil Pollution Emergency Plan;
- the information raised by relevant persons, government departments and agencies that is relevant to making a decision;
- the information raised through public comment during the public comment period that is relevant to making a decision;
- relevant plans of management and threatened species recovery plans developed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and relevant policy statements and guidance published by the Department of the Agriculture, Water and the Environment.

¹ Environment Regulations, Regulation 10A Criteria for acceptance of environment plan

² Environment Regulations, Regulation 11(3) Publication of notice, etc.

2. Next steps

Responsibility for the ongoing environmental performance of the exploratory drilling activity remains, at all times, with Santos WA Northwest Pty Ltd.

NOPSEMA has legislated responsibilities to inspect and investigate offshore petroleum and greenhouse gas storage activities, and to enforce compliance with environmental law. These functions will be applied to this activity in accordance with NOPSEMA's policies.

3. Sensitive Information

Sensitive information received during the public comment period, such as the names and contact details of commenters and specific information identified by the commenter or relevant person as 'sensitive', is not published in this report. Sensitive information is contained in a sensitive information part of the EP which has been considered by NOPSEMA during its assessment process.

4. Further information

If you would like further information about the activity, please contact the titleholder's nominated liaison person specified in the EP and on NOPSEMA's webpage for the Dancer-1 Exploration Drilling Environment Plan.

If you would like to be notified of regulatory information on the activity, such as start and end dates and enforcement actions (if any), please subscribe to updates via NOPSEMA's website.

How NOPSEMA has taken into account key matters raised during public comments, the assessment and decision-making process for Dancer-1 Exploration Drilling EP

#	Issues raised	Titleholder response	NOPSEMA's assessment and decision
1	<p>Matter: Fundamental issues</p> <p>Claim considers that the activity, and therefore the DEDEP, is inconsistent with these key principles (outlined below)</p>	<p>Santos' Environmental Hazard Identification and Assessment Guideline (EA-91-IG-00004) includes consideration of the principles of Ecologically Sustainable Development (ESD).</p> <p>For each of the identified aspects in Sections 6 and 7, Santos has considered whether the associated risks and impacts are consistent with the principles of ESD. No changes have been made to the EP regarding this matter.</p>	<p>NOPSEMA notes that the drilling activity proposed is a single exploration well authorised by an exploration permit.</p> <p>The concern presented relates primarily to the potential yet uncertain future exploitation of petroleum resources which would require subsequent project proposals and development activities.</p>
1.1	<p>Claim: Precautionary Principle</p> <p>Claim that this activity is fundamentally inconsistent with the principles of Ecologically Sustainable Development (ESD) including the Precautionary Principle</p> <p>The DEDEP does not identify any climate change risks associated with the activities of exploring and developing new fossil fuel resources. That is, the DEDEP fails to identify that there is a threat of serious and irreversible damage associated with anthropogenic climate change</p>	<p>Santos' Environmental Hazard Identification and Assessment Guideline (EA-91-IG-00004) includes consideration of the principles of Ecologically Sustainable Development (ESD).</p> <p>Santos clarifies that this EP is only for an exploration drilling activity and not for the development of fossil fuels which would be subject to separate approvals. For each of the identified aspects in Sections 6 and 7, Santos has considered whether the associated risks and impacts are consistent with the principles of ESD. No changes have been made to the EP regarding this matter.</p>	<p>NOPSEMA notes that the exploration permit issued to Santos by the Joint Authority³ does not confer rights to produce petroleum. Issue of relevant titles to support project development is subject to separate approvals by the Joint Authority.</p> <p>Evaluation of environmental impacts and risks associated with offshore projects are considered separately through future approvals should Santos progress to project development.</p> <p>NOPSEMA has assessed the potential impacts of GHG emissions arising from the Dancer-1 exploration drilling activity itself and concluded</p>

³ The Joint Authorities are a decision maker under the Offshore Petroleum Greenhouse Gas Storage Act 2006 (OPGGs Act). Key functions and powers of Joint Authorities include release of offshore petroleum exploration areas and the granting or refusal of offshore petroleum titles.

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1.2	<p>Claim: Intergenerational Equity Principle</p> <p>Claim that development of petroleum and gas resources is fundamentally inconsistent with long-term health, diversity and productivity of the environment from a climate change perspective.</p> <p>The DEDEP cannot be made consistent with the aim of maintaining and enhancing the health, diversity and productivity of the environment for the benefit of future generations, as required by the Intergenerational Equity Principle</p> <p>Seismic exploration as proposed in the DEDEP is a necessary precursor to the extraction and burning of a new fossil fuel resource. Claim that this fundamentally runs counter to international climate stabilisation efforts and the Paris Agreement temperature limits</p>	<p>Santos' Environmental Hazard Identification and Assessment Guideline (EA-91-IG-00004) includes consideration of the principles of Ecologically Sustainable Development (ESD).</p> <p>For each of the identified aspects in Sections 6 and 7, Santos has considered whether the associated risks and impacts are consistent with the principles of ESD.</p> <p>For clarity – whilst the activity includes Vertical Seismic profiling (VSP), Santos confirms that no seismic vessel exploration is part of the scope of this exploration drilling EP.</p> <p>No changes have been made to the EP regarding this matter.</p>	<p>that with the described measures and controls, impacts will be of an acceptable level and reduced to ALARP in accordance with the Environment Regulations. The EP has identified the National Greenhouse and Energy Reporting Act 2007 (NGER Act) including the Safeguard Mechanism as relevant for the activity. The EP has adequately addressed the GHG emissions associated with undertaking the activity and applies controls to minimise GHG emissions, such as use of low-sulphur fuels and no incineration of waste.</p>

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1.3	<p>Claim: Conservation Principle</p> <p>Claim that development of petroleum and gas resources is fundamentally inconsistent with long-term health, diversity and productivity of the environment from a climate change perspective. The DEDEP does not achieve the “fundamental” aims of the Conservation Principle.</p>	<p>Santos’ Environmental Hazard Identification and Assessment Guideline (EA-91-IG-00004) includes consideration of the principles of Ecologically Sustainable Development (ESD).</p> <p>For each of the identified aspects in Sections 6 and 7, Santos has considered whether the associated risks and impacts are consistent with the principles of ESD. No changes have been made to the EP regarding this matter.</p>	
2	<p>Matter: Concern that EP is non-compliant with key content requirements for activity description</p> <p>Claim: That Santos must revise Section 2 of the DEDEP to ensure that it complies with this requirement before the DEDEP can be considered for acceptance by NOPSEMA, by including a detailed description of the projected future of the oil field to provide context to the current environment plan as set out in the Environment plan content requirement Guidance Note.</p>	<p>Santos understands the requirements of Environment plan content requirement guidance note (2020) and submits that the activity description is adequately and appropriately described (the drilling of an exploration well) for the petroleum activity to be assessed.</p> <p>Santos is unable to provide a detailed description of the “projected future of the oil field” until exploration is undertaken. Assessment of projected future of the oil field would be information provided in any future EPs for development drilling and/or operations if the field was assessed as being commercially viable.</p> <p>No changes have been made to Section 2 or elsewhere within the EP regarding this matter.</p>	<p>NOPSEMA notes that the activity covered by this EP is limited to drilling a single exploration well.</p> <p>Given that the titleholder is still at the exploratory phase and is yet to determine the nature of hydrocarbons resources or its viability for commercial development, it is not feasible to provide a detailed description of the future oil field development. Any future development of the oil field will be subject to relevant titles being granted (see above) and subsequent regulatory approvals.</p> <p>NOPSEMA is satisfied that the description of the current activity meets the requirements of the Environment Regulations.</p>

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3	<p>Matter: <i>Poor baseline information presented for humpback whale migration</i></p> <p>Claim: That the Proponent has presented outdated, poor-quality baseline information regarding biologically important areas (BIA) for humpback whales. Consequently, the Proponent has not yet demonstrated that the activity would not have an unacceptable impact on humpback whales as a result of underwater noise emissions and should be required to gather contemporary data on humpback whale population and distribution to form an acceptable information baseline for assessment.</p>	<p>In response to the claim, Santos has reviewed the baseline data provided in the EP and the Values and Sensitivities of the Marine and Coastal Environment (Appendix C of the EP) relating to humpback whale migration. Additional references such as Irvine et al. (2018) have been included to provide further contemporary evidence to support the baseline description.</p> <p>The claim mentions Oceanwise (2020), however, Santos has been unable to identify what this citation refers to. Other references mentioned (Bejder et al 2016) have been reviewed and incorporated into the baseline descriptions (Section 3.2.4.2 and 6.4.2.2 of the EP and Section 7.1.5 of the Values and Sensitivities of the Marine and Coastal Environment appendix) to show there has been an increase in the humpback whale population in Western Australia.</p> <p>Note that the first sentence of Section 3.2.4.2 of the EP has also been updated to remove an incorrect reference to the humpback whale resting on migration BIA, which is not intersected by the operational area.</p> <p><i>NOPSEMA note: Santos provided a list of references which can be found on titleholder report at: https://info.nopsema.gov.au/environment_plans/531/s_how_public</i></p>	<p>NOPSEMA recognises that there was a concern about the quality of baseline information on humpback whale migration to support the risk evaluation of noise emission impacts on this species.</p> <p>In making a decision regarding this matter, NOPSEMA took into account the content of the EP; relevant scientific literature; NOPSEMA's Decision Making Guidelines (GL1721), Approved Conservation Advice for Megaptera novaeangliae (humpback whale) (DoE 2015), EPBC Act Policy Statement 2.1 (DEWHA 2008), and the EPBC Act Significant Impact Guidelines 1.1 – Matters of National Environmental Significance (DEWHA 2013).</p> <p>NOPSEMA noted that Santos has reviewed and referenced additional relevant contemporary information about humpback whale distribution, abundance and migration in its description of the environment and risk assessment of noise emissions.</p> <p>Considering the location and nature and scale of the drilling activity, NOPSEMA is satisfied that the information provided about humpback whale migration in the Biologically Important Area is sufficient to inform the risk assessment of noise emissions and marine fauna (see key matter 4 below).</p>

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4	<p>Matter: <i>Concern that noise emissions from operations will negatively impact humpback whale migration and may have an unacceptable high environmental impact.</i></p> <p>Claim: That the Proponent has failed (or neglected) to review recent scientific advances in relation to the impacts of seismic and drilling noise emissions on marine megafauna, including humpback whales.</p> <p>That it is critical that the Proponent acknowledges the recent and highly relevant scientific literature (i.e. Duarte et al 2021 & Cato et al 2019) and that the key recommendations of these reports are incorporated into the next revision of the DEDEP.</p> <p>That a key matter for NOPSEMA's assessment is impacts to humpback whale migration and that, as discussed above, the Proponent is required to demonstrate a contemporary scientific basis for its statement that these impacts will not exceed an 'acceptable level' by addressing the recommendations of Duarte et al 2021 and Cato et al 2019 that relate to noise pollution-intensive aspects of the proposed activities in the DEDEP.</p>	<p>Santos has recently commissioned a technical study into Underwater Noise Impacts on Marine Fauna (JASCO, 2020a). Although not publicly available, Santos has used the findings of this study to update the underwater noise emissions impact assessment section of the EP.</p> <p>Santos notes that, as part of the activity, Vertical Seismic profiling (VSP) is planned. However, there will be no vessel-based seismic activities occurring and hence, that does not form part of the scope of the activity as outlined in Section 2 of the EP. VSP has a much shorter transmission pathway compared with seismic surveys and air guns, therefore VSP has a smaller total volume and impact on marine fauna compared with seismic surveys (Kent et al., 2016).</p> <p>In order to predict the level of impact resulting from the petroleum activity, Santos has used NMFS (2014) as mentioned in the claim as a behavioural threshold. For impulsive noise, NMFS currently uses step function thresholds of 160 dB re 1 µPa SPL (unweighted) to assess and regulate noise-induced behavioural impacts for marine mammals (NOAA 2018, NOAA 2019).</p> <p>Because of the complexity and variability of marine mammal behavioural responses to acoustic exposure, NMFS has not yet released technical guidance on behaviour thresholds for use in calculating animal exposures (NMFS 2018), and Southall et al (2019) does not address the topic of behavioural effects at all. A US-based expert working group lead by Brandon Southall is</p>	<p>NOPSEMA recognises the environmental values of the region and acknowledges the activity overlaps the biologically important area (BIA) for humpback whale migration. Ensuring the activity will be carried out in such a manner that will not have an unacceptable impact on migrating humpback whales, was a focus of NOPSEMA's assessment.</p> <p>In making a decision regarding this matter, NOPSEMA took into account the content of the EP, relevant scientific literature, NOPSEMA's Decision Making Guidelines (GL1721), Approved Conservation Advice for Megaptera novaeangliae (humpback whale) (DoE 2015), EPBC Act Policy Statement 2.1 (DEWHA 2008), and the EPBC Act Significant Impact Guidelines 1.1 – Matters of National Environmental Significance (DEWHA 2013).</p> <p>NOPSEMA noted that Santos updated its risk assessment of noise emissions impacts on marine fauna to address additional contemporary scientific information, including relevant scientific literature presented through the public comment. The updated risk assessment confirmed the area in which behavioural responses of marine mammals to noise from the MODU/vessel operations and VSP may occur would be limited to up to 1 km and 2.4 km respectively.</p>

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		<p>in the process of developing an updated approach to assess noise-induced behavioural effects on marine mammals based on the latest research results and risk assessment frameworks. The only alternative criteria addressing behavioural impacts for marine mammals (Germany (BMU 2013) and The Netherlands (de Jong et al. 2015)) are tailored specifically for harbour porpoises (<i>Phocoena phocoena</i>, a HF cetacean species), both promulgating a threshold level for the onset of behavioural responses of 140 dB re 1 μPa²·s SEL. (JASCO, 2020a)</p> <p>NMFS (2018) has been used for auditory threshold shift (TTS / PTS) in marine mammals. We note that Southall et al. (2019) published an updated set of criteria for onset of TTS and PTS in marine mammals, however the proposed thresholds and weighting functions for exposure to underwater sound do not differ in effect from those proposed by NMFS (2018).</p> <p>For non-impulsive noise, NMFS currently uses step function (all-or-none) threshold of 120 dB re 1 μPa SPL (unweighted) to assess and regulate noise-induced behavioural impacts for marine mammals (NOAA 2019). The 120 dB re 1 μPa threshold is associated with continuous sources and was derived based on studies examining behavioural responses to drilling and dredging (NOAA 2018), referring to Malme et al. (1983), Malme et al. (1984), and Malme et al. (1986), which were considered in Southall et al. (2007). (JASCO, 2020a)</p> <p>Santos has updated Section 6.4.2 of the EP to update</p>	<p>Santos has committed to ensuring that the activity is managed so that there is no injury or mortality to EPBC Act (1999) and WA Biodiversity Conservation Act (2016) listed marine fauna during operational activities (DR-EPO-05).</p> <p>The EP does not predict any injury or mortality to humpback whales. As the predicted area where behavioural responses may occur represents a small proportion of the overall BIA, noise is unlikely to present a barrier to movement or disrupt migratory pathways or behaviour. The primary control measures that will be implemented to ensure there is no physical injury to listed marine fauna are Santos Procedures for interacting with marine fauna (DR-CM-010) and MODU seismic survey procedures (DR-CM-011) which align with Part A of the EPBC Act Policy Statement 2.1 – Interaction between offshore seismic exploration and whales.</p> <p>Considering the location of the drilling, the low likelihood that noise emissions from the activity will present a barrier to movement or disrupt migratory pathways or behaviour in the Biologically Important Area for humpback whale migration, the short duration of VSP operations (12-18 hours), and control measures in place, NOPSEMA has concluded that the activity will not cause unacceptable impacts to migrating humpback whales.</p>

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		<p>these references, noting that there has been no subsequent change to the threshold levels used for the assessment.</p> <p>Santos has conducted modelling of underwater noise impacts on marine fauna from VSP, including marine mammal injury and behaviour. Modelling shows that the maximum distance to the SPL threshold of 160 dB re 1 μPa (behaviour threshold; NOAA, 2019) was 2.42 km from the centre of the VSP array (JASCO, 2020b). Modelling against the PTS and TTS thresholds (Southall et al., 2019) for low frequency cetaceans predicts the maximum distances reached are 470 m for PTS and 3.1 km for TTS.</p> <p>Santos has updated Section 6.4.2.2 of the EP to include the above additional underwater noise analysis conducted by Jasco (2020a; 2020b), as well as supporting literature suggested in the claim (Cato et al 2019). In response to Duarte et al (2021), Santos has assessed potential cumulative effects from the activity on marine mammals from underwater noise emissions and determined that cumulative effects are not expected.</p> <p><i>NOPSEMA note: Santos provided a list of references which can be found on titleholder report at https://info.nopsema.gov.au/environment_plans/531/s_how_public</i></p>	

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5	<p>Matter: <i>Concern that noise emissions from operations will negatively impact flatback turtle biologically important areas and may have significant impact on species.</i></p> <p>Claim: The proponent has failed to identify noise interference from seismic activities as a threatening process relevant to the EP for flatback turtle biologically important areas (Table 3-8, DEDEP).</p> <p>The Proponent to include seismic noise as a threatening process relevant to the EP, and to develop and implement specific measures to mitigate and monitor against impacts of seismic activities on the flatback turtle, particularly within and nearby to the operational area.</p>	<p>Santos has updated Table 3-8 (Section 3.2.4.1) to identify noise emissions as a potential threat to flatback turtle.</p> <p>Santos notes that, although Section 6.4.2.3 of the EP already assesses impact of noise emission on marine turtles, the thresholds for impulsive noise suggested by Popper et al. (2014) shown in Table 6- 13 are no longer referenced (JASCO, 2020a), and instead has been replaced by Finneran et al. (2017). Santos has updated Section 6.4.2.3 of the EP to reflect these revised thresholds and include outcomes of the VSP modelling undertaken by JASCO (2020b).</p> <p>Modelling of VSP underwater noise undertaken by JASCO (2020b) (unpublished) using the Finneran et al. (2017) thresholds predicts that PTS threshold is exceeded at a maximum distance of 30 m, and TTS threshold is exceeded at a maximum distance of 380 m.</p> <p>Behavioural response in marine turtles may occur. The Recovery Plan for Marine Turtles in Australia (Department of the Environment and Energy et al. 2017) acknowledges the 166 dB re1 μPa SPL reported by McCauley et al. (2000b) as the level that may result in a behavioural response to marine turtles. Modelling of VSP underwater noise undertaken by JASCO (2020b) using the McCauley et al. (2000b) thresholds predicts that behavioural threshold is exceeded at a maximum distance of 1.22 km.</p> <p>In light of these new thresholds and modelling results,</p>	<p>NOPSEMA recognises the environmental values of the region and acknowledges the activity overlaps biologically important areas for species such as the flatback turtle. Ensuring the activity will be carried out in such a manner that will not have an unacceptable impact on flatback turtles was a focus of NOPSEMA's assessment.</p> <p>In making a decision regarding this matter, NOPSEMA took into account the content of the EP; relevant scientific literature; NOPSEMA's Decision Making Guidelines (GL1721), Recovery plan for marine turtles in Australia (DoEE 2017), EPBC Act Policy Statement 2.1 (DEWHA 2008), and the EPBC Act Significant Impact Guidelines 1.1 – Matters of National Environmental Significance (DEWHA 2013).</p> <p>NOPSEMA noted that Santos updated the EP to identify and assess the risks of seismic noise emissions from VSP operations on flatback turtles from the activity.</p> <p>Santos has committed to ensuring that the activity is managed so that there is no injury or mortality to EPBC Act (1999) and WA Biodiversity Conservation Act (2016) listed marine fauna during operational activities [DR-EPO-05].</p> <p>The primary control measures that will be implemented to ensure there is no physical injury to listed marine fauna are Santos</p>

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		<p>Santos has reconsidered the consequence evaluation for marine turtles, and determined that no changes to the consequence level are required.</p> <p><i>NOPSEMA note: Santos provided a list of references which can be found on titleholder report at https://info.nopsema.gov.au/environment_plans/531/how_public</i></p>	<p>procedures for interacting with marine fauna (DR-CM-010) and MODU seismic survey procedures (DR-CM-011).</p> <p>Considering the location of the drilling activity, the small overlap between the predicted area in which behavioural responses of flatback turtles to noise from VSP operations may occur (up to 1.22 km) and the BIA for flatback turtles (interesting buffer), the short duration of VSP operations (12-18 hours), the small number of individual turtles that may be potentially affected and control measures in place, NOPSEMA has concluded that the activity will not cause unacceptable impacts to flatback turtles.</p>
6	<p>Matter: <i>Temporal sensitivity of dugong to noise impacts has not been addressed.</i></p> <p>Claim: That the Proponent has not reviewed the temporal sensitivity of the dugong in the EP, in respect of breeding, calving and nursing (Table 7-17, DEDEP). At a minimum, the Proponent should address these sensitivities, including defined birthing seasons, and incorporate them into the EP to minimise the likelihood of the Proponent's activities having a disruptive or adverse impact on these key biological behaviours to ALARP.</p>	<p>Dugongs are identified in the EPBC PMST report as 'breeding known to occur within area' for the EMBA, with no presence expected in the Operational Area. As described in the Values and Sensitivities of the Marine Environmental (Appendix C to the EP), key populations of dugong along the WA coast are principally located at: Shark Bay (the largest resident population in Australia), Ningaloo Marine Park and Exmouth Gulf, the Pilbara coast and offshore areas including Montebello/Barrow/ Lowendal Islands. These locations are all greater than 60 km from the Operational Area.</p> <p>PTS onset and TTS onset for sirenians provided by Southall et al. (2019) are higher than those proposed for low frequency and high frequency cetaceans (as</p>	<p>NOPSEMA recognises the environmental values of the region and acknowledges that dugong are not expected within the operational area though may be present within the broader region.</p> <p>In making a decision regarding this matter, NOPSEMA took into account the content of the EP; relevant scientific literature; NOPSEMA's Decision Making Guidelines (GL1721), EPBC Act Policy Statement 2.1 (DEWHA, 2008), and the EPBC Act Significant Impact Guidelines 1.1 – Matters of National Environmental Significance (DEWHA, 2013).</p> <p>Considering the location of the drilling activity,</p>

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	<p>The Proponent should conduct further field-based surveys to ensure that these knowledge gaps are filled, and that seismic testing/exploratory drilling is avoided during periods of high sensitivity for dugongs, such as birthing and calving periods</p>	<p>shown in Table 6-10 and Table 6-11 in the EP), indicating that any effects would be concentrated closer to the source. Behavioural response to noise emissions by marine mammals, including sirenians, is therefore predicted to be localised (1 km from the MODU / support vessels, 2.42 km from VSP operations).</p> <p>Due to the water depth (approximately 63 m) and distance from the shoreline (60 km from Dampier Archipelago), dugong are not expected to be present within 2.42 km of planned activities. This is validated by the EPBC PMST search for the Operational Area (2 km) which does not list dugong.</p> <p>Subsequently, no impacts to dugong are expected from noise emissions. No changes to the EP have been made and no additional data collection is proposed or considered necessary.</p> <p><u>References:</u></p> <p>Southall, B.L., J.J. Finneran, C.J. Reichmuth, P.E. Nachtigall, D.R. Ketten, A.E. Bowles, W.T. Ellison, D.P. Nowacek, and P.L. Tyack. 2019. Marine Mammal Noise Exposure Criteria: Updated Scientific Recommendations for Residual Hearing Effects. <i>Aquatic Mammals</i> 45(2): 125-232. https://doi.org/10.1578/AM.45.2.2019.125.</p>	<p>the distance to known dugong population areas (>60 km) and that Santos has shown that it is unlikely that dugongs would be present within the operational area where predicted VSP noise emissions may cause behavioural responses in marine mammals (i.e. within 2.42 km), NOPSEMA has concluded that Santos has given an appropriate consideration of potential impacts of noise emissions on dugongs in preparation of the EP and that further field-based surveys are not required to support the risk assessment.</p>
7	<p>Matter: <i>Poor baseline information on benthic habitat and biodiversity of the Dampier and Montebello Australian Marine</i></p>	<p>Oil spill modelling predictions show that Montebello AMP is within the High Exposure Value Area (HEVA) and Dampier AMP is within the Moderate Exposure</p>	<p>NOPSEMA recognises that there was concern regarding the quality of baseline information for benthic habitat and biodiversity of the Dampier</p>

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	<p><i>Parks.</i></p> <p>Claim: That the DEDEP contains a critically insufficient level of information regarding the benthic habitat of the Dampier Australian Marine Park (AMP) and Montebello AMP. In particular, the DEDEP has ignored a comprehensive CSIRO study led by Senior Principal Research Scientist with CSIRO Oceans and Atmosphere Research Dr John Keesing, which collected detailed baseline data for benthic habitats and biodiversity in both MP's.</p> <p>The Proponent's baseline information for benthic habitat in the Dampier in the EP is presented in extremely low resolution (p 34, DEDEP), in non-descript habitat categories (p 35, DEDEP) and without reference to specific habitat types (Table 3-5, DEDEP) or a representative number of species (p 44 and 46, DEDEP). In other areas, discussion of benthic habitats is grouped and based on very old field data (p 28, DEDEP) which does not reflect significant ecosystem level changes in the past decade, including marine heatwave events</p> <p>The Proponent's description of the values of the Dampier AMP (p 44, DEDEP) is of extremely low quality and badly lacks detail. In relation to the Dampier AMP, the Proponent has not described which marine</p>	<p>Value Area (MEVA) and HEVA, which is defined by the modelling in Section 7.1.5 of the EP. The EP describes how the modelling is used to identify the high environmental value (HEV) receptors contacted by surface, subsurface (entrained hydrocarbon and DAH's), and shoreline accumulation.</p> <p>The EP (Section 7.1.6) includes a detailed risk assessment of 'hot spots' which are a subset of HEV areas that:</p> <p>Have the highest probability of contact (at least higher than 5%) above the impact assessment exposure values for surface hydrocarbons and shoreline accumulation based on modelling results; and</p> <p>Receive the greatest concentration or volume of oil, either floating or stranded oil, entrained hydrocarbon or DAHs above contact exposure values described in Section 7.1.5 of the EP.</p> <p>Montebello AMP and Dampier AMP are not identified as hot spots in the consequence evaluation (Section 7.2.4.1).</p> <p>In Section 6.2.1 of the EP, seabed disturbance (and subsequent impact to the benthic habitat) from the activity is described as occurring within only 780 m2 of the Operational Area. The Montebello AMP and Dampier AMP are 93 km and 60 km respectively from the Operational Area and therefore are outside of the environment that may be affected by seabed disturbance.</p>	<p>and Montebello Australian Marine Parks presented in the EP.</p> <p>In making a decision regarding this matter, NOPSEMA took into account the content of the EP; relevant scientific literature and NOPSEMA's Decision Making Guidelines (GL1721).</p> <p>Santos commits to ensuring that seabed disturbance is limited to planned activities and defined locations. The planned seabed disturbance from the drilling activity will be restricted to within the operational area and will not impact benthic habitats at the Dampier or Montebello AMPs. The description of benthic habitats at these AMPs is sufficient to inform spill response planning given the predicted low hydrocarbon exposure levels at these locations in the event of a worst-case incident.</p> <p>Relevant additional information on turtles and seabirds at the Montebello and Dampier AMP derived from the CSIRO report (Keesing, 2019) has been added to the description of the environment.</p> <p>Considering the location of the activity and its distance from the Montebello and Dampier AMPs, the analysis of the outcomes of stochastic spill modelling to inform response planning and additional information provided on turtles and seabirds at the Dampier and Montebello AMPs, NOPSEMA is satisfied that a sufficient description</p>

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	<p>turtles utilise interesting habitat, failing to demonstrate their capability to predict the extent, severity and duration of impacts and consequences affecting interesting turtle species.</p> <p>In relation to the Montebello AMP, the Proponent has also not identified which seabirds utilise breeding habitat, or which marine turtle species utilise breeding, nesting, interesting and foraging habitat within the Marine Park.</p> <p>To rectify these major deficiencies in the DEDEP and align with the Petroleum Activities and Australian Marine Park Guidance Note, the Proponent should gather this information from the recent CSIRO study on the benthic habitat and biodiversity of the Dampier and Montebello Australian Marine Parks.</p> <p>It is critical that the Proponent should be required to update the DEDEP with the information collected and presented in the CSIRO study on the benthic habitat and biodiversity of the Dampier and Montebello Australian Marine Parks.</p>	<p>Santos has updated Section 3.2.4.4 and 3.2.4.6 of the EP to provide further information relating to important BIA's at the Montebello AMP for marine turtles and seabirds using the CSIRO report (Keesing, 2019).</p> <p><u>References:</u></p> <p>Keesing, J.K. (Ed.) 2019. Benthic habitats and biodiversity of the Dampier and Montebello Australian Marine Parks. Report for the Director of National Parks. CSIRO, Australia.</p>	<p>of the environment has been provided on these AMPs to support the risk assessment.</p>

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8	<p>Matter: <i>Oil spill risk to Dampier and Montebello AMP's may be significantly underestimated: including assessments of low, medium and high environmental risk.</i></p> <p>Claim: The submission references the findings of two major scientific reports, which indicate that the values used by the Proponent in assessing risks and impacts are at least twenty-fold higher than the best available science on oil spill risk, which could have resulted in a significant underestimation of the risk and impact to the environmental values of the Dampier and Montebello AMP's, as well as 22 other AMP's within the EMBA.</p> <p>In the event of a hydrocarbon spill, all of the environmental values of the nearby Dampier and Montebello AMP's could face extreme losses across due to the well-established ecotoxicity of hydrocarbons. Santos claims that the risk of impacts from a loss of well control has been reduced to a level that is considered acceptable by proposed control measures.</p> <p>The thresholds used, including low, moderate, and high exposure values, are not consistent with other scientific literature about ecotoxicity thresholds.</p>	<p>Commonly used exposure values for oil spill modelling are provided by NOPSEMA Environmental Bulletin #1: Oil spill modelling (April 2019). These are based on available scientific literature and selected to approximate the spatial extent and variability of the receiving environment's contact with oil and subsequently inform risk evaluation and planning for oil spill response and monitoring.</p> <p>The NOPSEMA Environmental Bulletin #1 states that it is up to the applicant/titleholder to justify the thresholds being used for surface, entrained and dissolved hydrocarbons. Santos has undertaken a review of relevant scientific literature and acknowledges the presence of literature which indicates impacts may occur at lower exposure values in certain species or at different aspects of a lifecycle. However, for the purposes of an impact assess Santos has provided justification for the exposure values selected in Section 7.1.5 (Table 7-8) of the EP.</p> <p>In response to the comment, Santos has conducted a review of the literature used to support this justification, such as French-McKay (2018). Upon consideration of these new literature sources, Santos has determined to continue to adopt the commonly used exposure values provided by NOPSEMA for the Dancer-1 EP, as they are appropriate for the values and sensitivity of the receiving environment. In addition, the exposure values used help inform the response arrangements within the OPEP, that links to the Operational and Scientific Monitoring Plan (OSMP)</p>	<p>NOPSEMA recognises that there was a concern that the risk assessment as originally presented may have underestimated consequences for environmental values in AMP's within the EMBA in the event of an oil pollution incident.</p> <p>Receptor sensitivity to spilled oil is described and evaluated in the EP. The EP describes vulnerable receptor (regions) for both a surface release and a subsea release scenario; tables cross reference valued areas (receptors) with exposure values to identify scenario-specific hotspots. An assessment of specific receptors ("values", i.e. fish, reefs, birds, etc) is provided in terms of all the key scenario parameters for each receptor region.</p> <p>Receptor sensitivity to oil is modelled using exposure thresholds consistent with NOPSEMA expectations. Whilst acknowledging the range of exposure values described in literature, these thresholds are considered appropriate to allow for meaningful risk assessment, appropriately scaled response planning and informing environmental monitoring arrangements, while recognising limitations and uncertainties inherent in modelling predictions.</p> <p>NOPSEMA notes that Santos conducted a further round of literature review and confirmed that the exposure values applied were relevant and appropriate for the DEDEP. The same exposure</p>

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	<p>The Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement Report also used much lower toxicity threshold values that Santos has included in their OPEP</p> <p>To ensure that the worst-case environmental risks have not been underestimated (and therefore ensure that the proposed management and monitoring measures ensure the impact is reduced to as low as reasonably practical) that the titleholder should undertake new Oil Spill Modelling (SINTEF's OSCAR system was used in the DEDEP/OPEP) to ensure that the DEDEP and OPEP are consistent with the best available science regarding photoinduced PAH toxicity, and use the lower toxicity threshold value of PAH = 0.5ppb for surface waters.</p>	<p>which is sufficiently flexible, adaptable and conservative to account for uncertainty, and is able to provide for environmental monitoring at lower exposure values if required in the event of a spill.</p> <p>Section 7.1.5 (Table 7-8) of the EP has been updated to reflect the additional literature sources. No further changes to the impact assessment are required.</p> <p>References</p> <p>French-McKay D, Crowley D, Rowe JJ, Bock M, Robinson H, Wenning R, Hayward Walker A, Joeckel J, Nedwed TJ, Parkerton TF. 2018. Comparative Risk Assessment of spill response options for a deepwater oil well blowout: Part 1. Oil spill modelling. Marine Pollution Bulletin 133 (2018) 1001– 1015</p>	<p>values were used to inform the response arrangements within the OPEP and the Operational and Scientific Monitoring Plan (OSMP), both of which are designed to be sufficiently flexible and adaptable (accounting for uncertainty) to provide for environmental response and monitoring at lower exposure values if required in the event of a spill.</p> <p>NOPSEMA considers the thresholds used by Santos are appropriate for the application in light of inherent uncertainties in evaluating the oil pollution consequences and the available options for improved preparedness and response. The addition of any further precision in the choice of modelling thresholds would not be expected to result in any different choices in preparedness or response.</p>
9	<p>Matter: <i>Industry statistics on loss of well control (LOWC) events need revision</i></p> <p>Claim: That the Proponent should revise Section 7.2.5 and all related sections of the DEDEP, which may have been informed by 2010 OGP report that the Proponent has cited to support its conclusions, and to ensure that it's risk assessment of a LOWC</p>	<p>The SINTEF Offshore Blowout Database is only accessible to project sponsors, and not publicly available. The website quoted in Appendix D of the claim provides a high-level summary of the data, including the quoted 92 blowouts from exploration drilling. Santos notes that the 92 blowout/well releases over the 34 years period quotes does not represent a frequency as it does not account for the total number of wells drilled during that period.</p>	<p>NOPSEMA recognises the importance of basing environmental risk assessment on current and relevant scientific and statistical information.</p> <p>In conducting the risk assessment for a potential subsea or surface release of condensate from a loss of well control (LOWC) event, Santos' EP includes independent assessments of potential consequences from and likelihoods of a LOWC</p>

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	<p>event is informed by the best available science and industry knowledge of historical LOWC events to ensure this risk is entirely avoided or reduced to ALARP.</p>	<p>New data published by the IOGP (2019) presents the most current data available from several sources, including:</p> <p>SINTEF Analysis: 1980-2014</p> <p>Lloyds Register analysis for Operations of North Sea Standard: 1980-2014</p> <p>Lloyds Register analysis for US GoM OCS: 1980-2011</p> <p>IOGP (2019) states the frequency of blowouts from exploration drilling operations at wildcat wells is 1.5×10^{-4} blowouts per drilled well. This is based on operations of North Sea standard, which is comparable to operations within Australian commonwealth waters.</p> <p>Based on this, <u>Section 7.2.5</u> of the EP has been updated to reflect the revised frequency. This data does not change the likelihood outcome, which remains unlikely (defined as Has occurred elsewhere OR could occur within decades).</p> <p>No changes have been made to the likelihood or risk assessment outcomes.</p> <p><u>References</u></p> <p>IOGP (2019) Risk Assessment Data Directory – Blowout Frequencies. Report 434-02. September 2019.</p>	<p>incident.</p> <p>NOPSEMA considers that the likelihood values presented in the accepted EP are sufficiently supported and justified. The likelihood assessment conducted by Santos for this drilling activity results in a rating of "b-unlikely" and is based on industry and Santos statistics for drilling operations at wildcat wells in the North Sea. The industry-standard blowout and well release statistics used include frequencies for exploration drilling in the order of 1.5×10^{-4} per well drilled (IOGP, 2019). This equates to a potential rate of one blowout during exploration drilling in 6,666 wells drilled (i.e. 1.5 blowouts per 10,000 exploration wells). In the Santos Risk Matrix the rating of "b-unlikely" is defined as an event that "has occurred elsewhere or could occur within decades." Given the historical and expected levels of drilling activity in Australia and abroad, this definition and this choice of risk frequency rating are appropriate for this drilling activity.</p>

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10	<p>Matter: <i>Adequate arrangements and capability in place for timely and effective response to oil pollution incidents that may arise from the activity.</i></p> <p>The EP must set out suitable arrangements for testing, including appropriate objectives, schedules, means of evaluation and management of lessons identified.</p> <p>As first submitted, the OPEP described at a high level the proposed OPEP testing regime without offering sufficient detail on the actual testing proposed, and without clearly differentiating testing from the concepts of 'training' and 'exercise'.</p>	<p>Santos has provided a Testing Arrangements Plan (Appendix K) for the response arrangements identified in the OPEP.</p> <p>Objectives are set for each of the tests identified for various response arrangements and the effectiveness of the response arrangements against the objectives are examined using the KPIs, as detailed in Appendix K. Information on how recommendations and actions, identified from the tests are tracked to closure is provided in Section 5.6.1 (Testing Arrangements Plan).</p> <p>The Testing Arrangements Plan also identifies the schedule for testing activities ensuring that there is sufficient time to implement any potential improvements.</p> <p>The changes made effectively differentiate between the terms 'training', 'exercise' and 'testing'.</p>	<p>NOPSEMA expects that EP submissions will include demonstration that adequate arrangements and capability are in place for timely and effective response to oil pollution incidents that may arise from the activity.</p> <p>NOPSEMA gave particular attention to testing arrangements, given its expectation that titleholders will establish appropriate tests of response arrangements and capabilities to ensure they are effective and that they will exercise to a level sufficient to maintain response readiness.</p> <p>The updated OPEP provides useful clarification to the training and exercise program and its tracking. A new appendix was added to the OPEP which specifies a number of specific pre-activity and annual test points. Organised by oil spill response controls, the presentation of these testing points is such that they will be useful for internal audits and inspections as the types, schedule, and objectives are listed for each.</p> <p>Overall, NOPSEMA considers that the updated plan appropriately isolates specific test components, objectives, and KPIs.</p>