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Department of
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Our ref: DEPWS2022/0014

Ms Kylie Fitzpatrick
Department of Environment, Parks and Water Security
GPO Box 3675
Darwin NT 0801

Dear Ms Fitzpatrick

Re: Referral - Santos - Darwin Pipeline Duplication Project

The Department of Environment, Parks and Water Security (DEPWS) has assessed the information submitted for the above referral and provides the following comments:

Flora and Fauna Division

Review of the referral identifies the following risks and potential impacts associated with the proposed action:

- impacts to sensitive receptors such as coral, seagrass and mangrove habitats from elevated suspended sediments and excessive sedimentation;
- direct loss of habitat through dredging and dredge spoil disposal, as well as seabed mining of sand;
- indirect impacts from decline in water and sediment quality with potential loss of ecosystem function; and
- potential impacts from vessel interaction and underwater noise on marine megafauna such as turtles, dugongs and coastal dolphins.

Further comments on the risk assessment provided in the referral include:

- The referral relies heavily on INPEX data and INPEX project specific circumstances. Many of the assumptions underpinning the risk assessment may not be currently valid.
- The proponent has not provided plume and sediment transport modelling to:
  - inform the zone of influence;
  - inform time duration analysis of elevated suspended sediments and light availability at the seafloor; and
  - determine suspended sediment load due to dredging and dredge spoil disposal activities that can be used to assess impacts against the proposed Western Marina Science Institution (WAMSI) triggers.
- The referral has used inadequate benthic habitat data, either from the perspective of existing and/or acquired data, modelled data and modelling approach.
- Potential impacts and potential cumulative impacts to nutrient and trophic pathways from expanding the dredge spoil grounds have not been considered.

As such, the Flora and Fauna Division considers that there is inadequate information to properly assess the project's risks to biodiversity and environmental values. Based on information provided in the referral, the

Flora and Fauna Division considers that there is potential for significant impact to the marine environment and it is uncertain whether impacts will be adequately mitigated.

The Flora and Fauna Division note that the referral focuses on the supply of gas from the Barossa Field to Darwin LNG. Any assessment of the proposal in accordance with the principles of ecologically sustainable development (ESD) should weigh up the loss of habitats and possible change in ecosystem function from a new pipeline. In particular, the construction of a duplicate pipeline may not be necessary if the proponent installs a tie-in switch where the Barossa and Bayu-Undan pipelines meet. This would allow gas from the Barossa Field to still be brought onshore.

Section of Referral	Theme or issue	Comment
General comment		The referral makes use of INPEX monitoring results and then concludes that most activities (e.g. dredging, elevated turbidity, sediment disposal, sedimentation of suspended sediments) have had no impact on sensitive receptors or environmental values. However, this misrepresents INPEX's own assessment that more often than not their monitoring could not conclusively attribute changes to environmental conditions due to project impacts and/or other variables (e.g. cumulative impacts from other projects, natural variability). As such, most of the assumptions that the proponent has presented potentially bias the risk assessment in favour of the project, by reducing the likelihood that an impact may occur or reducing the severity of the impact. The proponent should at least rely on its own plume and sediment transport models to inform risk assessment of the project activities. The project has not considered indirect impacts and established the zone of influence of project activities. As such, the risk assessment provided in the referral is limited in its use.
		Further, the referral provides many statements without evidence. For example, section 9.4.2: In support of this conclusion, there is no evidence that the existing Bayu Undan to Darwin pipeline (26 inch) or Ichthys (42 inch) have significantly impacted coastal processes. No evidence has been provided to demonstrate how this conclusion was reached. In the same section (9.4.2) the referral states that only seabed disturbance has the potential to impact on coastal process. This is not completely accurate as backfill of the trench and reinforcement of the pipeline (rock placement) can alter the seafloor topography and thus change seafloor currents. Changes in seafloor currents can cause significant changes in sediment transport, sediment deposition and erosion, and thus potential impacts on seafloor communities (infauna and epifauna). These flow on impacts should be discussed and assessed. The referral notes that during trenching, spoil disposal and backfill activities, the increased turbidity and sediment levels in the water may result in a visible surface plume which is often associated with such activities. While such plumes may lead to a

		decline in aesthetics during these activities, they will be localised and temporary in nature. This is an unsubstantiated comment, as no plume modelling has been undertaken. Further, given that dredging will take close to two years the term "temporary" may not be appropriate.
	Factor Land Terrestrial Ecosystems	The Flora and Fauna Division agrees with the proponent's assessment that construction activities will occur within cleared and disturbed lands within the existing Darwin LNG facility disturbance envelope and therefore the construction and operation has a low risk to biodiversity and environmental values.
	Coastal process • Project activities and significant impact	Table 9.1 seems to infer that primary productivity and nutrient cycling are not impacted on by the project activities. Consequently, the referral has not assessed this potential impact for its significance. Primary production can be impacted by elevated suspended sediments in multiple ways; either by reduced light availability or suspended sediments trapping phytoplankton and zooplankton which are subsequently removed from the primary production cycle as the suspended sediments settle out on the seafloor. Further, dredge spoil disposal and seabed mining have a direct impact on infauna and the nutrient/trophic process within sediments. Changes to sediment composition from disposed sediment could also permanently change sediment chemical processes. As such, the primary productivity and nutrient cycling should be assessed as part of the risk assessment.
	Coastal process • Project activities and significant impact • Conservation significant areas	The referral has not established its zone of influence and therefore cannot determine whether the project will impact on significant conservation areas. For example, seagrass meadows occur within Shoal Bay. It is proposed that the dredge spoil disposal site is located next to that of INPEX. No modelling has been undertaken to determine if suspended sediments and light availability will impact on neighbouring seagrass meadows. Further, sediment chemistry around the INPEX dredge spoil site seems to indicate that sediment has moved from the dredge spoil ground into neighbouring areas. It is unclear how far the sediments have moved and to what extent this impacts on benthic fauna (infauna) and conservation significant areas, like seagrass meadows.
	Factor: Sea - • Marine Environmental Quality	The referral notes that: *Based on these monitoring observations for the significantly larger program of works, it would seem unlikely that with an appropriate management and monitoring framework that there is the potential for impacts from this Project to be any greater than those observed during Ichthys.*

		The referral has not taken into account the cumulative impacts nor assessed the zone of influence to support this statement.
	Factor: Sea - Marine Environmental Quality • Project activities and significant impact • Sediment quality • Infauna, epifauna and biota quality • Ecosystem health	The referral has not considered changes to sediment quality as a significant impact and therefore did not discuss. However, dredge disposal can have a significant impact on marine environmental quality. It has a direct impact on benthic fauna and flora and therefore has the potential to change ecosystem processes (nutrient pathways, water quality and trophic structures).
Section 9.5 Section 9.5.5	Factor: Sea - Marine Environmental Quality • Water Quality • Seabed disturbance • Suspended sediments & light availability • Sediment transport	The referral notes that there will be impacts to water quality from pipeline trenching, dredge spoil disposal and seabed mining activities. These activities will impact on suspended sediment conditions, light availability at the seafloor in the Darwin Harbour and Shoal Bay and sediment transport characteristics. Although the proponent has committed to undertake further dispersion modelling, the referral solely relies on INPEX's assessment to inform their risk assessment on impacts to water quality. This is not considered acceptable. Dispersion modelling is critical for determining the zone of influence and identifying where direct and indirect impacts overlap with sensitive habitats. Without this, the proponent is unable to scope the full impact of its activities on water quality, other than areas of direct impact. There is the potential that environmental conditions are site specific and therefore INPEX's assessments are not directly applicable. In particular, it is noted that dredging will occur in the western part of Darwin Harbour which has more complex hydrodynamics than East Arm. This could result in inappropriate assumptions feeding into the risk assessments. The Flora and Fauna Division recommends that plume dispersal and sediment transport modelling is undertaken and risk assessment is undertaken considering modelling outputs and potential indirect impacts. Further, the Flora and Fauna Division recommends that the 'Dredging and Dredge Spoil Placement Management Plan' includes a monitoring program. The objective of this would be to validate the sediment transport and plume models. This has relevance to assessing the health of sensitive receptors, like benthic primary producers, from sediment deposition.
Section 9.5.2.3	Factor: Sea - Marine ecosystems • Ecosystem health	The referral notes: During trenching, spoil disposal and backfill activities, the increased turbidity and sediment levels in the water may result in a visible surface plume which is often

		associated with such activities. While such plumes may lead to a decline in aesthetics during these activities, they will be localised and temporary in nature. This is an unsubstantiated comment, as no plume modelling has been undertaken. Further, given that dredging will take close to two years the term "temporary" may not be appropriate.
	Factor: Sea - Marine ecosystems	The referral assesses the risk to biodiversity and environment values on the basis of direct impacts from project construction and operational activities. It has inferred potential indirect impacts, however has not established zone of influence and thus cannot adequately assess whether significant habitats or environmental values are impacted on.
	Factor: Sea - Marine ecosystems • Benthic habitats	The referral uses benthic habitat data from 2019 (Galaiduk et al. 2019 and Siwabessy et al. 2016). There is more recent benthic modelling undertaken by the Australian Institute of Marine Science (AIMS) (2021[1]) which should be used to inform ecosystem values. The modelling takes into account a wider variety of environmental drivers and has adjusted its modelling approach to take into account the rarer benthic community types. The referral cannot solely rely on modelled habitat data. The proponent has undertaken some benthic surveys for the purpose of laying the pipeline. However this effort is inadequate for the purpose of verifying whether the modelled benthic habitat data represents which benthic communities actually occur within the pipeline corridor and the zone of influence. These surveys do not allow the accurate assessment of the extent, composition and characteristics of benthic habitats. The risk assessment also downplays the value of filter feeder habitat in channel and channel slope areas. Generally the filter feeder habitats that occur on rocky and mixed substrates (various compositions of rock and coarse sediments) are diverse and provide structure for fish and other invertebrate fauna. This habitat functions as refuge, feeding and reproductive areas. These habitats are relatively rare when compared to the extent of sand and mud dominated habitats and are present within the pipeline corridor. It is recommended that proponent undertakes a dedicated benthic survey for the pipeline corridor in Darwin Harbour and on knolls and rocky/mixed sedimentary environments within the zone of influence. The benthic survey design should be based on identifying physical environmental characteristics, as outlined for example in Nicholas et al. (2019); should follow benthic habitat modelling as undertaken by AIMS (2021); and undertake an impact risk assessment that takes into account the

[1] AIMS 2021: Revised predictive benthic habitat map for Darwin Harbour, AIMS 2021.

		function of benthic habitats (infauna, epifauna and flora) rather than just a biodiversity perspective.
	Factor: Sea - Marine ecosystems • Benthic habitats • Benthic Primary Producers	The referral notes that: ... *benthic communities (particularly corals and sponges) can be impacted by suspended sediment through three primary cause effect pathways: light reduction, increased suspended sediment concentrations, and sediment deposition (smothering).* The referral cites work undertaken by WAMSI. This is most probably appropriate for the impact risk assessment, even though it is site specific. The referral further states that: *Trenching for pipeline installation will result in pulses of increased turbidity, suspended solids and subsequent reduction in light availability.* In order to understand the impact to trenching, and increased turbidity, the referral should clarify how "pulses of increased turbidity" is applicable in this case. If dredging/trenching is continuous, it would be assumed that the dredging plume is continuous. It is important to understand this, as the referral uses "pulses" as the reason for not exceeding the benthic primary producers' high impact (i.e. mortality) environmental trigger of a 3-fold decrease in light levels, and a combination of 10mg/L and 2.3mol photons/m^2/day over a 42-day period (WAMSI 2019). No plume modelling has been undertaken and the proponent has not determined what suspended sediment concentrations are likely to be. Therefore, there is no data to compare against WAMSI triggers and thus, the risk assessment is limited to INPEX specific circumstances. As the proponent has committed to undertake plume and sediment modelling, it is recommended that the risk assessment is reviewed in context of project specific data, plume and sediment modelling outputs, and updated habitat layers.
	Factor: Sea - Marine ecosystems • Benthic habitats • Seagrass	The referral only considers seagrass meadows in Fannie Bay. Considering the hydrodynamic conditions of Darwin Harbour it is unlikely that turbidity and suspended sediments will play a significant role in determining impacts to these meadows. However, this assumption should be tested through plume modelling. The referral has failed to consider impacts to seagrass meadows in Shoal Bay and Casuarina Coastal Reserve. Again it is recommended that plume and sediment transport modelling for dredge spoil disposal is undertaken so that an appropriate risk assessment can be undertaken.
9.6.2	Factor: Sea - Marine ecosystems • Conservation Significant areas	The referral states: *While there will be direct impact to the seabed in this area and subsequent localised and temporary decrease in water quality, this is only expected to result in temporary behaviour changes to fish during construction. There is not expected to be any*

		significant impact to the RPA and the addition of the Project pipeline will add additional, artificial habitat for reef fish. No evidence has been provided to support the statement in relation to a localised and temporary decrease in water quality. Given the duration of the dredging campaign and failure to undertake plume and sediment transport modelling there is no understanding of the time duration and spatial extent in water quality decline. The referral also states: *There is widespread habitat available in the immediate vicinity that marine fauna are able to access and consequently no significant change to these conservation significant areas is expected.* This argument is not supported because the spatial extent of declined water quality has not been established and the proportion of impacted versus non-impacted areas has not been established. There is insufficient information to make this claim and subsequently indicates that the risk assessment requires further review. Further, the referral has not considered whether the available habitats are important for feeding or life stages of listed fish species (*Environment Protection and Biodiversity Conservation Act 1999* or *Territory Parks and Wildlife Conservation Act 1976)* and important commercial and/or recreational species. Consequently the referral's risk assessment requires revision to take into account the full suite of potential impacts.
	Factor: Sea - Marine ecosystems • Migratory and marine vertebrate fauna	The referral has identified that marine megafauna and turtles occur in East Arm and Darwin Harbour. In particular, it identifies that there are three species of coastal dolphin (Australian Humpback, Snubfin and Bottlenose) that consistently use the area for foraging and social activities (Brooks et al 2017)[2]. Given their occurrence within the footprint and neighbouring areas, marine turtles are likely to use the filter feeder habitat for foraging. There is potential for these species to be impacted on by the project. Potential impact pathways include vessel traffic, dredging operations, pile driving and associated underwater noise, and lighting. To reduce the risk to these species, mitigation of potential impacts is required. The referral notes that the project is committed to develop a number of environmental management plans (EMP) to mitigate potential impact and associated risks. The Flora and Fauna Division recommends that the project consider at least the following mitigation measures for

[2] Brooks L, Palmer C, Griffiths AD and Pollock KH (2017) Monitoring Variation in Small Coastal Dolphin Populations: An Example from Darwin, Northern Territory, Australia. Front. Mar. Sci. 4:94. doi: 10.3389/fmars.2017.00094

		incorporation into EMPs in relation to vessel traffic, dredging, pile driving and lighting: • Implementation of vessel speed limits during the construction and operation phase. • Marine megafauna observation zones and exclusion zones; • That the observation period for marine megafauna prior to commencing dredging and pile driving is 20 minutes and that the observer is solely dedicated to the task of sighting and recording marine megafauna interactions prior to, and during, dredging and pile driving operations. • Lighting specifications follow national guidelines[3].
	Factor: Sea - Marine environmental quality • Cumulative impacts	A cumulative impact assessment was not undertaken. The proponent proposes to discuss with other proponents/dredge operators if dredging operations would coincide with another project. The Flora and Fauna Division does not consider that this adequate to inform an assessment of the risks to this factor. The Flora and Fauna Division recommends that plume modelling should at least include all the activities from the project could impact on suspended sediment. The proponent should also provide the Dredging and Dredge Spoil Placement Management Plan for review by appropriate experts before any dredging commences.
	Factor: Sea - Marine ecosystems • Project Activities and significant impact • Plankton • Ecological function and processes • Integrity of marine ecosystems, including biological and functional diversity	See comments for Coastal process - Project activities and significant impact

Should you have any further queries regarding these comments, please contact Rebecca de Vries by email Rebecca.deVries@nt.gov.au or phone (08) 8999 4454.

Yours sincerely

Maria Wauchope
A/Executive Director, Rangelands

23 February 2022

[3] National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds, Commonwealth of Australia 2020