UPDATED MAINTENANCE DREDGE ESTIMATES

Request for Further Information: DCCEEW Request 1.1

The department recognises that the estimated maintenance dredge values provided in the PD (Section 1.1.1b) are significantly greater than the values provided in the RFI during the Referral stage. The uncertainty of forecasting maintenance dredging requirements across extended timeframe is noted by the department and the precautionary approach of overestimation is endorsed to address potential impacts to MNES.

Noting this, the department is seeking clarification on how the approximately 80% increase in the maintenance dredging volume has been considered in the impact assessment and if/how this has influenced BCI consideration of significant residual impact to MNES resulting from the proposed action.

Mardie Minerals' Response:

Mardie Minerals has assessed the potential impacts to MNES resulting from the increase in maintenance dredge volume and concluded that there will be no change to the existing risks to MNES identified in Section 6.1 (Table 11, page 62-68), of the Preliminary Document. We have considered the following in reaching this conclusion:

1. **There is no change to direct impacts resulting from smothering of benthic substrate/habitats already predicted to result from capital and maintenance dredging.** Additional maintenance volumes will not smother additional habitat, instead they will simply result in greater depth of dredge spoil at the existing capital disposal site.

2. **The ZOMI and ZOHI boundaries for disposal of maintenance spoil will be smaller than those already identified in the sediment plume modelling for capital dredging.** The boundaries of the Zone of Medium Impact (ZOMI) and Zone of High Impact (ZOHI) for DMPA 4 are predicted by the extent of sediment dispersion and turbidity generated during spoil disposal activities. Sediment dispersion and turbidity are influenced by the sediment properties (such as sediment grain size and fines content), disposal methodology, and local hydrodynamic conditions (i.e. currents, wave action, severe weather events such as tropical cyclones).

   Mardie Minerals conclude that the boundaries of the predicted ZOMI and ZOHI at DMPA 4 (Att3_DMPA4 Disposal Plume Modelling 2024, Figure 7, Page 10) would not expand for the following reasons:

   a) **Dredging/disposal volumes and rates for all maintenance dredging are lower than capital dredging.** The ZOMI And ZOHI boundaries are defined for the capital dredging campaign and the dredging/disposal volumes and rates for all maintenance dredging (including with an increased dredge volume) will be significantly lower than those generated during the capital dredging. Specifically, the capital dredge volume is estimated to be up to 355,000m^3 whereas the average annual maintenance dredge volume is estimated to be up to 50,000 m^3 (as discussed in Section 1.1.1. of the PD, pages 1 to 5).

   b) **Maintenance spoil is predicted to have a higher sand and lower fines content.** As per the geotechnical borehole data analysed (refer to PD Attachment 4: Maintenance Dredging Estimate 2020, page 8), the particle size distribution from the seabed at all locations in the dredge area shows a relatively low fines content, with the median particle size ranging from 0.6mm to 3.6mm. This indicates that the sample material taken from the dredge area, and therefore the expected maintenance spoil, is generally coarse (sand to gravel). The expected higher sand and lower fines content of maintenance spoil will therefore limit turbidity and spread of the disposal plume.

   c) **Mardie Minerals has committed to best-practice disposal and monitoring methods that will ensure ZOHI and ZOMI boundaries are not exceeded.** As outlined in Section 3.4, page 34,

Section 4, page 40 and Section 8, page 65 of the Dredge and Spoil Disposal Management Plan (DSDMP; Attachment 2), best practice methods to minimise and monitor plume dispersion during capital dredging will also be employed during maintenance dredging. These best practice methods include controlled disposal within small dump boxes within DMPA 4, active turbidity monitoring, and adaptive management of dredge volumes and disposal rates through baseline, progress, and clearance surveys before, during, and after dredging.

Specifically, prior to commencing a maintenance dredging event Mardie Minerals will carry out a baseline survey; the coverage of the baseline survey will include hydrographic surveys of the dredging area (and extending 100m outwards), the agreed sailing corridor, and DMPA 4 (and extending 100m outwards). During dredging, Mardie Minerals will conduct a daily progress survey over the dredge area of dredging works conducted in the preceding 24 hours, and a weekly survey over DMPA 4 of sediment placed. After completion of a maintenance dredging event, Mardie Minerals will then carry out a clearance survey to demonstrate compliance with the Approvals granted and for the depth declaration by the Pilbara Ports Harbour Master. The clearance survey will include all areas covered in the baseline survey. The surveys above will determine the actual rate of sedimentation that is occurring which Mardie Minerals will then use to plan the future maintenance dredging requirements. Planning of future maintenance dredging can then determine the optimum maintenance dredging program in terms of frequency (e.g. 1-yearly, 2-yearly, 5-yearly. etc.). Mardie Minerals will use disposal area management technology that maximises the use of DMPA 4 to achieve even placement across DMPA 4. This includes dividing DMPA 4 into small dump boxes, to enable even placement. Each vessel shall be equipped with a satellite positioning system that incorporates in the background the dump boxes and their unique code to enable the vessel master to identi

fy the correct placement location. A dump box shall be considered as being available when a hydrographic survey confirms sufficient capacity exists to accept another load of dredge spoil.

Mardie Minerals is confident that this combination of monitoring and management will ensure the ZOMI and ZOHI boundaries are not exceeded during maintenance dredging, regardless of the volume.

3. **Controls already in place to minimise the potential for impacts on MNES resulting from vessel transit and disposal are precautionary and will ensure any additional vessel activity required to dispose of higher maintenance spoil volumes continues to present a consistent and low risk to MNES.** Mardie Minerals considers that the consequence of vessel impacts will remain constant and the likelihood of impacts due to increased vessel transit will remain low because none of the factors influencing likelihood of impacts will change as a result of increase maintenance dredge volumes. Specifically:
   a) the slow speed of the dredge vessel (8 – 12 knots) will not change,
   b) the short journey length (approximately 27 NM per return trip) will not change, and
   c) the low frequency of vessel movements (up to three return trips per day) and relatively short duration of movements will not change.

   Implementation of the following standard mitigations for all dredging and disposal activities will also reduce the risk for all disposal activities:
   a) Implementation of the DSDMP (Att2_DSDMP (Rev 5)).
   b) Dredging will be scheduled to avoid key ecological windows.
   c) Monitoring and management zones will be implemented with MFOs; and
   d) Large marine fauna sightings will be reported to all vessels.

Request for Further Information: DCCEEW Request 1.2

Provide further explanation of the methods used to estimate maintenance dredge volume outlined in section 1.1.1b. Outline the likelihood of further re-estimation of maintenance dredge volumes and how adaptive management will be informed to mitigate impacts to MNES.

Mardie Minerals Response

Two methods have been used to estimate the maintenance dredge volume to date; a) sediment transport modelling and b) application of existing maintenance dredging volumes at a nearby facility

Sediment transport modelling

Mardie Minerals engaged Baird Australia Pty Ltd (Baird) to estimate the annual maintenance dredging volumes for the Approved Proposal (Att4_Maintenance Dredging Estimate 2020).

The estimate is based on the original dredge pocket and dredging volume of 800,000m^3. The estimate is based on a revision to the sediment transport modelling conducted by Baird in 2019 which has been updated to include ambient wet and dry season periods, measured turbidity data, and geotechnical borehole data and seabed sediment samples collected in the nearshore and offshore areas to the Approved Proposal. Based on the geotechnical analysis of borehole data it was confirmed that the fines at the seabed surface over the shoal feature (immediately southwest of the dredge footprint) have been winnowed out leaving behind coarser material. The upper surface essentially provides an armoured layer against the erosion of fines in the deeper layers of the seabed over the shoal. This understanding was used to inform the modelling of the seabed composition in a revised modelling approach. Four representative sediment classes were modelled – fine sand, silt, fine silt and clay.

The sources of sedimentation that can affect the dredged areas in the model include: (1) sediment from the seabed which is eroded under the current and wave conditions and which is transported along the seabed into the relative calm of the deeper channel areas (bedload transport), and (2) sediments in suspension under natural seasonal conditions combined with fine material which is eroded from the bed under the current and wave conditions, which eventually settles in the relative calm of the deeper areas (suspended sediment transport).

The model estimated that:

- The rate of sedimentation in the wet season is approximately twice that of the dry season; this is due to lower suspended sediment concentration in the model during dry season conditions associated with the relatively calmer metocean conditions (lower waves).
- The highest sedimentation rates are within the berth pocket with 0.23 m to 0.36 m sedimentation of fine sediments modelled annually.
- The ranges of annual sedimentation by section of the dredge design are:
    - Berth Pocket: 2,900 to 4,600 m^3
    - Lower marine precinct: 6,400 to 7,200 m^3
    - Upper marine precinct: 7,600 to 13,800 m^3
    - Channel south: 4,400 to 8,400 m^3
    - Mid-channel: 6,100 to 11,000 m^3
    - Channel north: 11,600 to 15,500 m^3.

As per the sediment transport modelling conducted by Baird (Att4_Maintenance Dredging Estimate 2020, pages 12 and 20), sedimentation rates have been provided as an upper and lower bound ranging from a

total 39,000 to 65,500 m^3 annually in the dredged areas under ambient conditions – this range was used to initially estimate maintenance dredge volumes for the Approved Proposal.

Application of existing maintenance dredging volumes at a nearby facility

During 2024, the dredge channel design was revised to *inter alia* avoid significant dredging and make best use of the natural seabed level, which ensures much more of the offshore area is at design depth where no capital and maintenance dredging will be required. Mardie Minerals therefore engaged WSP Australia Pty Limited (WSP) to provide an updated estimate of maintenance dredging volumes. This work resulted in a significant reduction in the volume of dredging required, to 355,000m^3; some of the berth pockets identified above no longer required significant capital (and therefore maintenance) dredging.

WSP advised that after capital dredging of the revised design, the volume and frequency of required maintenance dredging will be dependent on the sedimentation rate within the berth pocket and navigation channel. WSP concluded that sedimentation rates are particularly difficult to accurately estimate as they are heavily dependent on the variability of natural conditions and can fluctuate significantly from year to year. Numerical models can be used to provide sedimentation estimates, but unlike wave and current models, traditionally there is a lower degree of confidence in the results. In practice, WSP considered that the most reliable sedimentation rates for channels are based on historic monitoring surveys and dredging records built up over time after construction.

Where channels have been established for a long period of time, these historic records generally provide a more accurate basis of estimate for future maintenance dredging requirements. For the Approved Proposal, the navigation channel will be a new channel and these records therefore do not exist as yet, however, comparison can be drawn to the experience at other nearby facilities. Based on WSP's consultation with Pilbara Ports and taking into consideration the volume and frequency of dredging undertaken at the nearby Port of Ashburton facility, the recommendation of 50,000 m^3 as an upper limit of annual maintenance dredging requirements is considered a practical and realistic estimate by WSP. In practice, the rate of sediment movement in the Pilbara is relatively low, with significant movements dependent on the occurrence and frequency of tropical lows and tropical cyclones over the wet season. Therefore, planning based on annual averages is considered a reasonable approach by WSP.

As this is the most contemporary estimate available to Mardie Minerals, and because it represents a precautionary approach to the assessment of dredging impacts, this higher figure to 50,000 m^3 has now been adopted for the current referral.

Future estimation of maintenance dredging volumes

After the capital dredging activities have been completed, Mardie Minerals will be able to more accurately estimate the maintenance dredge volume based on actual rates of sedimentation in the dredged area. The following methods will be used to inform the estimate (see also description of these activities above in response to RFI 1.1):

- After capital dredging Mardie Minerals will carry out a baseline survey which includes hydrographic surveys of the dredging area (and extending 100m outwards), the agreed sailing corridor, and DMPA 4 (and extending 100m outwards)
- After completion of a maintenance dredging event, Mardie Minerals will carry out a clearance survey to demonstrate compliance with the Approvals granted and for the depth declaration by the Pilbara Ports Harbour Master. The clearance survey will include all areas covered in the baseline survey.
- These surveys will determine the actual rate of sedimentation that is occurring in the dredged area which Mardie Minerals will then use to plan future maintenance dredging requirements.
- Based on these surveys, the disposal rates of the next maintenance dredging event can be calculated and controlled, the turbidity will be monitored at DMPA 4 in accordance with the Dredge and Spoil Disposal Management Plan (DSDMP), and adaptive management measures employed as required.

Adaptive management measures that will be undertaken include:

- review of and adjustment to the exact placement location of maintenance dredge spoil into small dump boxes within DMPA 4 in order to achieve even placement across DMPA 4
- adjusting the disposal schedule within the period April to October (inclusive) which will include changes to the frequency and volume of disposal, to allow for evaluation of environmental responses and enabling adjustments based on observed impacts
- preparing and submitting a revised DSDMP to regulatory authorities for assessment
- adjusting / enhancing the frequency and scope of environmental monitoring to track sediment dispersion.