GOVERNMENT OF WESTERN AUSTRALIA

Environmental Protection Authority

Optimised Mardie Project

Mardie Minerals Pty Ltd

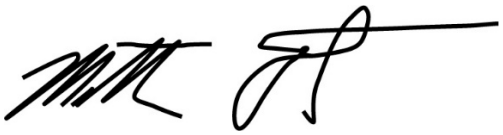
Report 1740
June 2023

This assessment report has been prepared by the Environmental Protection Authority (EPA) under s. 44 of the *Environmental Protection Act 1986* (WA). It describes the outcomes of the EPA's assessment of the Optimised Mardie Project proposal by Mardie Minerals Pty Ltd.

The Optimised Mardie Project was determined under the Commonwealth *Environment Protection and Biodiversity Act 1999* to be a controlled action and to be assessed by the EPA under an accredited process. This document is also the result of the EPA's accredited assessment process.

This assessment report is for the Western Australian and Commonwealth Ministers for Environment and sets out:

- what the EPA considers to be the key environmental factors identified in the course of the assessment
- an assessment of the matters of national environmental significance
- the EPA's recommendations as to whether or not the proposal may be implemented and, if it recommends that implementation be allowed, the conditions and procedures, if any, to which implementation should be subject.
- other information, advice and recommendations as the EPA thinks fit.



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Proposal

The Optimised Mardie Project is a significant amendment to expand the approved original Mardie Project. The proposal is located 80 kilometres southwest of Karratha, in the Pilbara region of Western Australia.

The original Mardie Project was referred to the Environmental Protection Authority (EPA) in April 2018. The proposal was approved subject to conditions in Ministerial Statement 1175 on 24 November 2021. Ministerial Statement 1175 authorised a high quality salt and Sulphate of Potash (SoP) project and associated export facility. Production rates under the Mardie Project include four million tonnes per annum (Mtpa) of salt, 100 kilotonnes per annum (ktpa) of SoP, and up to 300 ktpa of other salt products, sourced from a 150 gigalitre per annum (GL/a) seawater intake.

The proponent for the proposal is Mardie Minerals Pty Ltd.

The Optimised Mardie Project, includes the following changes to the approved proposal:

- expand the concentrator and crystalliser ponds
- include a port facility laydown area
- widen an access road
- increase the terrestrial development envelope by 3,978 hectares (ha) (total 19,645 ha)
- increase the disturbance within the terrestrial development envelope by 2,334 ha
- increase in project throughput, which includes:
  - increase in seawater intake to 180 GL/a
  - increase in brine discharge to 5.5 GL/a
  - increase in export volumes to 5.35 Mtpa of salt and 140 ktpa of SoP
- a secondary seawater intake option within Mardie Creek
- increase the dredge footprint by 10 ha and alteration of the methodology within the dredge channel development envelope (no changes to dredge volume)
- increase the dredge channel development envelope by 3.5 ha
- inclusion of a quarry adjacent to Mardie Road.

Environmental values

Inland Waters, Benthic Communities and Habitat (BCH), Marine Fauna, Flora and Vegetation, Terrestrial Fauna and Social Surroundings are the key factors that may be impacted by the proposal.

Consultation

The EPA published the proponent's referral information on its website for seven days public comment. The EPA also published the proponent's additional information on its website for public review for four weeks (from 5 September 2022 to 4 October 2022). The EPA considered the comments received during these public consultation periods in its assessment.

Mitigation hierarchy

The mitigation hierarchy is a sequence of proposed actions to reduce adverse environmental impacts. The sequence commences with avoidance, then moves to minimisation, rehabilitation, and offsets are considered as the last step in the sequence.

The proponent considered the mitigation hierarchy in the development and assessment of its proposal, and as a result will:

- avoid impacts to closed canopy (CC) mangrove and the majority of Scattered mangrove and algal mat through the design of the development envelope
- avoid impacts to Mardie creek tributaries by locating the crystalliser ponds on the upper reaches of the intertidal zone
- avoid three registered heritage sites, the Mardie Station homestead and woolshed complex
- avoid good to excellent quality native vegetation
- avoid direct impact to one record of *Buddelundia* 'sp.indet through a 50 metres (m) exclusion zone
- minimise the risk of fatal vessel strikes to marine fauna through low speed limits of 8–10 knots
- minimise risk of marine fauna entrapment through the design of seawater intake to be fitted with screens and maximum intake speeds of 0.15 metres per second (m/s) to prevent marine fauna being drawn into the intake
- minimise clearing within vegetation type *AcAjTe* which may provide habitat for threatened flora *Minuria tridens.*

Assessment of key environmental factors

The EPA has identified the key environmental factors (listed below) in the course of its assessment. For each factor, the EPA has assessed the residual impacts of the proposal on the environmental values and considered whether the environmental outcomes are likely to be consistent with the EPA environmental factor objectives. As the proposal is an Optimised Mardie Project to an existing proposal, the EPA's assessment has been undertaken in the context of the existing proposal, having regard to the combined and cumulative effects on the environment. The EPA has also considered whether to inquire into the implementation conditions for the existing proposal. The EPA considers that there is additional information on the cumulative effects and the mitigation measures are better defined for combined effects.

Inland Waters

Residual impact or risk to environmental value		Assessment finding
1.	Changes to groundwater regimes and quality due to hypersaline seepage from ponds, potentially impacting intertidal BCH, Mardie Pool (and associated riparian vegetation) and Mt Salt mound spring, as a result of the increase in area of crystalliser ponds from 1,877 ha to 2,625 ha.	The proponent's proposed mitigations, with particular regards to seepage recovery, would be effective in addressing impacts associated with hypersaline seepage, subject to the completion of detailed hydraulic investigations to inform adequate thresholds, triggers, and mitigation actions. Condition B3 (Inland Waters) has been imposed to ensure intertidal BCH, Mardie Pool (and associated riparian vegetation) and Mt Salt mound spring will not be significantly impacted as a result of implementation of the proposal.
2.	Alteration and reduction of surface water flows due to the increased area of ponds and the altered design of ponds, roads, potentially impacting intertidal BCH and Mardie Pool.	The proponent's revised modelling has demonstrated that the combined Mardie Project (including the Mardie Project and the Optimised Project) can be managed to meet the outcomes specified in Ministerial Statement 1175. Condition B3 (Inland Waters) has been imposed to ensure intertidal BCH, Mardie Pool (and associated riparian vegetation) and Mt Salt mound spring will not be significantly impacted as a result of implementation of the proposal.
3.	Alteration and reduction of tidal inundation due to the altered design of the intertidal causeway, potentially impacting intertidal BCH with particular regards to algal mats.	Modelling for the revised causeway design indicates that total inundation extents would be comparable to the pre-development base case. Condition B3 (Inland Waters) has been imposed to ensure intertidal BCH, Mardie Pool (and associated riparian vegetation) and Mt Salt mound spring will not be significantly impacted as a result of implementation of the proposal.

Benthic Communities and Habitats

Residual impact or risk to environmental value		Assessment finding or Environmental outcome
1.	Disposal of up to 5.5 GL per annum of brine into the dredge channel.	The EPA advises that there are unlikely to be significant residual impacts subject to the implementation of recommended conditions (B4-1, B4-2, B1-4 and B5-4) so

		there are no project attributable impacts on associated environmental values. This ensures consistency with the EPA objective for benthic communities and habitats.
2.	Direct and unrecoverable impacts to filter feeder/macroalgae/seagrass BCH Additional 10 ha of subtidal BCH No increase in direct impacts to vegetated subtidal BCH.	The EPA advises that this residual impact is likely to be able to be regulated through reasonable conditions (recommended conditions A1, B1-1, B1-3, B1-4, B5-4, B4-3) to ensure the proposal is implemented in a manner that maximum extents of the proposal are not exceeded and EPA objectives for Benthic Communities and Habitats and Marine Environmental Quality are met.
3.	Indirect and recoverable impacts to filter feeder/macroalgae/seagrass BCH.	The EPA advises that there are unlikely to be significant residual impacts subject to the implementation of reasonable conditions (recommended conditions A1, B1-1, B1-3, B1-4, B5-4, B4-3) (see above). In the event there are significant residual impacts that are detected through ongoing monitoring, consistent with condition B10, the proponent shall undertake contingency measures for the purpose of guiding the strategic protection and management of the ecological values of these habitats on the west Pilbara coast.
4.	Introduction of marine pests.	The EPA advises that there are unlikely to be significant residual impacts subject to the implementation of reasonable conditions (recommended conditions B2-1, B2-2). These conditions are imposed to ensure there is no introduction or establishment of marine pests in Western Australian state waters as a result of the proposal.
5.	Direct disturbance to intertidal BCH comprised of disturbance to 34 ha of coastal samphire.	The EPA advises that the significant residual impact can be regulated through reasonable conditions (recommended conditions A1, B1-4 and B10). Given the significant residual impacts and risks of the proposal to mangroves, algal mat, and coastal samphire, consistent with condition B10, the proponent shall undertake offset measures for the purpose of guiding the strategic protection and management of the ecological values of these habitats on the west Pilbara coast.
6.	Impacts to intertidal BCH as a result of decreased frequency of freshwater inundation.	The EPA advises that residual impacts are likely to be able to be regulated through reasonable conditions (recommended

		conditions B1-1, B1-3, B1-4, B5-4, B3-1, B4-3 and B10), with contingency for offsets consistent with condition B10 for the purpose of guiding the strategic protection and management of the ecological values should significant residual impacts be detected.
7.	Impacts to BCH as a result of increased freshwater inundation.	The EPA advises there are unlikely to be significant residual impacts. Potential impacts will be able to be regulated through reasonable conditions (B1-4 and B3-2).
8.	Indirect impacts to intertidal BCH from saline seepage and changes to groundwater flows.	The EPA advises that residual impacts are likely to be able to be regulated through reasonable conditions (recommended conditions A1, B1-1, B1-3, B1-4, B5-4, B3-2, B4-3 and B10) with contingency for offsets consistent with condition B10, should significant impacts be detected. These offsets are for the purpose of guiding the strategic protection and management of the ecological values of these habitats on the west Pilbara coast.

Marine Fauna

Residual impact or risk to environmental value		Assessment finding or Environmental outcome
1.	Direct and indirect impacts to marine fauna during construction from underwater noise (dredging and piling) and vessel strike.	The EPA advises that this residual impact is likely to be able to be regulated through reasonable conditions (recommended conditions B5-1, B5-2, B5-4, B5-6, B5-7 and B5-8). Implementation of condition B5 (Marine Fauna) will ensure the EPA objective for Marine Fauna will be met.
2.	Potential impacts to nesting adult and hatchling turtle orientation and sea finding success or adult nesting utilisation as a result of operational lighting.	The EPA advises that this residual impact is likely to be able to be regulated through reasonable conditions (recommended condition B5-1 and B5-3). Implementation of condition B5 (Marine Fauna) will ensure the EPA objective for Marine Fauna will be met.
3.	Indirect impacts of loss of BCH on marine fauna or modification of tidal creek habitat.	The EPA advises that this residual impact is likely to be able to be regulated through reasonable conditions (recommended condition A1-1, B1-1, B1-2 and B1-4). Implementation of condition B1 (BCH) will ensure the EPA objective for Marine Fauna will be met.
4.	Risk of entrainment for marine fauna from seawater intake.	The EPA advises that this residual impact is likely to be able to be regulated through reasonable conditions (recommended condition A1-1). Implementation of condition

		A1 will ensure the EPA objective for Marine Fauna will be met.
5.	Vessel strike risk for marine fauna.	The EPA advises that this residual impact is likely to be able to be regulated through reasonable condition (recommended conditions B5-2 and B5-5). Implementation of condition B5 (Marine Fauna) will ensure the EPA objective for Marine Fauna will be met.

Flora and Vegetation

Residual impact or risk to environmental value		Assessment finding or Environmental outcome
1.	Clearing of up to 695 ha of native vegetation which occurs in 'Good' to 'Excellent' condition. The combined effect of the approved project (2,319 ha) and the Optimised Mardie Project will be up to 3,014 ha of good to excellent native vegetation cleared.	The clearing of 'Good' to 'Excellent' condition vegetation within the Pilbara Bioregion is a residual impact in the context of biological diversity and ecological integrity. The EPA advises that this residual impact is likely to be regulated through reasonable conditions (limitations on extent A1) and including a requirement of offsets (recommended condition B9). The EPA has concluded that the environmental outcome is likely to be consistent with the EPA objective for Flora and Vegetation.
2.	The combined effect of the approved project and the Optimised Mardie Project will be disturbing 202 individuals of *M. tridens.*	The EPA advises the residual impact is likely to be regulated through reasonable condition (recommended condition B7-1 (2) and B7-2). The EPA has concluded that the environmental outcome is likely to be consistent with the EPA objective for Flora and Vegetation.
3.	Impacts to *Tecticornia* taxa	The EPA advises there is unlikely to be a residual impact subject to reasonable condition (recommended condition B7-1 (3)). The EPA has concluded that the environmental outcome is likely to be consistent with the EPA objective for Flora and Vegetation.
4.	Indirect impacts associated with the introduction and spread of weeds, unintentional spillage or seepage of brine and increased dust deposition.	The EPA advises there is unlikely to be a residual impact subject to reasonable condition (recommended condition B7-1 (4)) The EPA has concluded that the environmental outcome is consistent with the EPA objective for Flora and Vegetation.

		It is also noted that this aspect can be subject to other statutory decision-making processes.

Terrestrial Fauna

Residual impact or risk to environmental value		Assessment finding or Environmental outcome (choose which one to use)
1.	Direct impact to the following habitat types that are important to threatened fauna: • 15.5 ha of northern quoll habitat. The combined effect of the Mardie Project (64.5 ha) and the Optimised Mardie Project will be up to 80 ha • 34 ha of Migratory Shorebird coastal samphire habitat. The combined effect of the Mardie Project (296 ha) and the Optimised Mardie Project will be up to 330 ha • 54 ha of northern coastal free tailed bat - tidal samphire shrubland habitat. The combined effect of the Mardie Project (1,132 ha) and the Optimised Mardie Project will be up to 1,186 ha • 342 ha of Pilbara leaf nose bat good to excellent condition Triodia grasslands habitat. The combined effect of the Mardie Project (882 ha) and the Optimised Mardie Project will be up to 1,566 ha • 695 ha of foraging and dispersal habitat for the grey falcon. The combined effect of the Mardie Project (2,319 ha) and the Optimised Mardie Project will be up to 3,014 ha of good to excellent condition vegetation.	The EPA advises that this significant residual impact should be subject to reasonable implementation conditions (recommended condition B6), including a requirement for an offset (recommended condition B9 and condition B10), to ensure the environmental outcome is likely to be consistent with the EPA objective for Terrestrial Fauna.
2.	Impacts to short range endemic (SRE) invertebrates and habitats.	The EPA advises impacts are likely to be able to be regulated through reasonable conditions (recommended condition B6). The EPA has concluded that the environmental outcome is consistent with the EPA objective for Terrestrial Fauna.

3.	Indirect impacts to threatened fauna through vehicle strike, noise emissions, artificial light feral animals and pond entrapment.	The EPA advises impacts are likely to be able to be regulated through reasonable conditions (recommended condition B6) and subject to regulation by DWER and DMIRS. The EPA has concluded that the environmental outcome is consistent with the EPA objective for Terrestrial Fauna.

Social Surroundings

Residual impact or risk to environmental value		Assessment finding or Environmental outcome
1.	Disturbance to two 'other heritage places' DPLH site 38637 and DPLH 38638.	The EPA advises impacts are likely to be able to be regulated through reasonable conditions (recommended condition B8). The EPA has concluded that the environmental outcome is consistent with the EPA objective for Social Surroundings.
2.	Disturbance of land used for traditional purposes. Up to 1.111 ha of Spinifex grassland, shrubland and woodland areas. The combined effect of the Mardie Project (2,401 ha) and the Optimised Mardie Project will be up to 3,512 ha.	The EPA has concluded there is unlikely to be a material impact on Spinifex grassland, shrubland and woodland areas and the environmental outcome is consistent with the objective for this factor.
3.	Visual amenity of Mardie Homestead.	The EPA has concluded there is unlikely to be a material impact on visual amenity and the environmental outcome is consistent with the objective for this factor.
4.	Noise and dust emissions.	The EPA has concluded there is unlikely to be a material impact from noise and dust emissions subject to regulation by DWER. The EPA has concluded that the environmental outcome is consistent with the EPA objective for Social Surroundings.

Holistic assessment

The EPA considered the connections and interactions between relevant environmental factors and values to inform a holistic view of impacts to the whole environment. The EPA formed the view that the holistic impacts would not alter the EPA's conclusions about consistency with the EPA factor objectives.

Conclusion and recommendations

The EPA has taken the following into account in its assessment of the proposal:

- environmental values which may be significantly affected by the proposal

- assessment of key environmental factors, separately and holistically (this has included considering cumulative impacts of the proposal where relevant)
- likely environmental outcomes which can be achieved with the imposition of conditions
- consistency of environmental outcomes with the EPA's objectives for the key environmental factors
- EPA's confidence in the proponent's proposed mitigation measures
- whether other statutory decision-making processes can mitigate the potential impacts of the proposal on the environment
- principles of the *Environmental Protection Act 1986*.

The EPA has recommended that the proposal may be implemented subject to conditions recommended in Appendix A.

1 Proposal

The Optimised Mardie Project (significant amendment) is a proposal to expand the approved Mardie Project (approved proposal). The proposal is located 80 kilometres southwest of Karratha, in the Pilbara region of Western Australia (see Figure 1).

The proposal is for a significant amendment to the proposal approved under Ministerial Statement 1175 to incorporate the following changes (see Figure 2):

- expand the concentrator and crystalliser ponds
- include a port facility laydown area
- widen an access road
- increase the terrestrial development envelope by 3,978 ha (total 19,645 ha)
- increase the disturbance within the terrestrial development envelope by 2,334 ha
- increase in project throughput, which includes:
  - increase in seawater intake to 180 GL/a
  - increase in brine discharge to 5.5 GL/a
  - increase in export volumes to 5.35 Mtpa of salt and 140 ktpa of SoP
- include a secondary seawater intake option within Mardie Creek
- increase the dredge footprint by 10 ha and alteration of the methodology within the dredge channel development envelope (no changes to dredge volume)
- increase in dredge channel development envelope by 3.5 ha
- inclusion of a quarry adjacent to Mardie Road.

The proponent for the proposal is Mardie Minerals Pty Ltd.

The proponent referred the proposal to the Environmental Protection Authority (EPA) on 18 February 2022. The referral information was published on the EPA website for seven days public comment. On 28 April 2022, the EPA decided to assess the proposal at the level of Referral Information with addition information required. The EPA published the additional information on its website for public review over four weeks from 5 September 2022 to 4 October 2022.

The proposal was determined under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) to be a controlled action and to be assessed by the EPA under an accredited assessment process.

The proposal is set out in section 2 of the proponent's referral supporting report (Preston Consulting 2022), which is available on the EPA website.

The elements of the proposal which have been subject to the EPA's assessment are included in Table 1.

The EPA has assessed the residual impacts of the significant amendment by considering the expansion and changes which are now proposed in the context of the original proposal. The EPA has also considered the combined impacts of the original proposal and the proposed changes, and cumulative impacts of the significant amendment with other proposals in the region. The EPA has considered new information on the mitigation of impacts on the approved proposal and significant amendment.

Table 1: Location and proposed extent of proposal elements

Proposal element	Location	Original proposal	Significant amendment	Combined proposal
Physical elements				
Terrestrial development envelope	Figure 2	Up to 15,667 ha. Disturbance of no more than 2,319 ha of Good to Excellent condition vegetation.	Up to **19,645 ha**. Disturbance of no more than **695 ha** of Good to Excellent condition vegetation.	Up to **19,645 ha**. Disturbance of no more than **3,014 ha** of Good to Excellent condition vegetation.
Crystalliser ponds	Figure 2	Up to 51 crystalliser ponds covering an area of 1,877 ha (not specified in authorised extent).	An additional **9** crystalliser ponds, and reconfiguration of existing **51** crystalliser ponds covering an area of up to **2,625 ha.**	Up to **60** crystalliser ponds covering an area of up to **2,625 ha.**
Direct and indirect impacts to Horseflat PEC	Figure 2	Disturbance of no more than 145 ha of direct impacts and 20 ha indirect impacts within the development envelope.	No change	Disturbance of no more than 145 ha of direct impacts and **20 ha** indirect impacts within the development envelope.
Landward samphire	Figure 2	Disturbance of no more than 854 ha within the development envelope.	Disturbance of no more than **9 ha** within the development envelope.	Disturbance of no more than **863 ha** within the development envelope.
Coastal samphire	Figure 4	Disturbance of no more than 296 ha within the development envelope.	Disturbance of no more than **34 ha** within the development envelope.	Disturbance of no more than **330 ha** within the development envelope.
Algal mat	Figure 4	Disturbance of no more than 880 ha within the	No Change	Disturbance of no more than **880 ha** within the

Proposal element	Location	Original proposal	Significant amendment	Combined proposal
		development envelope.		development envelope.
Direct disturbance to mangrove habitat outside of Robe River Delta Mangrove Management Area (RRDMMA)	Figure 4	Disturbance of no more than 13 ha within the development envelope.	No Change	Disturbance of no more than **13 ha** within the development envelope.
Direct disturbance to mangrove habitat inside the RRDMMA	Figure 4	No more than 4 ha of clearing within the RRDMMA, subject to the requirements of condition B3-4.	No change.	No more than **4 ha** of clearing within the RRDMMA, subject to the requirements of condition B3-4.
Dredging	Figure 5	No more than 800,000 m^3, disturbing no more than 55 ha within the 304 ha dredge development envelope.	An increase in the dredge development envelopment of **3.5 ha**. Dredging volume unchanged. Disturbance of **10 ha** subtidal BCH.	No more than 800,000 m^3, disturbing no more than **65 ha** within the **307.5 ha** dredge development envelope.
Drainage corridors maintain surface water flows	Figure 2	Minimum of two drainage corridors of a minimum 200 m wide, aligned with existing natural drainage lines.	No change.	Minimum of two drainage corridors of a minimum 200 m wide, aligned with existing natural drainage lines.
Foraging habitat for the Pilbara leaf-nosed bat	-	Disturbance of no more than 2,562 ha within the development envelope.	Disturbance of no more than **678 ha** within the development envelope.	Disturbance of no more than **3,240 ha** within the development envelope.
Foraging habitat for the Northern coastal free – tailed bat	-	Disturbance of no more than 1,132 ha within the development envelope.	Disturbance of no more than **54 ha** within the development envelope.	Disturbance of no more than **1,186 ha** within the development envelope.
Foraging habitat for the Pilbara olive python	-	Disturbance of no more than 6 ha within the development envelope.	No Change	Disturbance of no more than **6 ha** within the development envelope.

Proposal element	Location	Original proposal	Significant amendment	Combined proposal
Foraging habitat for the Northern quoll	-	Disturbance of no more than 64.5 ha within the development envelope.	Disturbance of no more than **15.5 ha** within the development envelope.	Disturbance of no more than **80 ha** within the development envelope.
Operational elements				
Discharge of bitterns, including desalinisation plant bitterns	Figure 6	No greater than 3.6 gigalitres per annum (GL/a) with a specific gravity no more than 1.25 via diffuser into the designated Low Ecological Protection Area (LEPA) shown on Figure 6.	No greater than **1.9 GL/a** with a specific gravity no more than **1.25** via diffuser into the designated LEPA shown on Figure 6.	No greater than **5.5 GL/a** with a specific gravity no more than **1.25** via diffuser into the designated LEPA shown on Figure 6.
Seawater intake		Seawater intake not exceeding 0.15 m/s through intake pipes fitted with four-side screens.	No change	Seawater intake not exceeding 0.15 m/s through intake pipes fitted with four-side screens.
Groundwater	-	No dewatering of groundwater for any reason except to meet the requirements of condition B3-1.	No change	No dewatering of groundwater for any reason except to meet the requirements of condition B3-1.
Timing elements				
Mine life	-	Up to 63 years from issue of MS 1175.	No change	Up to 63 years from issue of MS 1175.

Units and abbreviations
GL/a – gigalitres per annum
ha – hectare
m - metre
m^3 – cubic metre
m/s – metre per second

Application of *Environmental Protection Act 1986* amendments to the proposal

The proposal was referred as a significant amendment (Optimised Mardie Project) to the existing Mardie Project which was approved through MS 1175. The EPA decided to assess the Optimised Mardie Project on 2 May 2022.

Given the proposal is a significant amendment to an existing approval, the EPA's assessment has been undertaken in the context of the existing Mardie Project, having regard to combined and cumulative effects on the environment. The EPA has also considered whether to inquire into the implementation conditions for the approved Mardie Project.

The EPA has not re-assessed the approved Mardie Project (MS 1175) which is currently regulated through a variety of mechanisms.

Proposal alternatives

The proponent considered alternatives for the significant amendment, including the option for an offshore dredge material disposal area, however, this was removed due to potential additional environmental impacts. The quarry area was relocated to the southeast of the approved Mardie Project to avoid Aboriginal heritage sites and northern quoll denning and shelter habitat (Preston Consulting 2022).

The proponent used baseline studies and investigations to inform the location of the significant amendment, so that the impact to the environment can be minimised as far as practicable. The proponent therefore referred the significant amendment in its current location and form, and this is the significant amendment that the EPA has assessed.

Original proposal implementation

The Mardie Project was approved through Ministerial Statement 1175, issued on 24 November 2021.

The proponent advised that construction commenced in 2022.

- ponds 1 and 2 have been constructed and the embankments for ponds 3, 4 and 5 are well advanced and a levee has been built near the Robe River Delta Mangrove Management Area
- eighteen terrestrial bores have been installed but the coastal monitoring bore network is yet to be installed due to access issues; the proponent has advised that the bores will be installed prior to the ponds being filled.

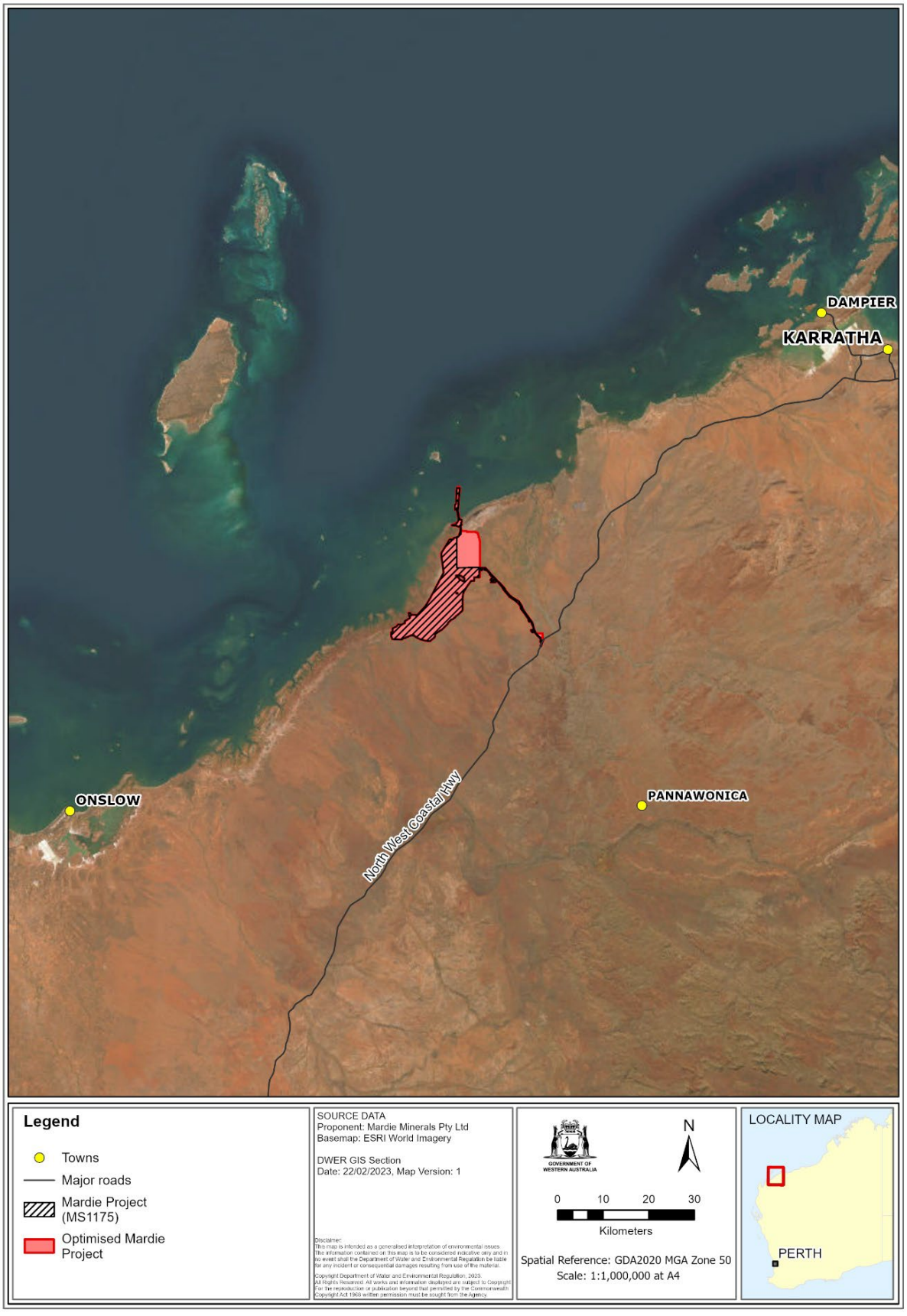

Figure 1: Project location

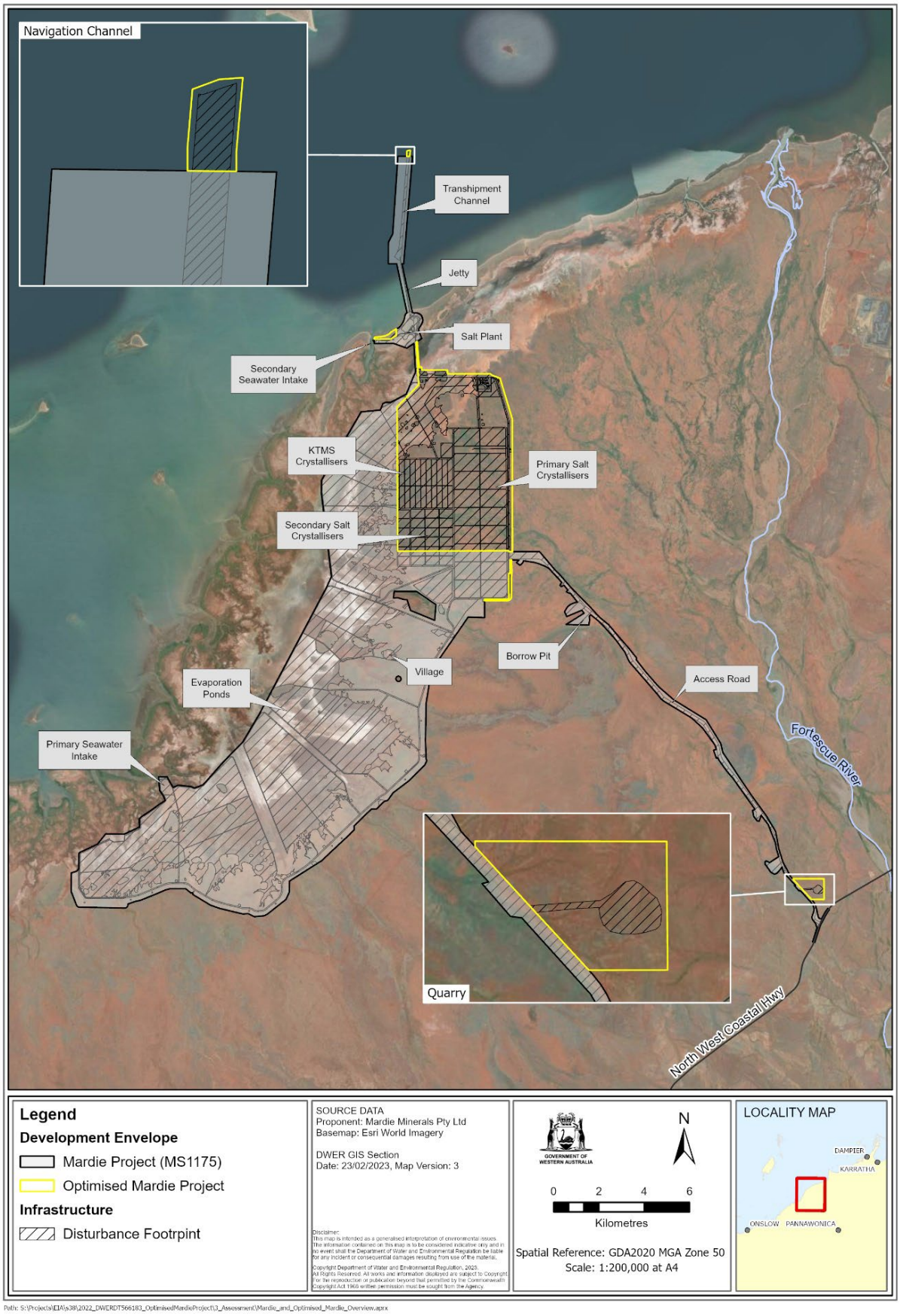

Figure 2: Development envelope and disturbance footprint

2 Assessment of key environmental factors

This section includes the EPA's assessment of the key environmental factors. The EPA also evaluated the impacts of the significant amendment on other environmental factors including greenhouse gas, marine environmental quality and coastal processes and concluded these were not key factors for the assessment. This evaluation is included in Appendix D.

The EPA has assessed the significant amendment in the context of the approved proposal as authorised in Ministerial Statement 1175, while having regard to the combined and cumulative effect that the implementation of the approved proposal may have on the following environmental factors.

2.1 Inland Waters

2.1.1 Environmental objective

The EPA environmental objective for inland waters *is to maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected* (EPA 2018).

2.1.2 Assessment context – previous assessment and authorised extents

Ministerial Statement 1175 for the Mardie Project authorised the following residual impacts to inland waters (or resulting from changes to inland waters) in the project area:

- changes to the health, extent and diversity of up to five hectares (ha) of intertidal benthic communities and habitat as a result of changes to groundwater regimes or groundwater quality
- decreased freshwater inundation and changes to the extent of surface water flooding and tidal inundation
- no adverse impact to water levels or water quality in Mardie Pool as a result of changes to ground or surface water regimes or quality.

EPA Report 1704 identified the following additional residual impacts and risks associated with changes to inland waters for the Mardie Project:

- impacts to groundwater regimes and quality due to saline seepage from evaporation and crystalliser ponds (regulated by the authorised extent of impacts to intertidal BCH and Mardie Pool as described above)
- risk of changes to surface water regimes and quality as a result of erosion
- risk of impacts to surface water quality as a result of spills of brine, chemicals and hydrocarbons, seepage from ponds, pond wall breaches and leachate from onshore dredge spoil disposal.

Physical elements and activities proposed to be constructed or carried out in the Mardie Optimised Project (the proposed change to the authorised Mardie Project)

have the potential to cause greater, lesser or different impacts to inland waters in the project area than those described above.

2.1.3 Investigations and surveys

The EPA advises that the proponent has relied on the survey data that was collected for the approved Mardie Project. A number of additional predictive models and studies were developed for the Mardie Optimised Project using the existing data. The EPA advises that these investigations, studies and peer reviews were used to inform the assessment of the potential impacts to inland waters:

- Mardie salt flood study phases 1-3 (Phase 3 includes incorporation of a high-level design for the Optimised Mardie Project into the hydraulic model) Appendix 2.6 of the additional information (Advisian 2021)
- site wide flood impact assessment summary, Technical memorandum Appendix 2.6 of the additional information (Advisian 2022b)
- Mardie Project Groundwater risk assessment, Optimised Project. Appendix 2.4 of the additional information (AQ2 2021a)
- Mardie Project Proposed investigation and monitoring program. Appendix 2.5 of the additional information (AQ2 2021b)
- causeway tidal inundation assessment – technical memorandum. Appendix 2.6 of the additional information (Advisian 2022a)
- review of Groundwater Monitoring and Management Plan for Mardie Salt and Potash Project (Optimised design) Appendix 3.2 of the additional information (Ataie-Ashtiani 2022).

The EPA has determined that it can proceed with the assessment of the Optimised Mardie Project, based on the additional predictive models and studies, and conservative assumption that the groundwater system is represented by a complex and density coupled process.

2.1.4 Assessment context – existing environment

This section describes the existing environment in the northern section of the Mardie Optimised Project where the works and any additional impacts are located.

Groundwater regimes and quality.

The proponent has provided preliminary characterisation of the groundwater regime based on sampling conducted for the Mardie Project and additional historical data sourced from DWER. The additional ponds are located in the Fortescue River alluvial aquifer, which was previously expected to be impacted by a proportion of the proposed ponds for the approved Mardie Project. The likely extent of the Fortescue River alluvial aquifer is shown in Figure 3 (BCI 2022).

The Fortescue River alluvial aquifer is recharged directly from the Fortescue River by periodic streamflow, carrying freshwater towards the coast, with salinity increasing towards the ocean. General groundwater levels and flow direction in the project area have been estimated and are shown in Figure 3.

Environmental values that are likely to be sensitive to changes in groundwater flow and quality include:

- Mt Salt Mound Spring

  The proponent has not noted any particular ecological or heritage values associated with this mound spring. In the absence of specific surveys, the EPA has assumed there are ecological values for this receptor for the purpose of this assessment.

- Mardie Pool

  The pool is located to the south of the additional ponds proposed for the Optimised Mardie Project (Figure 2). While the pool has heritage and ecological values, the water is degraded by cattle use (see surface water quality below). The pool is likely to be supported by both ground and surface water flows (BCI 2022).

- Intertidal benthic communities and habitat (BCH)

  Intertidal BCH is considered to have a high level of ecological values, including primary productivity, ecosystem maintenance, nutrient cycling and habitat values. EPA guidance statement 1 – Guidance for protection of mangroves (EPA 2001) notes that mangroves in this region are an important part of coastal ecosystems.

- Groundwater dependent ecosystems (GDE)

  Riparian vegetation surrounding Mardie Pool has the potential to be partially reliant on groundwater (BCI 2022). No other potential GDE, excluding intertidal BCH as discussed above, occurs in the areas with potential to be impacted by groundwater flows from the Optimised Mardie Project.

Surface water and tidal regimes

During large magnitude rainfall events, flooding of the Fortescue River dominates the northern half of the project area (that is, the focus of the additional/different work proposed for the Optimised Mardie Project). During small rainfall events flooding of the river does not occur. Flood behaviour is typified by sheet flow across the intertidal plain towards the ocean. During these events water discharges through numerous small, incised channels or estuarine creeks (Advisian 2022b).
The clay pan is extensively inundated during higher spring tides with the only inflow and outflow path being Mardie creek at the western end. During large flood and storm events, water from the claypan can also drain to the north-east or break out across low-lying sections of the coastal foredune. Seawater is mostly contained to the tidal channels. Values that are sensitive to changes in surface water flows and tidal regimes include BCH and Mardie Pool.

Surface water Quality

Surface water in the intertidal area of the Optimised Mardie Project is highly variable in relation to salinity as it is influenced by frequent inundation from flood and tidal waters.

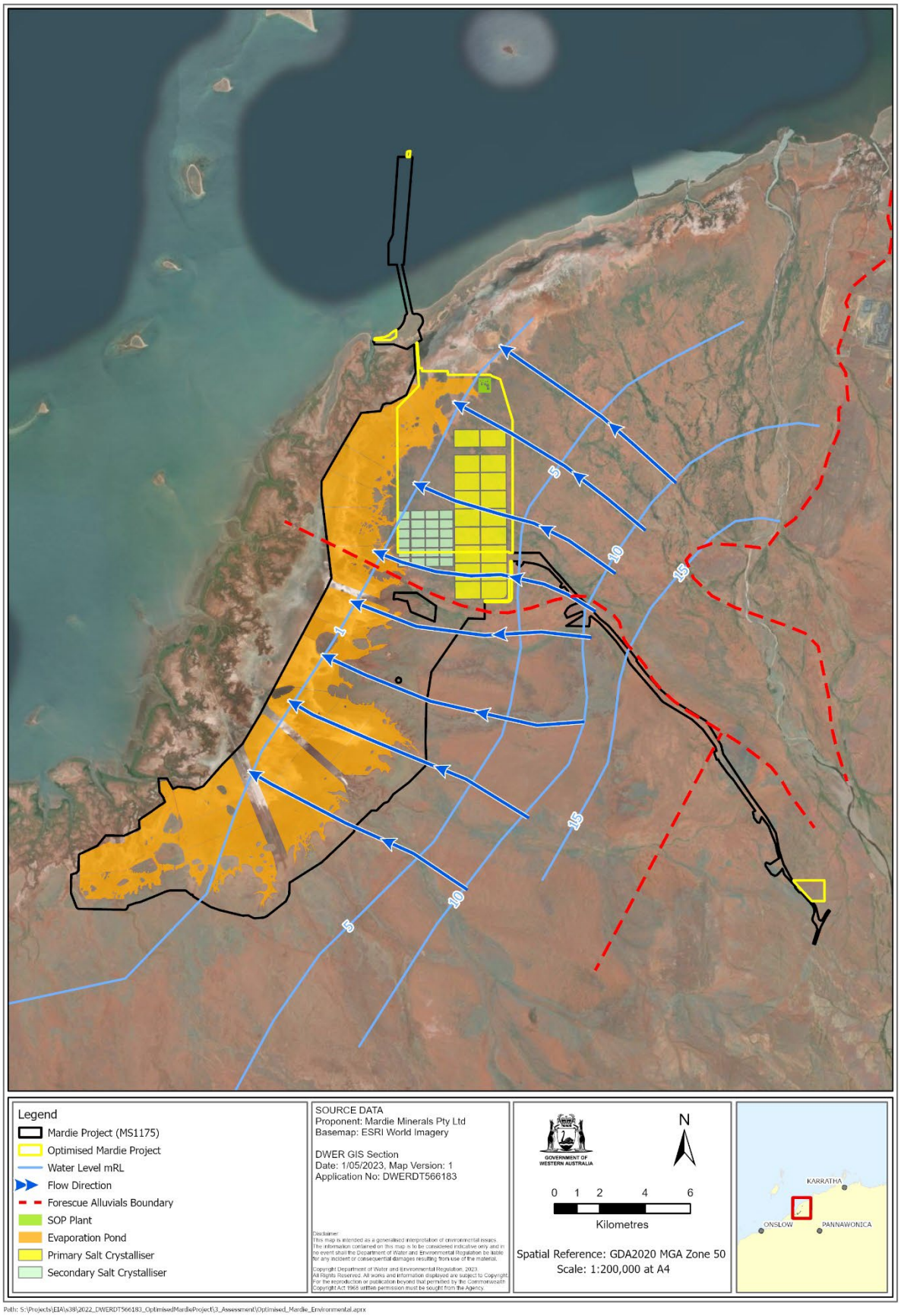

Figure 3: Fortescue River Alluvial Aquifer and groundwater gradients

Surface water quality within Mardie Pool (the only permanent surface water in the proposal area) is somewhat degraded by cattle use. Baseline surface water quality information for Mardie Pool is available and has been provided in the proponent's Groundwater Monitoring and Management Plan (BCI 2023a).

Acid sulfate soil assessments were undertaken for the assessment of the approved Mardie Project and the risk was determined to be low. Given that the same environmental features exist within the Optimised Mardie Project, a similar low risk is likely to occur in this area.

2.1.5 Consultation

The additional information was released for public review for a period of four weeks. Matters raised during public consultation on the Optimised Mardie Project and the proponent's responses are provided in the response to submissions document (BCI 2022).

The key issues relevant to inland waters raised during the public consultation on the Optimised Mardie Project, are as follows:

- impacts to groundwater flows from seepage and mounding beneath ponds with specific regards to lack of baseline data
- changes to surface water regimes and tidal inundation
- impacts to surface water quality from hydrocarbon spills, brine leakages and lateral seepage from additional ponds.

2.1.6 Potential impacts from the proposal

The proposed change to the approved proposal would result in the following impacts to inland waters in the project area:

- changes to groundwater regimes and quality due to seepage from ponds, potentially impacting intertidal benthic communities and habitat (BCH)
- alteration and reduction of surface water flows due to additional of altered design of ponds
- alteration and reduction of tidal inundation due to the altered design of the intertidal causeway
- impacts to surface water quality from spills of hydrocarbon, brine, lateral seepage of brine through pond walls and pipeline leakage
- erosion and sedimentation as a result of constructed landforms.

2.1.7 Avoidance measures

The proponent has designed the Optimised Mardie Project to avoid impacts to inland waters through placement of the additional crystalliser ponds largely outside of the intertidal zone, and away from the Mardie Creek tributaries. The revised design increases the buffer between the crystalliser ponds and Mardie Pool.

In addition, the Optimised Mardie Project retains the avoidance measures included in the approved Mardie Project design, including avoidance of groundwater abstraction through the use of desalination to provide feed water for processing, and subsequent avoidance of impacts from desalination brine disposal by use of the desalination brine in the salt production process.

2.1.8 Minimisation measures (including regulation by other DMAs)

The proponent has proposed measures to minimise impacts to inland waters by:

1. designing concentrator and crystalliser ponds to be safe and stable, according to Department of Mines, Industry Regulation and Safety (DMIRS) requirements under the *Mining Act 1978*
2. routine inspection of condition and performance of pond walls, pipelines, containment systems and internal drainage structures, and other controls to reduce risk of unintentional brine pipeline spills as required by works approvals under Part V of the *Environmental Protection Act 1986*
3. monitoring of erosion at outlets of southwest corridors after each significant flow event
4. abstraction of seawater only when tides are above mean sea level.

The issues raised in consultation in regard to impacts to surface water quality are addressed in the minimisation measures.

2.1.9 Rehabilitation measures

The Optimised Mardie Project would be rehabilitated similar to the approved Mardie Project, and in accordance with the requirements of the *Mining Act 1978*. The proponent has prepared a Mine Closure Plan. The Mine Closure Plan meets the requirements of the Statutory Guidelines for Mine Closure Plans (DMIRS, March 2020). As per the Mine Closure Plan, rehabilitation actions outlined by the proponent include:

- all salts to be harvested from ponds prior to closure
- concentrator ponds to be opened up to allow tidal flows to enter the ponds
- infrastructure to be removed, unless retained by Mardie station or Pilbara Ports Authority
- crystalliser ponds to be rehabilitated to an acceptable landform.

2.1.10 Assessment of impacts to environmental values

The following impacts identified in section 2.1.6 are not significantly different to, or greater in magnitude than those assessed for the approved Mardie Project and can be managed by the conditions and other regulatory mechanisms outlined in EPA Report 1175. These impacts are addressed in section 2.1.8. and include:

- impacts to surface water quality from spills of hydrocarbon, brine, lateral seepage of brine through pond walls and pipeline leakage
- impacts to surface water quality as a result of the disturbance of acid sulfate soils

- erosion and sedimentation as a result of constructed landforms.

The following impacts identified in section 2.1.6 have the potential to result in a residual impact following the proponent's application of the mitigation hierarchy as described above:

- changes to groundwater flows due to seepage from ponds, potentially impacting intertidal BCH, GDE, Mardie Pool and Mt Salt Mound spring
- alteration and reduction of surface water flows due to additional ponds
- alteration and reduction of tidal inundation due to the altered design of the intertidal causeway.

Groundwater Regimes and quality

There is a potential for hypersaline seepage from concentrator and crystalliser ponds added through the Optimised Mardie Project to cause groundwater mounding. This mounding could interfere with density flow systems that potentially support algal mats (AQ2 2021a). There is also potential for seepage of hypersaline water to be transported via groundwater flows to sensitive receptors, including Mardie Pool and its associated riparian vegetation (BCI 2022). The seepage is unlikely to impact the Mt Salt Mound spring (BCI 2022).

Crystalliser ponds have a greater potential than concentrator ponds to impact groundwater flows and quality, due to the concentrated hypersaline nature of the brine. The approved Mardie Project included 51 crystalliser ponds covering an area of 1,877 ha. The Optimised Mardie Project includes 60 crystallisers ponds covering an area of 2,625 ha (RTS BCI 2023).

The additional ponds to those approved for the Mardie Project have been designed and located further inland and as a result the Optimised Mardie Project provides a greater buffer between the additional crystalliser ponds and Mardie Pool (BCI 2022). This avoids many impacts to the pool and allows increased adaptive management of impacts from seepage, and therefore minimises impacts from the ponds (BCI 2022).

EPA Report 1704 for the approved Mardie Project noted that impacts associated with hypersaline seepage could be mitigated by the proponent's proposed saline seepage recovery actions. The EPA concluded that this proposed mitigation would be effective subject to the development of detailed triggers, thresholds, and mitigation actions (EPA 2021). For the Optimised Mardie Project, the proponent has submitted a revised Groundwater Monitoring and Management Plan (GMMP) that includes requirements for additional baseline studies and for the development of triggers, thresholds, and mitigation actions. In addition, the GMMP includes groundwater monitoring criteria that are linked to monitoring and management actions under the Benthic Communities Habitat Monitoring and Management Plan (BCHMMP). The DWER has advised that the plan is adequate for this purpose.

The EPA notes that the revised GMMP demonstrates that an adequate program of work has been designed to characterise the groundwater regime in the project area and predict and detect impacts in a timely manner. This provides increased

confidence that effective mitigation actions can be implemented to prevent significant impacts associated with hypersaline seepage from the crystalliser ponds.

The EPA has therefore recommended condition B3-1 (1) and (4), and condition B3-2 which reflect and replace conditions 3-1 and 3-3 imposed by Ministerial Statement 1175. Condition B3-1 requires the proponent to manage the Optimised Mardie Project such that a number of objectives are met, including preventing impacts to water levels and water quality in Mardie Pool, and limiting impacts to intertidal BCH as a result of groundwater seepage to less than 5 ha. Condition B3-2 requires the proponent to implement the revised GMMP.

Surface water flows

The proponent's modelling of flood flows from inland catchments for the Optimised Mardie Project is described in Advisian 2021 and Advisian 2022b. The model quantifies the likely impacts of the Optimised Mardie Project against a pre-development scenario (that is, the combined impacts of the approved Mardie Project and the Optimised Mardie Project). The proponent has also deduced the impacts of the Optimised Mardie Project relative to the approved Mardie Project from the results of the modelling.

The Optimised Mardie Project will not result in any significant changes to surface water flows to Mardie Pool, Salt Mound Spring and the RRDMMA, as the new ponds are located a sufficient distance from these areas (BCI 2023). The majority of impacts would occur from smaller magnitude rainfall events. Up to 195 ha of algal mat is expected to experience a decrease in the frequency of flooding as a result of the Optimised Mardie Project (BCI 2021). This decrease is shown to occur during smaller rainfall events. There is some uncertainty as to the extent of likely impact from changes to inundation, though given algal mats currently experience a low frequency of freshwater flooding, it is possible they are resilient to reduced frequency of freshwater inundation.

Despite this uncertainty, any change in the inundation of algal mats will be detected through the GMMP, triggering further monitoring and management under the BCHMMP (O2 Marine, 2023a).

During small rainfall events, the Optimised Mardie Project is also expected to result in an additional 185 ha of the intertidal zone being dry where it would have been flooded in a pre-development scenario. Almost all of this area is within bare mudflats or salt flats and is localised around pond walls and diversion drains, where algal mats are not present (BCI 2021).

Given the dominance of flooding from the Fortescue River across the floodplain where the proposed change to the Optimised Mardie Project is located, it is unlikely that any infrastructure in this area would significantly impede flows to the intertidal zone during higher magnitude rainfall events.

Based on the modelling, the location of the new ponds away from the Mardie Pool and the mangrove area, and any potential impacts from the Optimised Mardie Project being shown to occur during smaller magnitude rainfall events, the proponent

has demonstrated that the combined effects of the approved and Optimised Mardie Projects can be managed to meet the outcomes identified in Ministerial Statement 1175, including limits on the areas of decreased inundation of costal samphire and mangrove habitats (Advisian 2021).

The EPA has therefore recommended condition B3-1 (2), (3), (5), (6) and (7) which reflect and replace relevant sections of condition 3-1 imposed by Ministerial Statement 1175. This condition requires the proponent to avoid adverse impacts to Mardie Pool as a result of changes to surface water flows, and to limit the magnitude of changes to surface water in the intertidal habitats such that no more than 13 ha of mangroves outside of the RRDMMA receives a decrease in freshwater inundation.

In addition, the EPA has recommended condition B1-3 requiring the proponent to ensure changes to the health, diversity and extent of benthic communities and habitat as a result of changes to surface water are detected as early as possible and if required are mitigated using best practice contingency measures.

Tidal inundation

The placement of the additional ponds further inland for the Optimised Mardie Project avoided any changes to tidal inundation from the location of pond walls when compared to the approved Mardie Project (BCI 2021).

The causeway proposed for the Optimised Mardie Project is different to the approved Mardie Project and includes replacing an extent of the causeway in the upper intertidal flats with pond walls (BCI 2021). The proponent has modelled changes to tidal inundation as a result of the revised causeway design which incorporates improved knowledge of the project area (Advisian 2022a).

The updated modelling for the Optimised Mardie Project causeway indicates that total inundation extents for the combined proposal would be comparable to the pre-development base case, with only a 0.2% reduction in inundation area over areas of algal mat. Further, the revised design does not result in any reduction in inundation compared to that represented in the assessment of the approved Mardie Project (Advisian 2022a).

The EPA has therefore recommended conditions B3-1 (3), which reflects and replaces condition 3-1 (3) imposed by Ministerial Statement 1175. This condition requires the proponent to ensure that the final design and construction of the causeway is consistent with the extent of inundation in the updated modelling provided in the *Causeway Tidal Inundation Assessment – technical memorandum* (Advisian 2022a).

Cumulative Impacts

The combined impact of the Optimised Mardie Project in combination with the Mardie Project has been minimised through project design, including a commitment to not redirect Peters Creek in the RRDMMA and improvements in causeway design.

The EPA has considered the cumulative impacts of the Optimised Mardie Project in the context of the Mardie Project and other regional pressures. The EPA considers that potential cumulative impacts could be managed by requiring specific environmental outcomes to be achieved by the proponent, conditioning the commitment to not redirect Peters Creek, requiring contributions to research to enable strategic protection of ecological values of habitats in the region, and by providing other advice about the expectations of other proposals in the region.

2.1.10 Summary of key factor assessment and recommended regulation

The EPA has considered the likely residual impacts of the Optimised Mardie Project on inland waters and associated environmental values. In doing so, the EPA has considered whether reasonable conditions could be imposed, or other decision-making processes can ensure consistency with the EPA factor objective. The EPA assessment findings are presented in Table 1.

The EPA has also considered the principles of the *Environmental Protection Act 1986* (see Appendix C) in assessing whether the residual impacts will be consistent with its environmental factor objective and whether reasonable conditions can be imposed (see Appendix A).

The EPA has also had regard to its conclusions in EPA Report 1704 for the Mardie Project.

Table 2: Summary of assessment for inland waters

Residual impact or risk to environmental value		Assessment finding or Environmental outcome	Recommended conditions and DMA regulation
1.	<u>Proposal</u> The Optimised Mardie Project would increase the number and area of crystalliser ponds, thereby increasing the risk of changes to groundwater regimes and quality. <u>Combined effect of Mardie Project and Optimised Mardie Project</u> The combined proposal might result in an increased risk of changes to groundwater regimes and quality relative to the pre-development case.	The proponent's proposed mitigations, with particular regards to seepage recovery, would be effective in addressing impacts associated with hypersaline seepage, subject to the development of adequate thresholds, triggers and mitigation actions. There is a higher level of confidence in the proponents GMMP than during the assessment of the approved Mardie Project.	**Condition B3-1 (Inland waters)** Limits impacts to intertidal BCH and Mardie Pool as a result of changes to groundwater regimes and quality. **Condition B3-2 (Inland waters)** Requires implementation and revision of the proponent's GMMP.
2.	<u>Proposal</u>	The proponent's revised modelling has demonstrated that	**Condition B3-1 (Inland waters)**

	The Optimised Mardie Project would result in additional alteration and reduction of surface water flows due to additional of altered design of ponds, roads, potentially impacting intertidal BCH and Mardie Pool. <u>Combined effect of Mardie Project and Optimised Mardie Project.</u> The combined proposal would result in alteration of surface water flows from inland areas to the coast.	the combined project (including the Mardie Project and the Optimised Project) can be managed to meet the outcomes specified in Ministerial Statement 1175.	Avoid impacts related to surface water flows to Mardie Pool. Limit the magnitude of changes to surface water flows to intertidal BCH consistent with the extent authorised for the Mardie Project. **Condition B1-3 (Benthic Communities and Habitat)** Ensure that changes to the health, diversity and extent of intertidal BCH are detected as early as possible and addressed using best practice measures.
3.	<u>Proposal</u> The Optimised Mardie Project would result in alteration and reduction of tidal inundation due to the altered design of the intertidal causeway, potentially impacting intertidal BCH with particular regards to Algal Mat. <u>Combined effect of Mardie Proposal and Optimised Mardie Project</u> The combined effect of the proposal might result in a greater risk of changes to tidal inundation relative to the pre-development case.	Modelling for the revised causeway design indicates that total inundation extents for the combined project would be comparable to the pre-development base case.	**Condition B3-1 (Inland Waters)** Requires the final design and construction of the causeway to be consistent with the extent of inundation modelled.

2.2 Benthic Communities and Habitats

2.2.1 Environmental objective

The EPA environmental objective for Benthic Communities and Habitat (BCH) is *to protect benthic communities and habitats so that biological diversity and ecological integrity are maintained* (EPA 2021b).

2.2.2 Investigations and surveys

The EPA advises the following investigations and surveys were used to inform the assessment of the potential impacts to benthic communities and habitat:

- Assessment of Mangal and Algal Communities for the Mardie Solar Salt Project (Stantec 2018)
- Mardie Project Intertidal Benthic Communities and Habitat (O2 Marine 2020b)
- Mardie Project Subtidal Benthic Communities and Habitat (O2 Marine 2020c)
- Mardie Project Benthic Communities & Habitat Cumulative Loss Assessment (O2 Marine 2020a)
- Mardie Project: Introduced Marine Pest Risk Assessment (O2 Marine 2020b)
- Bitterns Outfall Modelling Report (Baird 2021)
- Dredge Dispersion Modelling Report (Baird 2022)

2.2.3 Assessment context – existing environment

The EPA uses local assessment units (LAUs) to map and assess impacts to benthic habitats on an appropriate scale, and to assist in assessing cumulative impacts at a regional scale. The Optimised Mardie Project has utilised the same seven LAUs defined in the approved Mardie Project. Subtidal BCH mapped in these seven LAUs are shown in Figure 5.

Subtidal BCH

The study area for subtidal BCH is a shallow, naturally turbid environment characterised by bare sand/silt with patchy distributions of filter feeder/macroalgae/seagrass and coral/macroalgae habitat. Coral species in the study area are present in low to moderate densities. Within the study area, a total of 445 ha of filter feeder/macroalgae/seagrass BCH, and 189 ha of coral/macroalgae BCH were mapped, with the remainder of the study area comprised of sand (6,940 ha). Coral communities mapped in the study area were generally of low diversity and abundance, representing less than 2% of the mapped BCH in the study area (O2 Marine 2020c). No subtidal BCH in the study area is considered to be locally or regionally significant.

The study area is unlikely to represent important foraging habitat for significant species (Preston Consulting 2020). Dugongs were not observed in the study area despite over 700 hours of observation (Preston Consulting 2020), and marine turtles were primarily observed around the offshore islands (Pendoley Environmental 2019). Subtidal habitats, including macroalgae, seagrass and sand/mud are of high ecological value and are known to support juvenile phases of key commercial fishery species, including bluespotted emperor, brown tiger prawns, endeavour prawns and western king prawns.

Intertidal BCH

The study area for intertidal BCH includes the intertidal areas of the seven LAUs shown in Figure 6. The study area includes extensive intertidal flats made up of a variety of benthic communities including mangroves, algal mats, coastal samphire, mudflat/salt flat, rocky shores and sand dunes, as shown in figure 6. The area is subject to a wide range of tidal and floodwater events and experiences cyclical inundation and exposure.

Intertidal BCH is considered to have a high level of ecological values, including primary productivity, ecosystem maintenance, nutrient cycling and habitat values. EPA guidance statement 1 – Guidance for protection of mangroves (EPA 2001) notes that mangroves in this region are an important part of coastal ecosystems. In the absence of agreement on the values of algal mats, in EPA Report 1704, the EPA determined to assess the approved Mardie Project based on the assumption that algal mats have high ecological values (EPA 2021).

2.2.4 Consultation

During the public review of the proponent's ERD, submitters queried whether impacts to benthic communities and habitats had the potential to impact on the commercial bluespotted emperor and prawn fishery and recreational fishing interests within the area.

The Optimised Mardie Project includes a change in project layout and dredge methodology and improvements in diffuser design that have resulted in an overall reduction in the predicted impacts to vegetated BCH, further reducing the potential for indirect impacts to key commercial and recreational fish stocks.

2.2.5 Potential impacts from proposal

The Optimised Mardie Project has the potential to significantly impact on BCH from:

- discharge of up to 3.6 GL/a waste product (bitterns) from the evaporation ponds and desalination plant to the marine environment via a 200 m eight port diffuser at the end of the trestle jetty approximately 5 km offshore
- direct disturbance, sedimentation, smothering and increased turbidity associated with dredging up to 800,000 m^3 of sediment
- introduction of marine pests
- risk of altering groundwater flows with indirect impacts to intertidal BCH (see section 2.1 Inland Waters)
- risk of altering surface water flows and quality with indirect impacts to intertidal BCH (see section 2.1 Inland Waters)

The Optimised Mardie Project will directly impact on:

- an additional 34 ha of coastal samphire up to a revised total of 330 ha
- 311 ha decrease in the area of algal mat that would experience an increased frequency of freshwater flooding

- 195 ha of algal mat that would experience a decrease frequency of freshwater flooding
- 10 ha increase in direct disturbance to subtidal BCH but a reduction in direct disturbance to vegetated subtidal BCH

The Optimised Mardie Project will not impact directly or indirectly on the RDMMA.

In accordance with the *EPA technical guidance - Protection of the benthic communities and habitats,* cumulative impacts to BCH are calculated as the total historical losses, plus the total direct and indirect loss of the combined Mardie Project and Optimised Mardie Project. Cumulative loss calculations for each of the seven LAUs[1] and each intertidal and subtidal BCH type are shown below in Table 3.

Table 3: Cumulative impacts to BCH by local assessment unit

	LAU1	LAU2	LAU3	LAU4	LAU5	LAU6	LAU7
Algal mat	10 ha 1%	0	452 ha 35%	0	479 ha 36%	1 ha 3%	-
Mudflat/tidal creek	2 ha <1%	0	0	3 ha <1%	0	0	-
CC Mangrove	0	0	0	0	0	0	-
SC Mangrove	0	1 ha <1%	0	13 2%	0	4 ha 1%	-
Rocky shores	0	0	0	0	0	0	-
Samphire	8 ha 5%	15 ha 1%	216 ha 82%	97 ha 6%	322 ha 68%	335 ha 22%	-
Sandy beach	0	0	0	0	0	0	-
Salt flat/ mudflat	5 ha 1%	45 ha 13%	1,775 ha 86%	26 ha 6%	4,446 ha 91%	208 ha 33%	-
Bare bioturbated sand	-	-	-	-	-	-	104 ha 1%
Macroalgae/ seagrass/filter feeder	-	-	-	-	-	-	35 ha 6%
Coral macroalgae	-	-	-	-	-	-	44 ha 23%

Based on the regional studies, the cumulative loss of each habitat across all LAUs is as follows:

[1] Local Assessment Units (LAUs) are defined on a case-by-case basis taking into consideration aspects of the local marine environment and the functional ecology of the marine ecosystem. LAUs are generally around 50 km^2.

- irreversible loss of 954 ha (16%) of coastal samphire
- irreversible loss of 880 ha (25%) of algal mats
- irreversible loss of less than 1 ha (<1%) of CC mangroves and 17 ha (1%) of Scattered mangroves. No cumulative losses of CC mangroves within the RRDMMA
- direct impact to 5 ha (<1%) of tidal creek habitat
- irreversible loss of 35 ha (6%) and recoverable impact to 133 ha (24%) seagrass / macroalgae / filter feeder communities
- irreversible loss of 44 ha (23%) and reversible loss of 69 ha (36%) of coral / macroalgae community.

The EPA notes there has already been a minor disturbance for investigation purposes in the RRDMMA. The DWER has considered whether this is a compliance issue. The EPA is satisfied the minor disturbance does not affect the outcomes and objectives for the RRDMMA and that the disturbance will be required to be offset under condition B10 in the same way as other disturbance in this area.

2.2.6 Avoidance measures

The proponent has avoided impacts to intertidal BCH by designing the development envelope to avoid key environmental features including avoidance of additional impacts to mangroves or algal mats and ensuring minimal increases in impact to higher value coastal samphire habitat. In addition, the proponent has refined the design of the bitterns diffuser to avoid additional impacts to subtidal BCH by ensuring that there is no increase in the size of the mixing zones proposed within the dredging channel. While there has been an increase in the direct disturbance to subtidal BCH, the dredge channel has been designed to reduce impacts to vegetated subtidal BCH.

Avoidance measures for indirect impacts to intertidal BCH are described in section 2.1 Inland Waters.

2.2.7 Minimisation measures (including regulation by other DMAs)

The proponent has minimised impacts to subtidal BCH by locating the bitterns dispersal ports within the area that would be disturbed by dredging activities, ensuring that additional subtidal BCH is not impacted by bitterns disposal outside of the required disturbance area, thereby avoiding additional impacts to subtidal BCH.

The proponent has committed to the following:

- implementing a Dredge Management Plan (DMP) to minimise the area of subtidal BCH subject permanent impacts from smothering and sedimentation
- implementing a MEQMMP to ensure that impacts to biota, including subtidal BCH, are limited to within established areas of low ecological protection
- minimising the risk of introducing Marine Pests in accordance with the *Biosecurity and Agriculture Management Act 2007* (BAM Act) through the

implementation of approved Marine Pest Management Procedure (Rev 1, dated 1 September 2022)

- use of a diffuser to maximise the dilution of bitterns discharge at the outfall point
- implementing the GMMP (BCI 2023) to mitigate potential indirect impacts
- implementing the BCHMMP (O2 Marine 2023a)
- the following controls will be used to minimise the risk of impact from unintentional brine pipeline spills:
  - pipelines will be fitted with leak detection
  - water flows will be shut off if leaks are detected
  - pipelines will be inspected regularly, especially during extreme heat or fire events
  - pipelines will be located off access road surfaces
  - if pipelines have to cross access roads, they will be buried
  - investigations will be conducted into the cause of any spills and remedial actions will be taken to minimise the chance of reoccurrence
  - spill response training to mitigate damage for site-based personnel
- verify inundation model within twelve months of the completion of the pond walls to confirm indirect impact predictions associated with changes to tidal regimes (refer to section 5)
- contractually require silk curtains to be in place during the construction of the secondary seawater intake to remove the requirement to monitor prior to the installation of the silk curtains. The silk curtains will be removed when turbidity within the completed work areas is equivalent or lower than what is outside the silt curtain.

2.2.8 Rehabilitation

At the completion of operations, the site will be rehabilitated to reinstate BCH. This will include:

- removal of salts from each pond prior to closure
- concentrator pond walls to be opened up to allow tidal flows to enter ponds
- all infrastructure to be removed if not retained by Mardie Station or Pilbara Ports Authority
- all crystalliser ponds to be rehabilitated to an acceptable landform.

The EPA notes the proponent would be required to submit a Mine Closure Plan consistent with the Statutory Guidelines for Mine Closure Plans (DMIRS 2020) and in accordance with the *Mining Act 1978*.

2.2.8 Assessment of impacts to environmental values

The EPA considers that the key environmental values associated with subtidal BCH for this proposal are coral, macroalgae, seagrass and filter feeders, and their

associated values of primary production, and foraging habitat for marine fauna. The key environmental values associated with intertidal BCH for this Optimised Mardie Project are mangroves, coastal samphire and algal mats and their associated values of nutrient cycling, primary productivity and habitat for marine fauna and migratory shorebirds.

The EPA considers additional specific measures should be included in the BCHMMP prior to operations commencing, to address remaining uncertainties in monitoring and adaptive management and to include proven, reliable contingencies (including changes to operations) for BCH matters. The EPA considers this is a reasonable requirement given the extensive area and timeframe of the proposal and the residual uncertainties. The EPA recommends that the BCHMMP be revised within one year to ensure that contemporary scientific information has been considered in the design and implementation of monitoring and management.

Direct and indirect impacts to intertidal BCH

The Optimised Mardie Project allows for the direct disturbance of an additional 34 ha of coastal samphire. Coastal samphire is noted to provide important habitat for migratory birds and the northern free-tailed bat (*Mormopterus lumsdenae*). As such the clearing of coastal samphire is considered to be a significant residual impact. No additional direct impacts are predicted for mangroves. The Optimised Mardie Project is not predicted to result in any additional changes to the frequency of freshwater inundation within mangroves or coastal samphire. Significant residual impacts to coastal samphire will require an offset to ensure the environmental outcome is consistent with the EPA factor objective.

An additional 195 ha of algal mat BCH is predicted to experience a reduction in the frequency of freshwater inundation. While there is uncertainty as to the exact impact from changes to this inundation, it is possible that algal mats are resilient to reduced freshwater input due to the low frequency of freshwater flooding. Monitoring and management actions within the BCHMMP will be triggered should there be a detectable change in groundwater and surface water flows under the GMMP, consequently any residual impacts are expected to be managed through the BCHMMP (O2 Marine, 2023a).

Indirect impacts to BCH are described and addressed in section 2.1 Inland Waters. The Optimised Mardie Project will not result in any additional direct or indirect impacts to mangrove habitat within the RRDMA. Thus, while the conditions from MS 1175 remain applicable due to the potential impacts from the approved Mardie Project, there are no predicted impacts or impact pathways associated with the Optimised Mardie Project and thus impacts to the RRDMA have not been assessed further.

The EPA considers there is potential for a significant impact without appropriate mitigation and offsets, but this can be regulated through conditions B1-1, B1-2, B1-3 and B1-4, and an offset (B-10) can be imposed to ensure the environmental outcome is consistent with the EPA's objective for BCH.

Bitterns disposal

Impacts to BCH have been minimised through optimisation of diffuser design which has allowed for higher discharge rates without any change in the predicted mixing zone. Consistent with *Technical Guidance – Protecting the quality of WA's marine environment,* a Low Ecological Protection Area (LEPA) has been established around the outfall point. While the LEPA has increased by 3.9 ha, it remains contained within the dredge channel where subtidal BCH would have been permanently removed by dredging for the approved Mardie Project.

The overall size of the Moderate Ecological Protection Area (MEPA) boundary will remain unchanged at 53.9 ha, however the revised MEPA has been moved further offshore and as such has moved away from areas of moderate cover Coral / Macroalgae BCH, resulting in a 4.4 ha reduction in extent of these habitats within the MEPA. An additional 3.5 ha of sparse to low density Filter Feeder / Macroalgae / Seagrass BCH occurs within the revised MEPA however, the revised MEPA contains lower sub-tidal BCH values than the previously authorised MEPA.
The EPA has assessed that discharge of diluted bitterns through a diffuser within a previously disturbed dredge channel is consistent with the EPA's objectives for this factor, subject to the implementation of management actions in the proponent's MEQMMP and BCHMMP as specified in conditions B1-4 and B4-3.

Dredging

The Optimised Mardie Project includes a change in the design of the dredge channel, with an additional 10 ha of disturbance, however, there are no proposed increases in dredge volumes or the direct disturbance of vegetated BCH. The extent of the indirect sedimentation impacts has been modelled (Baird, 2022; Appendix 8.2) which demonstrates that there will be reduced impacts to BCH and the size of the Zone of Moderate Impact (ZoMI) and Zone of High Impact (ZoHI) will be smaller than the existing boundaries. The DMP (O2 Marine, 2023b) will be implemented to ensure ongoing monitoring and management of potential impacts from dredging. The dredge envelope has also been moved further offshore to minimise impacts to subtidal BCH. Residual impacts to BCH will be monitored and managed through the implementation of the BCHMMP (O2 Marine 2023a). The proponent has proposed to contribute funds to the existing Western Australian Marine Science Institution (WAMSI) Research Program to offset any remaining residual impacts. As a result, the residual impacts are likely to be counter-balanced consistent with the EPA's objectives for this factor.

Introduced marine pests

The introduction of marine pests presents a risk to the health and ecological integrity of BCH. The Optimised Mardie Project will utilise vessels during construction and operation that will be transported to the marine and dredge channel development envelope area from other ports within Australia and overseas which have the potential to transport marine pests. Based on the vessel type to be used in construction and operation, a marine pest risk assessment was completed by the proponent which identified a low risk for bulk carriers and crew transfer vessels,

medium risk for transhipment vessel, barges, tugs and long-reach excavator and a high risk for jack-up barge and dredging barge (02 Marine 2020i).

The EPA has assessed the project management risk (proposed treatment and management measures) to reduce the risk of the introduction of marine pests as prescribed by 02 Marine (2020i), which include:

- implementation of the Department of Primary Industries and Regional Development (DPIRD) 'vessel check' biofouling risk assessment which is a requirement for vessels entering Ports by Pilbara Ports Authority (PPA)
- under the *Commonwealth Biosecurity Act 2015*, all vessels are required to use the Marine Arrives Report System (MARS) which include ballast water management requirements
- sourcing construction equipment from low/risk domestic locations
- regular maintenance of operation vessel (O2 Marine 2020i).

The Optimised Mardie Project was identified as being of 'low risk' of introducing marine pests within and adjacent to the marine and dredge channel development envelope. The EPA notes the application of industry controls through DPIRD and PPA.

The EPA has assessed that the residual impacts of marine pests within the marine environment from this proposal are likely to be consistent with EPA objective for this factor, subject to the implementation of the Marine Pest Management Procedure (Rev 1, dated 1 September 2022). The EPA has recommended a condition to ensure that the Marine Pest Management Procedure is implemented as previously described (condition B2-2).

Indirect impacts to key commercial and recreational fish species

The Optimised Mardie Project includes a revision to the dredge channel and diffuser design that minimises the impacts of dredging and bitterns discharge, further reducing the risk of indirect impacts to juvenile bluespotted emperor and prawns. The Optimised Mardie Project is associated with an increase in direct impacts to subtidal BCH of 10 ha, but a reduction in impact to vegetated BCH that includes macroalgae and seagrass habitats that may support juvenile bluespotted emperor. The cumulative effect of the approved Mardie Project and Optimised Mardie Project with other historical losses is a loss of only 1% of the regional sand and mud substrate that supports juvenile prawns, and only 6% of the seagrass and macroalgal habitat that is associated with juvenile bluespotted emperor. These areas are not considered to hold any greater significance than other similar habitats within the area. Thus, the EPA considers the risk of impact to the fish stocks to be low.

The EPA has assessed that the potential for indirect impacts to BCH as a result of changes to groundwater regimes and surface water flows would manifest in impacts to the bluespotted emperor and prawn fisheries. The EPA considers that maintaining ecological health and integrity of BCH will mitigate potential impacts to the commercial and recreational fishing stocks and can be achieved through implementation through the GMMP and the BCHMMP. The EPA has noted concerns

from commercial fishers and in this case recommend a condition that requires contingency monitoring to be included within the BCHMMP to monitor fisheries stocks should environmental outcomes relating to BCH not be achieved and there be the potential for impacts to fisheries stocks.

Cumulative impacts

The combined impacts of the Mardie Project and Optimised Mardie Project are set out in Table 4. Despite an increase in dredge area and bitterns discharge, the combined impacts to vegetated BCH are reduced due to improvements in design.

Cumulative impacts have been assessed within the local assessment units, in accordance with the EPA technical guidance – *Protection of benthic communities and habitats*. The combined Mardie Project and Optimised Mardie Project are the only reasonably foreseeable projects that will potentially impact on these LAUs. The proponent has designed the combined Mardie Project to minimise direct and indirect impacts to subtidal and intertidal BCH. Predicted direct losses of mangroves are less than 1% with no predicted indirect impacts and no cumulative loss of mangroves within the RRDMMA. While the loss of algal mats and mud / salt flats is higher within some LAUs, the EPA considers that the cumulative loss of algal mats, salt flats and mud flats is not a risk to the ecological integrity of BCH within the region due to the representativeness of these habitats elsewhere.

The area of coral BCH that will be directly impacted by the combined Mardie Project footprint represents marginal habitat and is unlikely to be a significant contributor to coral recruitment within the region. Rather, the high value, biologically diverse reefs with far denser colonisation surrounding the offshore islands, being the primary driver of long-term ecosystem health and sustainability of nearshore Pilbara coral communities in this area. Therefore, whilst this BCH provides suitable habitat for a variety of marine fauna species, the cumulative loss of 44 ha is not considered a significant risk to the ecological integrity and biological diversity of this BCH. Similarly, while seagrass / macroalgae represents an important habitat type that supports significant biodiversity, this habitat type is well represented regionally, and the cumulative loss of 35 ha is relatively small and not considered to represent a risk to ecological integrity and biodiversity within the region.

The EPA has considered the cumulative impacts of the Optimised Mardie Project in the context of the Mardie Project and other regional pressures. The EPA considers that potential cumulative impacts could be managed by requiring specific environmental outcomes to be achieved by the proponent, requiring contributions to research to enable strategic protection of ecological values of habitats in the region, and by providing other advice about the expectations of other proposals in the region.

2.2.8 Summary of key factor assessment and recommended regulation

Table 4: Summary of assessment for benthic communities and habitats

Residual impact or risk to environmental value		Assessment finding	Recommended conditions and DMA regulation
1.	Combined disposal of up to 5.5 GL per annum of brine into the dredge channel (increase of 1.9 GL/a) 54 ha (53%) increase in bitterns plume: • No vegetated BCH within LEPA • 0.9 ha reduction in vegetated BCH within MEPA.	The discharge of bitterns to the marine environment has the potential to impact on the BCH through changes to the marine environment. Bitterns discharge will occur within the dredging footprint area of permanent loss of BCH avoiding additional impacts to BCH. The proponent has minimised the potential impacts of bitterns discharge by improving the diffuser design such that there is only a 3.9 ha increase in the LEPA from the approved Mardie Project. An environmental outcome consistent with the EPA's factor objective is achievable with the implementation of recommended conditions.	**Condition A1 (Limitations and extent of Optimised Mardie Project**) Limits on discharge quantity. **Condition B4 (Marine Environmental Quality)** B4-2 Limitations on the size of the LEPA, MEPA and HEPA.
2.	Direct and unrecoverable impacts to filterfeeder/macroalgae/ seagrass BCH: • Additional 10 ha of subtidal BCH loss to a combined total of 35 ha • No increase in direct impacts to vegetated subtidal BCH • 1 ha reduction in direct impacts to filter feeder / seagrass.	Dredging associated with the Optimised Mardie Project will result in the direct and unrecoverable loss of sub tidal BCH. The proponent has committed to the implementation of the Dredge spoil and dreding management plan (DSDMP) and BCHMMP to monitor and manage impacts to subtidal BCH. An environmental outcome, consistent with the EPA's objective for this factor, is achievable with the implementation of recommended conditions	**Condition A1 (Limitations and extent of proposal)** Limits on extent of disturbance and volume to be dredged. **Condition B1 (Benthic communities and habitats)** B5-4 Implementation of the DSDMP. B1-4 Implementation of the BCHMMP. B1-1 Environmental outcomes. B1-2 Environmental objectives. Offsets.

Residual impact or risk to environmental value		Assessment finding	Recommended conditions and DMA regulation
		and the balance of residual impacts with offsets.	
3.	Indirect and recoverable impacts to filter feeder/macroalgae/seagrass BCH as a result of dredging (decrease in predicted extent of zones of high and moderate impact): • 1.7 ha reduction in indirect impacts to coral/macroalgae • 57 ha reduction in zone of high impact • 476 ha reduction in zone of moderate impact.	There are no proposed increases in dredge volumes or the direct disturbance of vegetated BCH from dredging. Modelling demonstrates that the extent of sedimentation will be smaller than that authorised for the Mardie Project.	**Condition A1 (Limitations and extent of proposal)** Limits on extent of disturbance and volume to be dredged. **Condition B1 (Benthic communities and habitats)** B5-4 Implementation of the DSDMP. B1-4 Implementation of the BCHMMP. B1-1 Environmental outcomes. B1-2 Environmental objectives.
3.	Introduction of marine pests.	There is the potential for project vessels to introduce marine pests to the project area that may impact on health and ecological function of BCH. The proponent has committed to the implementation of the Marine Pest Management Plan. An environmental outcome, consistent with the EPA's objective for this factor, is achievable based on the proposed management.	**Condition B2 (Inland Waters)** B2-2 Implementation of the Marine Pest Management Plan. B2-1 environmental outcomes.
4.	Direct disturbance to intertidal BCH comprised of disturbance to 34 ha of coastal samphire up to a combined total of 954 ha of coastal samphire.	The Optimised Mardie Project will result in the direct disturbance of an additional 34 ha of coastal samphire. Coastal samphire is considered to be important foraging habitat for listed species and thus is considered a significant residual impact. An environmental outcome, consistent with	**Condition A1 (Limitations and extent of proposal)** Limits on extent of disturbance and volume to be dredged. **Condition B1 (Benthic communities and habitats)** B5-4 Implementation of the DSDMP.

Residual impact or risk to environmental value		Assessment finding	Recommended conditions and DMA regulation
		the EPA's objective for this factor, is achievable with the implementation of recommended conditions and requirement for offsets to balance residual impacts.	B1-4 Implementation of the BCHMMP. B10. Research Offsets.
5.	Impacts to intertidal BCH as a result of decreased frequency of freshwater inundation.	The Optimised Mardie Project is likely to result in a decrease in freshwater inundation for 195 ha of intertidal BCH. There is uncertainty regarding the potential residual impacts of this decrease in inundation, however, the proponent has committed to the implementation of the GMMP and BCHMMP to ensure that potential impacts are detected early and adaptive monitoring can be implemented. The residual impact is likely to be able to be regulated through conditions but has the potential to be significant if the expected environmental outcome is not achieved. If this occurs, an offset must be imposed to ensure the ensure the environmental outcome is not likely to be inconsistent with the EPA's objective for benthic communities and habitats.	**Condition B1 (Benthic communities and habitats)** B1-1 outcome based conditions. B1-2 objective based conditions. B1-4 Implementation of the BCHMMP. **Condition B3 (Inland Waters)** B3-2 Implementation of the GMMP. B3-1 Environmental outcomes.
6.	Impacts to BCH as a result of increased freshwater inundation.	Impacts unlikely to be material, subject to monitoring and adaptive management. Subject to the implementation of recommended conditions, an environmental outcome, consistent with the EPA's objective for this	**Condition B1 (Benthic communities and habitats)** B1-4 Implementation of the BCHMMP. B1-1 Environmental outcomes. B1-2 Environmental objectives. Condition B3 (Inland Waters).

Residual impact or risk to environmental value		Assessment finding	Recommended conditions and DMA regulation
		factor, is likely to be achieved.	B3-2 Implementation of the GMMP.
7.	Indirect impacts to intertidal BCH from saline seepage and changes to groundwater flows.	There is uncertainty in the understanding of groundwater and the potential for changes in groundwater flows and pond seepage to impact on intertidal BCH. The proponent has committed to the implementation of the BCHMMP and GMMP to ensure that potential impacts are monitored, and triggers and thresholds are updated based on baseline information as it becomes available. An environmental outcome, consistent with the EPA'ss objective for this factor, is achievable subject to the implementation of recommended conditions.	**Condition B1 (Benthic communities and habitats)** B1-4 Implementation of the BCHMMP. **Condition B3 (Inland Waters)** B3-2 Implementation of the GMMP. B3-1 Environmental outcomes.

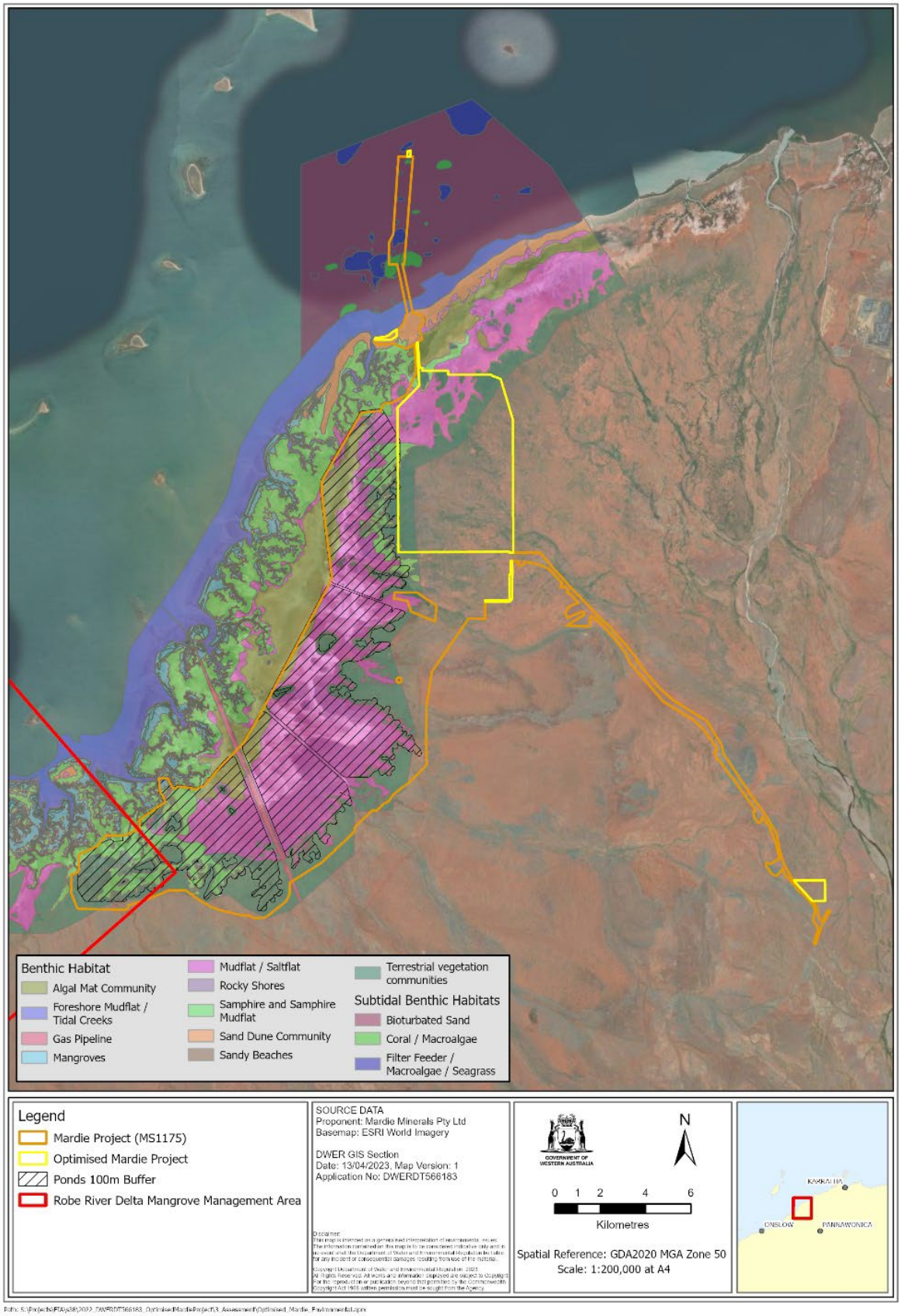

Figure 4: Benthic communities and habitats within the Optimised Mardie Project and original proposal area

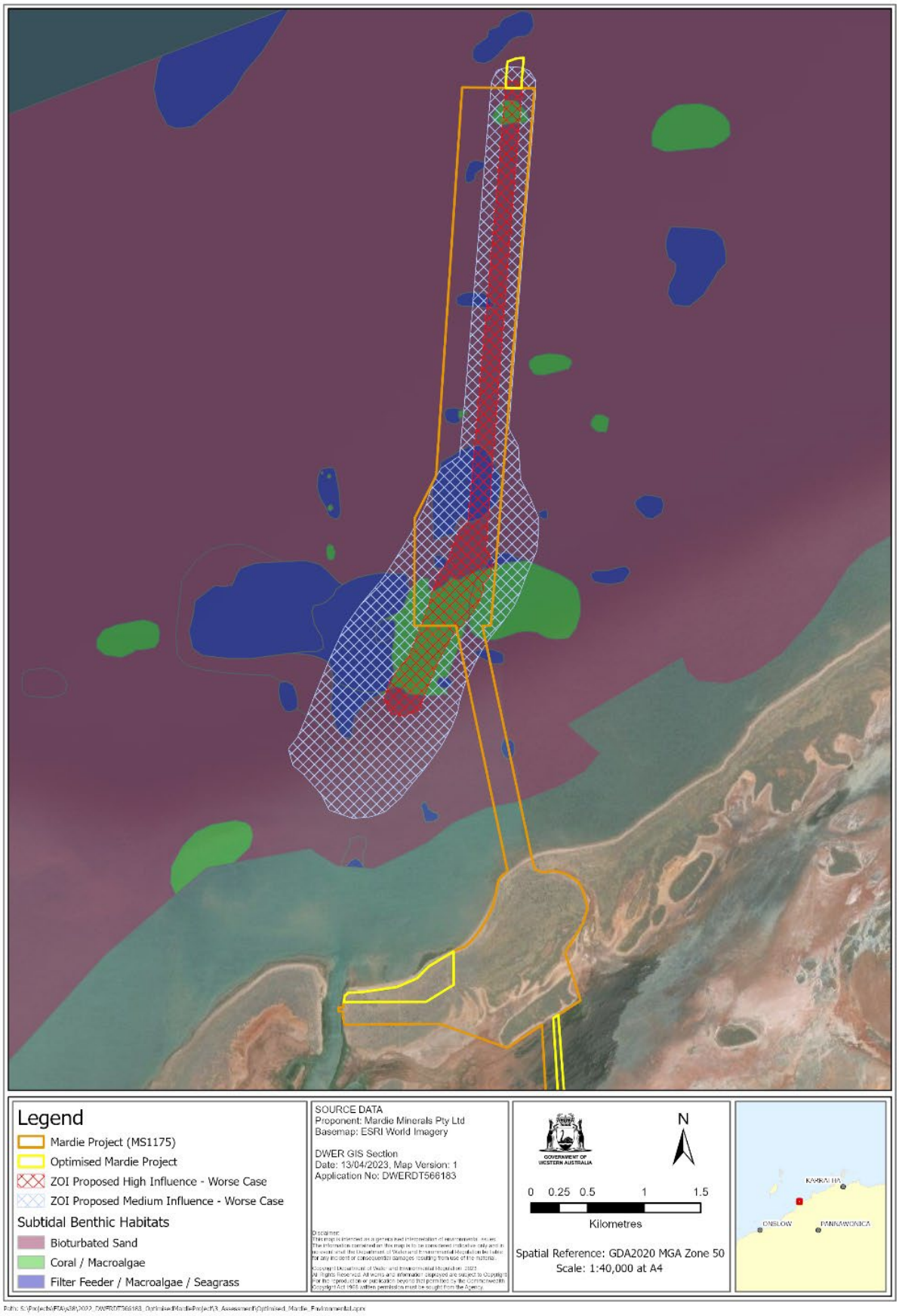

Figure 5: Dredge development envelope with zones of influence

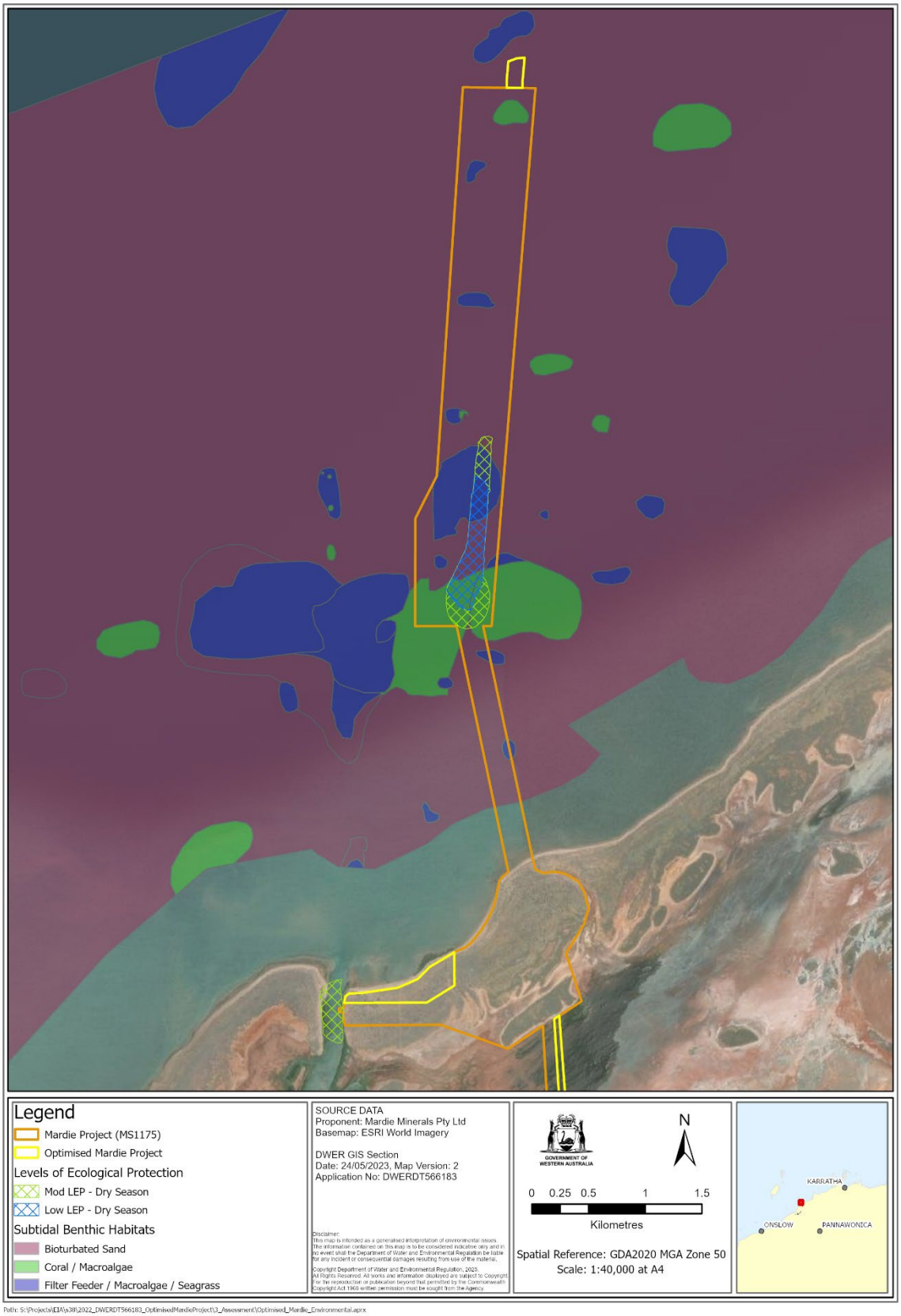

Figure 6: Levels of ecological protection associated with brine discharge location

2.3 Marine Fauna

2.3.1 Environmental objective

The EPA's environmental objective of the factor Marine Fauna is *to protect marine fauna so that biological diversity and ecological integrity are maintained* (EPA 2021b).

2.1.2 Assessment context – previous assessment and authorised extents
Ministerial Statement 1175 for the Mardie Project authorised the following residual impacts to Marine Fauna in the project area:

- clearing in the fauna habitat type identified as low-quality turtle nesting habitat (sandy beach habitat) in the Mardie Project – Environmental Review Document - June 2020) is limited to a width of 50 metres, parallel to the high water mark
- no entrainment or entrapment of marine turtles and fauna within seawater intake pipes (primary, desalination, and diffuser intake), which will be fitted using a four (4) side screen with no larger than 5 millimetres mesh width. Seawater intake on these pipes must not exceed 0.15 metres per second.

EPA Report 1704 identified the following additional residual impacts and risks to Marine Fauna from the Mardie Project:

- clearing (disturbance) of sub-tidal and intertidal marine fauna habitat in addition to gas pipeline disturbance habitat
- risk of marine fauna mortality as a result of vessel strike
- risk of fauna entrapment in seawater intakes
- risk of introduction of introduced marine pests
- potential for marine noise emissions to impact on behaviours and potential impacts to hearing for significant marine species
- potential for artificial light spill emissions to impact on nesting behaviours for turtles.

Physical elements and activities proposed to be constructed or carried out in the Optimised Mardie Project (the Optimised Mardie Pproject) have the potential to cause greater, lesser or different impacts and changes to Marine Fauna in the project area than those described above.

2.3.2 Investigations and surveys

Information collected for the Mardie Project assessment and used for this assessment included:

- a desktop review of marine fauna presence based on database searches, a literature review of coastal development projects in the Pilbara, scientific journal articles, and incidental observations recorded during field surveys undertaken by O2 Marine and Stantec for other scopes of works (A07-2 Marine Fauna Assessment; O2 Marine 2020).

- marine turtle monitoring surveys were undertaken in 2019/20 for the Mardie proposal to capture data on nesting beach utilisation, nesting success, hatchling emergence success and hatchling orientation. These surveys were not conducted in accordance with the minimum survey effort recommendations within the National Light Pollution Guidelines. The results of these surveys were included as part of the Mardie Project proposal (A07-1 Marine Turtle Monitoring Report; Pendoley Environmental 2019). Marine turtle monitoring is ongoing to address the limitations and shortfalls of baseline monitoring surveys conducted to date with an increased focus on the sandy beach habitat adjacent to the development area. The proponent has had limited access to these areas historically.

The following investigations developed for the Mardie Project assessment were used to inform the prediction of impacts from the Optimised Mardie Project:

- marine Noise Impact Assessment (AO6-4 of Mardie Project environmental review documentation; Talis 2019)

2.3.3 Assessment context - existing environment

The waters surrounding the Optimised Mardie Project area support a variety of fauna, several of which are protected under State and Commonwealth legislation. Conservation significant marine fauna considered likely to interact with the Optimised Mardie Project include:

- Dugong (*Dugong dugon*) Marine, Migratory EPBC Act, Specially Protected BC Act, Vulnerable IUCN
- Australia humpback dolphin (*Sousa sahulensis*) Marine, Migratory EPBC Act, Priority 4 BC Act, Near threatened IUCN
- Humpback whale (*Megaptera novaeangliae*) Marine, Migratory, Vulnerable EPBC Act, conservation dependent BC Act, Least Concern IUCN
- Green sawfish (*Pristis zijsron*) - Vulnerable EPBC Act, Vulnerable BC Act, Critically Endangered IUCN
- Loggerhead turtle (*Caretta caretta*) - Endangered, Migratory, Marine EPBC Act, Endangered BC Act, Vulnerable IUCN
- Green turtle (*Chelonia mydas*) - Vulnerable, Migratory, Marine EPBC Act, Vulnerable BC Act, Endangered IUCN
- Flatback turtle (*Natator depressus*) - Vulnerable, Migratory, Marine EPBC Act, Vulnerable BC Act
- Hawksbill turtle (*Eretmochelys imbricate*) - Vulnerable, Migratory, Marine EPBC Act, Vulnerable BC Act, Critically Endangered IUCN
- Short-nosed seasnake (*Aipysurus apraefrontalis*) Critically Endangered EPBC Act and BC Act, Critically Endangered, IUCN
- Reef manta ray (*Manta alfredi*) Marine, Migratory EPBC Act, Marine, Migratory BC Act, Vulnerable IUCN.

Biologically important areas coincide with the Optimised Mardie Project area for blue and humpback whales. The project also overlaps habitat critical to the survival of green, hawksbill and flatback turtles as defined in the Recovery Plan for Marine Turtles in Australia (DoEE 2017). Flatback, green and hawksbill turtles were recorded during turtle monitoring surveys with high numbers of flatback and green turtles nesting at offshore islands and nesting of flatback and hawksbill turtles recorded adjacent to the development envelope on the mainland (Pendoley 2019).

The survey identified that the offshore islands (particularly Long and Sholl Islands) provide suitable and viable habitat for turtle nesting representing rookeries (Pendoley 2019). While a lower level of nesting effort was observed on the mainland beaches, survey effort was lower due to access restrictions. The EPA has conservatively considered the mainland nesting habitat to also be important habitat to account for access restrictions during surveys.

Humpback whales predominantly occur further offshore and have been observed within 5 km of the dredge channel (O2 Marine, 2020). Other species of whale, such as pygmy blue whales, minke and Bryde's whales transit waters offshore of the development area (Preston Consulting 2020). Dolphins, including the Australian humpback dolphin, dugongs, reef manta rays and short-nosed sea snakes all have the potential to occur in shallow inshore waters adjacent to the development. Green sawfish are known to occur in the coastal waters and creek systems of the development area though the development area is considered unlikely to constitute important nursery habitat (Preston Consulting 2020).

2.3.4 Potential impacts from the proposal

The Optimised Mardie Project has the potential to impact on marine fauna through:

- indirect and direct impact of underwater noise during construction
- direct impacts from vessel strike during construction and operations
- indirect and direct impacts to turtle nesting and hatchling emergence on nearby nesting beaches from operational lighting
- indirect impacts during construction and operations from hydrocarbon spill and marine debris
- brine disposal affecting marine fauna and marine fauna habitat in the vicinity of the discharge
- indirect impacts to bluespotted emperor and green sawfish as a result of loss of subtidal and intertidal habitat.

The potential of the Optimised Mardie Project to impact marine fauna indirectly through other factors are addressed in previous sections of this report:

- disturbance of subtidal and intertidal marine fauna habitat (refer to section 2.2 BCH).

The potential impacts of brine disposal are considered unlikely to be material to marine fauna due to the location of the brine discharge point within the dredge footprint, the extent of the area affected by brine, the proponent's minimisation

measures described in section 2.3.8, and the application of the MEQMMP and BCHMMP. Therefore, these issues are not considered further in this assessment.

2.3.5 Avoidance measures

The proponent has designed the Optimised Mardie Project to avoid any additional disturbance to key fauna habitat within the marine environment, including:

- avoiding disturbance of additional marine fauna habitats including sandy beach and tidal creek habitat
- disposing of dredge spoil on land to minimise impacts within the marine environment
- refinement of bitterns discharge design to allow increased discharge within the dredge footprint, avoiding additional impacts to vegetated subtidal BCH.

2.3.6 Minimisation measures (including regulation by other DMAs)

The proponent has proposed measures to minimise impacts to marine fauna by:

1. Implementation of the approved Dredge Management Plan (O2 Marine, 2023c that includes the following commitments:
    - vessels will not be permitted to travel at speeds greater than 8 knots within project boundaries
    - minimise the risk of fatal vessel strikes to marine fauna through the use of marine fauna observers (MFO) and minimum separation distances.
2. Development of the Mardie Illumination Plan for coastal and marine infrastructure and implementation of the Marine Turtle Monitoring Program (Rev 3; Pendoley Environmental 2023) which include commitments for
    - pre and post construction monitoring of marine turtle nesting and hatchling emergence and orientation
    - adaptive management to be implemented should adverse impacts on adult and hatchling marine turtles be detected.
3. Implementation of the approved Benthic Communities and Habitats Monitoring and Management Plan (O2 Marine, 2023a) which includes:
    - monitoring and management of intertidal and subtidal BCH.

The issues raised during the public consultation about potential impacts to marine fauna have been considered through minimisation measures 1, 2 and 3.

2.3.7 Consultation

Matters raised during stakeholder consultation and the proponent's responses are provided in Table 5, section 3.3 of the referral supporting document (Preston Consulting 2021) and in the response to submissions document (Preston Consulting 2022).

The key issues raised during the public consultation were regarding the potential impacts to groundwater flows, impacts to marine fauna from artificial light emissions,

and impacts to intertidal and subtidal BCH that supports juvenile bluespotted emperor and green sawfish.

These issues have been addressed in sections 2.3.5, 2.3.6 and 2.3.8 of this Report.

2.3.8 Assessment of impacts to environmental values

The EPA considered that the key environmental values for marine fauna likely to be impacted by the Optimised Mardie Project are conservation significant species from underwater noise during construction, artificial light from operations, and from habitat loss/modification for marine turtles, sea snakes and green sawfish.

In considering the likely residual impact to marine fauna associated with the Optimised Mardie Project, the EPA has considered:

- DoEE (2017) National Strategy for Mitigating Vessel Strike of Marine Megafauna
- DoEE (2020) Light Pollution Guidelines: National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds
- EPA (2010) Environmental Assessment Guideline No. 5 – Environmental Assessment Guideline for Protecting Marine Turtles from Light Impacts.

Underwater noise

Dredging activities will generate underwater noise during construction, which may either have a physiological impact to an animal's hearing (which can be either permanent or temporary) or a behavioural response (such as fleeing or moving away). The proponent did not revise underwater noise modelling to predict the extent of noise propagation during construction. The noise modelling conducted for the Mardie Project was based on the use of a backactor dredge, while the Optimised Mardie Project allows for the use of a significantly louder Cutter Suction Dredge. The change in dredge methodology would be associated with a significantly larger range to predicted impacts from underwater noise. Dredging activities also pose a risk to some species of marine fauna from vessel strike.

To minimise impacts, the proponent has committed to implementing the Dredge Management Plan (O2 Marine 2023a) that includes a commitment for all vessels to travel at speeds of not greater than 8 knots within the project area. To manage and mitigate the remaining environmental impacts, the proponent has committed to validate the noise effect ranges and utilise Marine Fauna Observers (MFOs) to observe to a distance of 1500 m for marine fauna and implement an exclusion zone of 500 m.

In considering the proposal's likely impacts, the EPA recognises that the duration of impacts is relatively short. The EPA considers that there are uncertainties in the prediction of impacts from underwater noise, and the mitigation and management proposed by the proponent does not provide confidence that the desired environmental outcomes can be achieved. The EPA advises that, the impacts can be managed with the application of industry standard mitigation.

Consequently, the EPA has recommended conditions B5-7, requiring the implementation of industry standard noise management protocols including soft starts, observation zones and exclusion zones. The EPA has also recommended condition B5-8 which restricts the proponent from conducting dredging activities during key ecological windows. The EPA considers that the management and mitigation protocols detailed in these conditions will achieve the environmental outcomes recommended in condition B5-1 and be consistent with the EPA objective for marine fauna.

Artificial light

Artificial light will be generated by project infrastructure and associated export vessels and has the potential to have a significant impact on marine turtles as it can disrupt critical behaviours. Both adult female marine turtles and emerging turtle hatchlings use light to orientate towards the ocean, and artificial light has the potential to cause misorientation and/or disorientation. This can result in:

- increased mortality from predation, exhaustion or exposure
- hatchlings to become trapped in pools of artificial light around marine infrastructure and vessels which has been shown to reduce the success of hatchling dispersal through increased predation.

The proponent commissioned a baseline artificial light assessment to determine baseline levels of sky brightness at offshore Islands and one mainland beach. The only light source visible from mainland and offshore light monitoring sites was the Sino Iron facilities located over 30 km away on the easterly horizon. Both adult and hatchling marine turtles were found to orient normally (Pendoley 2019). Hatchling emergence success was relatively consistent across offshore islands but was nearly twice as high at mainland nesting beaches, indicating that despite a lower level of nesting effort the mainland beaches may still represent important nesting habitat.

To minimise the potential impacts, the proponent has committed to developing the Mardie Illumination Plan and updating the Mardie Marine Turtle Monitoring Program to incorporate the outcomes of additional baseline surveys undertaken in 2022 and 2023. While there is uncertainty in the potential for artificial light to impact on sawfish and sea snakes, the application of best practice lighting principles through the implementation of the Mardie Illumination Plan would appropriately minimise impacts to these receptors. Marine mammals such as whales are not predicted to be impacted by artificial light.

The EPA recognises that there were some limitations in the initial baseline data collected and a lower survey effort on mainland nesting beaches due to access restrictions. As a result, additional surveys were undertaken in 2022/2023. The EPA has taken a conservative approach to impacts on these beaches and results of these surveys will be used to update to the Marine Turtle Monitoring Program. As a result, the EPA has recommended condition B5-3 to require the proponent to submit the revised monitoring plan prior to the use of artificial lighting at night. The Illumination Plan may be updated in accordance with new information from the ongoing monitoring program and as a result, the EPA has recommended condition B5-3 to ensure the Illumination plan is submitted to DWER and approved by the CEO prior to

the operation of artificial lights at night, and B5-1 to ensure that environmental outcomes relating to marine fauna and artificial light will continue to be met over the life of the project.

The EPA considers that given the scale of the potential impacts from artificial light and the application of industry standard light mitigation and management procedures consistent with the *National Light Pollution Guidelines for Wildlife including Marine Turtles, Seabirds and Migratory Shorebirds (Commonwealth of Australia 2020),* combined with the recommended outcome-based conditions, that the EPA's objective for marine fauna would be met.

Clearing, degradation or modification of marine fauna habitat

Green sawfish, sea snakes and marine turtles may utilise sub tidal habitats and intertidal creeks as foraging, refuge and nursery areas. There is also stakeholder concern that impacts to benthic communities and habitats will have negative impacts on the bluespotted emperor fishery. An evaluation of the Optimised Mardie Project impacts to benthic communities and habitats, the proposed mitigation and management and assessment against the EPA's factor objective is located in section 2.2. The Optimised Mardie Project will not result in a significant increase in the clearing or degradation of habitat for green sawfish, sea snakes or marine turtles. It is considered that if the EPA's factor objective for benthic communities and habitats is met, then indirect impacts to marine fauna as a result of habitat loss or modification will be prevented. The EPA has recommended condition B1-2 (5) that requires the provision of secondary monitoring of the bluespotted emperor fishery should monitoring indicate a significant impact to BCH.

The Optimised Mardie Project allows for an additional seawater intake in intertidal creeks that may support juvenile turtles and green sawfish. To minimise the risk of entrainment, the proponent has committed to a maximum flow rate of 0.15 m/s and the use of screening over the intake. In considering the Optimised Mardie Project's likely impacts, the EPA recognises that there are some uncertainties in the understanding of habitat use by sawfish and juvenile turtles within the creek systems and in the potential impacts of seawater intake on water levels within the creek system. Consequently, the EPA has recommended condition A1 requiring limitations on when seawater can be pumped from creeks and the pumping rate. The EPA considers that the limitations and measures in this condition will result in the proposal meeting the EPAs objective for marine fauna.

Vessel strike

The Optimised Mardie Project will increase the throughput of the combined project compared to the approved project. This increase will be associated with an increase in export volume and subsequent increase in the risk of vessel strikes. To minimise the impacts, the proponent has committed to a speed limit of 12 knots within the project area during normal operations. The dredge monitoring and management plan (O2 Marine 2023b), includes a commitment to a speed limit of 8 knots within the project area.

The EPA considers that the risk of vessel strike is similar for both normal transhipment and export operations, and dredging, especially when considering that dedicated marine fauna observers will be utilised during dredging.

The EPA has therefore recommended condition A1 that imposes a speed limit of 8 knots on vessels within the project area to ensure that the risk of vessel strike to marine fauna is managed consistent with the EPAs objective for marine fauna.

Cumulative impact assessment

The EPA has assessed the cumulative effects of the Optimised Mardie Project by considering the context of the approved Mardie Project, existing developments, and other reasonably foreseeable proposals including the Ashburton Infrastructure project.

The EPA considers that given the conditions that have been imposed on the Ashburton infrastructure project and the proposed conditions for the Optimised Mardie Project, that a cumulative increase in underwater noise levels will occur outside of the key temporal windows for sensitive fauna species.

The EPA notes that noise levels within the area will increase overall during operations with the introduction of this Optimised Mardie Project. However, the EPA considers the increase is unlikely to have significant impacts on marine fauna or marine fauna behaviours given the likely levels and type of noise to occur (non-impulsive noises) and relatively low density of individual animals of species undertaking critical behaviours within the project areas.

As noted above, the Sino Iron facility is the only other visible light source from offshore islands and the Optimised Mardie Project, is unlikely to increase the cumulative impact of artificial light emissions in combination with the Sino Iron light emissions.

The EPA notes the proponent has committed to implementing the mitigation measures recommended by the national guidelines through the development of a Mardie Illumination Plan, and the EPA has recommended conditions to ensure that the sea-finding ability of nesting turtles and turtle hatchlings are not significantly affected by the Optimised Mardie Project.

Cumulatively, the EPA considers that impacts are not to a critical threshold that would alter the likely environmental outcomes from this Optimised Mardie Project. The EPA has recommended a condition that requires the proponent to minimise the risk that the Optimised Mardie Project increases the cumulative adverse impacts on regional populations of adult marine turtle and marine turtle hatchling misorientation, disorientation and associated increases in mortality rate (recommended condition B 5-1).

2.3.9 Summary of key factor assessment and recommended regulation

The EPA has considered the likely residual impacts of the Optimised Mardie Project on marine fauna environmental values. In doing so, the EPA has considered whether

reasonable conditions could be imposed, or other decision-making processes can ensure consistency with the EPA factor objective. The EPA assessment findings are presented in Table 5.

The EPA has also considered the principles of the EP Act (see Appendix C) in assessing whether the residual impacts will be consistent with its environmental factor objective and whether reasonable conditions can be imposed (see Appendix A).

Table 5: Summary of assessment for marine fauna

Residual impact or risk to environmental value		Assessment finding	Recommended conditions and DMA regulation
1.	Direct and indirect impacts to marine fauna during construction from underwater noise (dredging and piling, increase in underwater noise footprint associated with use of cutter suction dredge).	Underwater noise from construction and vessel strike have the potential to impact marine fauna. The proponent has incorporated fauna observation protocols into the DMP to minimise impacts during construction. An environmental outcome consistent with the EPA factor objective for marine fauna is achievable if subject to recommended conditions.	**Condition A1-1 (limitation and extent of proposal)** Restriction on the time of year when dredging and spoil disposal can occur. **Condition B5 (marine fauna)** B5-4: implement DMP. B5-5: speed limit on project vessels. B5-6: noise mitigation measures for dredging. B5-7: noise mitigation for piling. B5-1: environmental outcomes.
2	Potential impacts to nesting adult and hatchling orientation and sea finding success or adult nesting utilisation as a result of operational lighting (no additional lighting compared to Mardie Project).	Artificial light from the combined Optimised Mardie Project infrastructure and Mardie Project, as well as construction vessels has the potential to impact on marine fauna. The proponent has been given approval to undertake a staged approach to the development of an illumination plan, with the final plan due for submission to DWER in mid-2023. An environmental outcome consistent with the EPA factor objective for marine fauna is achievable if subject to recommended conditions.	**Condition B5 (marine fauna)** B5-1 Outcomes relating to nesting and hatchling success. B5-3: Develop and have approved an illumination plan and turtle monitoring program.

Residual impact or risk to environmental value		Assessment finding	Recommended conditions and DMA regulation
3	Indirect impacts of loss of BCH on marine fauna or modification of tidal creek habitat as a result of combined Mardie Project and Optimised Mardie Project.	The loss of BCH and modification of tidal creek habitat may have an indirect impact on marine fauna. The proponent has developed a BCH management plan to mitigate impacts to BCH. The proponent has also committed to flow rate limits and seawater intake volume limits to minimise the impact of seawater intake on tidal creek habitat. An environmental outcome consistent with the EPA factor objective is achievable is subject to recommended conditions.	**Condition A1-1 (limitation and extent of proposal)** Temporal restrictions on seawater intake and volume limits. **Condition B1 (BCH)** B1-4 Implement BCH monitoring and management plan. **Condition B10 Intertidal and Subtidal Offsets** B10-1 Requirement to commit to a contingency fund for monitoring of bluespotted emperor if BCH monitoring indicates an impact to BCH.
5	Risk of entrainment for marine fauna from seawater intake.	There is the potential for seawater intake to impact on marine fauna. The proponent has committed to using screening on the intake pipe as well as limitations on the rate of seawater intake to minimise the risk of entrainment. An environmental outcome consistent with the EPA factor objective is achievable based on the above proposed mitigation and management.	**Condition A1-1 (limitation and extent of proposal)** Restriction on the time of tide when seawater can be abstracted and requirement for screens.
6	Vessel strike risk for marine fauna.	There is the potential for vessel movements in the project area to impact on marine fauna. The proponent has proposed a speed limit of 8 knots for vessels during construction to minimise the risk of vessel strike. The proponent has also committed to adhering to the approach distances	**Condition B5 (marine fauna)** B5-5 Speed limit for all vessels within project area of 8 knots. B5-2 environmental objectives.

Residual impact or risk to environmental value		Assessment finding	Recommended conditions and DMA regulation
		outlined in the EPBC Act Whale Watching Guidelines. An environmental outcome consistent with the EPA factor objective is achievable over the life of the project if subject to recommended conditions.	

2.4 Flora and Vegetation

2.4.1 Environmental objective

The EPA environmental objective for flora and vegetation is *to protect flora and vegetation so that biological diversity and ecological integrity are maintained* (EPA 2021b)

2.4.2 Investigations and surveys

The EPA advises the following surveys were used to inform the assessment of the potential impacts to flora and vegetation:

- Detailed Flora and Vegetation Survey for the Mardie Salt Project Optimisation and Quarry Area (appendix 6 of the Response to Submissions) (Phoenix Environmental 2021a)
- Optimised Mardie Project (supplementary report) (Preston Consulting 2022)
- Report of Targeted Searches at Mardie Salt Project for *Minuria tridens*. Memorandum (appendix 6.2 of the additional information) (Phoenix Environmental 2021b)
- Optimised Mardie Project (Response to Submissions to the Public Review Period) (Preston Consulting 2023).

These surveys were not fully consistent with the Technical Guidance – *Flora and vegetation surveys for environmental impact assessment* (EPA 2016). The local and regional context of significant flora and vegetation were limited by surveys of terrestrial vegetation that were mostly restricted to the development envelope. The EPA notes that there have also been additional surveys through work required under MS 1775 that has been used for this assessment as well as the surveys for the approved Mardie Project.

The EPA has determined that, although surveys did not fully meet EPA (2016d) Guidance for this factor, the proponent has undertaken extensive surveys across the area and existing surveys provide adequate information to inform the EPA's assessment of impacts to flora and vegetation. The EPA notes that the proponent has resolved a number of taxonomic issues with *Tecticornia* since the approved Mardie Project.

2.4.3 Assessment context – existing environment

Ministerial Statement 1175 authorised the following residual impacts related to Flora and Vegetation:

- clearing no more than 2,319 ha of vegetation in Good to Excellent condition;
- clearing no more than 145 ha direct impacts and 20 ha indirect impacts to the Horseflat Priority Ecological Community (PEC); and
- clearing of no more than 854 ha of landward samphire communities.

EPA report 1704 identified the following additional residual impacts:

- direct and indirect impacts to the known locations of significant flora species and flora species that represent range extensions of previously known records.
- risk of impacts to the diversity of *Tecticornia* taxa.
- risk of impacts associated with the spread of weeds, with particular regard to Mesquite.

Physical elements and activities proposed to be constructed or carried out in the Optimised Mardie Project (the proposed change) have the potential to cause greater, lesser known or different impacts and changes to flora and vegetation in the project area than those described above.

As defined in the Interim Biogeographic Regionalisation of Australia (IBRA), the Optimised Mardie Project occurs within the Roebourne subregion and Chichester subregion of the Pilbara bioregion.

Eleven vegetation types were recorded in the study area which comprised of hummock grasslands, tussock grasslands, low to mid shrublands dominated by declared pest *Prosopis spp*, mangroves and samphire shrublands (Phoenix Environmental 2021b).

The development envelope is approximately 19,645 ha, within which approximately 2,334 ha of native vegetation is proposed to be cleared. The vegetation within the development envelope ranges from ‘Degraded (17.96%) to “Excellent’ (8.61%) Condition. Most of the vegetation proposed to be cleared is in ‘Poor’ (44.6%) condition (Preston Consulting 2022).

No Threatened Ecological Communities and one PEC, being the Horseflat Land System of the Roebourne Plains PEC (Priority 3) listed by the Department of Biodiversity, Conservation and Attractions (DBCA), was recorded during the survey (Phoenix Environmental 2021b).

Surveys did not record any threatened flora listed under the *Biodiversity Conservation Act 2016* (BC Act). One species, *Minuria tridens,* is listed as vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and was recorded in the development envelope.

Nine priority flora species were identified in the desktop search, five of which were recorded during previous surveys and have the possibility of occurring in the development envelope. The species which has the greatest combined impact is *M. Tridens* which is a Priority 1 species in Western Australia.

A range extension was recorded for three species *Cassytha aurea* var*. aurea* (~107 km), *Cassytha racemosa* forma *pilosa* (~315 km) and *Dipteracanthus australasicus* subsp*. australasicus* (~170 km) and are therefore considered significant flora. Six *Tecticornia* specimens were collected from the study area and were considered significant flora in the approved Mardie Project assessment (Phoenix Environmental 2021b).
Prosopis spp. (commonly referred to as Mesquite) is widespread across the development envelope. It is a weed of national significance and a declared pest under the *Biosecurity and Agriculture Management Act 2007*.

2.4.4 Consultation

Matters raised during stakeholder consultation and the proponent's responses are provided in section 3.3 of the referral supplementary report (Preston Consulting 2022), and in the response to submissions document (Preston Consulting 2023).

The key issues raised during the public consultation on the Optimised Mardie Project and how they have been considered in the assessment are described in sections 2.4.7 and 2.4.9 of this Report.

2.4.5 Potential impacts from the proposal

The proposed change has the potential to significantly impact on flora and vegetation from:

- direct impacts to vegetation from clearing 2,334 ha of native vegetation.
- direct impacts to locally and regionally significant vegetation and flora
- indirect impacts to surrounding vegetation from increased risk of spreading Mesquite, increased dust deposition and unintentional spillage or seepage of brine.

The issue raised during public consultation about potential impacts from increasing the terrestrial development envelope is considered unlikely to be material because of the proponent's avoidance measures described in section 2.4.6.

2.4.6 Avoidance measures

The proponent has designed the Optimised Mardie Project to avoid impacts to conservation significant flora. The proponent has located the main infrastructure in the Optimised Mardie Project in areas of high infestation with Mesquite and where there is more native vegetation in a poor or degraded condition.

2.4.7 Minimisation measures (including regulation by other DMAs)

The proponent has proposed measures to minimise impacts to flora and vegetation:

1. minimise clearing within good to excellent condition
2. minimise clearing within AcAjTe (60.3 ha) vegetation type
3. implement weed hygiene and management measures/procedures to prevent spread of weeds and introduction of weed species
4. cleaning of vehicles moving between Mesquite infestation areas, cleared areas and areas with no weeds
5. restrictions on soil movement between Mesquite infestation areas, cleared areas and areas with no weeds
6. water or dust suppressants will be applied to disturbed areas
7. concentrator and crystalliser ponds will be designed and constructed to be safe and stable according to DMIRS requirements
8. brine pipelines will be fitted with leak detection and water flows will be shut off if leaks are detected.

The issue raised during the public consultation about potential impacts to clearing vegetation in good to excellent condition has been considered through minimisation measure 1.

2.4.8 Rehabilitation measures

The proponent has proposed all disturbance areas to be revegetated will be respread with topsoil and rehabilitated. Salts will be harvested from each pond prior to closure, concentrator pond walls will be opened up to allow tidal flows to enter the ponds, infrastructure will be removed if not retained by Mardie Station or Pilbara Ports Authority and crystalliser ponds will be rehabilitated to an acceptable landform.

The EPA notes the proponent would be required to submit a Mine Closure Plan consistent with the Statutory Guidelines for Mine Closure Plans (DMIRS 2020) and in accordance with the *Mining Act 1978*.

2.4.9 Assessment of impacts to environmental values

The EPA considered that the key environmental values for flora and vegetation likely to be impacted by the Optimised Mardie Project is vegetation in ‘Good’ to ‘Excellent’ condition, locally significant vegetation and significant flora species.

Vegetation

The EPA has assessed the likely residual impacts of the Optimised Mardie Project on vegetation to be clearing of up to 695 ha of ‘Good’ to ‘Excellent’ condition vegetation, and a combined clearing of up to 3,014 ha. The EPA recognises that cumulative loss of native vegetation through current and future mining, pastoralism, and infrastructure developments is a key threat to flora and vegetation values within the Pilbara bioregion.

The combined impacts from the approved Mardie Project and the Optimised Mardie Project will not impact on any Threatened Ecological Communities. One PEC, being the Horseflat Land System of the Roebourne Plains PEC (Priority 3) will have a combined impact of less than 0.5% in the regional context and this will not result in a change to its viability or conservation status.

The flora and vegetation surveys have been largely restricted to the development envelope of the Optimised Mardie Project and the approved Mardie Project. Consequently, the proportional impacts appear higher due to the mapped areas being largely restricted to areas that will be impacted. The majority of the vegetation types were found to be consistent with vegetation types that extend outside the development envelope (Phoenix Environmental 2021b) or have been found to align with vegetation types found in other locations such as on the coast at Cape Preston (Preston Consulting 2023). The restrictions identified for these vegetation types are likely to be an artefact of surveys.

There are some vegetation types that may be more restricted in extent than others and the proponent has committed to limit impacts to or minimise clearing to these vegetation types. These vegetation types appear to be more associated with listed flora species. In particular, the proponent has committed to minimising clearing within AcAjTe vegetation type which may provide habitat for *M. Tridens* (Preston Consulting 2022).

The EPA assessed potential impacts to conservation significant vegetation and concluded that it is not likely to impact on list threatened communities or change the status and viability of priority ecological communities. The EPA considers that the limitation on extent (condition A1) will appropriately minimise impacts to vegetation. The EPA has assessed the residual impact to vegetation in ‘Good’ to ‘Excellent condition that is additional to that authorised under Ministerial 1175 to require an offset. The EPA advises that the significant residual impact is likely to be able to be regulated through reasonable conditions and counterbalanced by offsets (refer to section 4 - Offsets) so the environmental outcome is likely to be consisted with the EPA objective for flora and vegetation.

Significant flora

The species with significant range extensions would be impacted by less than 5% and the level of impact would not change their status or viability at a species level. The EPA has assessed that impacts to flora species that represent range extensions would be consistent with the EPA’s objectives for flora and vegetation.

The priority species identified in surveys would all be subject to impacts of less than 1% of their known populations with the exception of *M. Tridens.* The other significant flora of consideration is those of the genus *Tecticornia* which were unidentified in the approved Mardie Project.

Minuria tridens

The Optimised Mardie Project does not significantly contribute to the impacts on the known occurrences of this species and there will be no direct impacts on the species

from the Optimised Mardie Project. The residual impacts for the approved Mardie Project on the known occurrences of the species was considered to represent a significant residual impact and was managed through condition 5-3(2)(b) of MS1175. The research strategy has been developed and approved under this condition.

The EPA considers that the Optimised Mardie Project does not result in significant impact to the species and the combined impacts are the same as the approved Mardie Project. The EPA therefore recommends the continued implementation of the approved research strategy to ensure the environmental outcome is consistent with the EPA objective for flora and vegetation.

Tecticornia *taxa*

Under Ministerial Statement 1175 pre-clearance *Tecticorna* surveys were required to be undertaken. The proponent has confirmed that the sterile species recorded within the study area have been identified by the Western Australian Herbarium. These species are listed in Appendix 10 of the Response to Submissions document (Preston Consulting 2023). None were recorded to be new species or listed under any legislation (Preston Consulting 2023).

The EPA has assessed the impacts to *Tecticornia* taxa are likely to be consistent with the EPA's objective for flora and vegetation subject to condition B7-1.

Indirect impacts to vegetation

The EPA has assessed likely residual impacts to flora and vegetation from indirect impacts to be:

- introduction and spread of weeds.
- unintentional spillage or seepage of brine.
- increased dust deposition.

The Optimised Mardie Project contains a number of known weed species. *Prosopis spp*. (commonly referred to as Mesquite) is widespread across the development envelope. The infestation at Mardie Station has a long history dating back to the 1930s and is recognised as the largest single core infestation in Australia (Phoenix Environmental 2021b). The proponent has committed to managing mesquite in consultation with the Pilbara Mesquite Management Committee (PMMC). The PMMC has acknowledged that eradication of this species at Mardie is unachievable, and the priority is to prevent the spread to neighbouring areas. The EPA notes that DMIRS can regulate weed hygiene practices through the mining proposal required under the *Mining Act 1978*.

The EPA has assessed that the risk of spread of weeds is likely to be consistent with the EPA's objectives for this factor. The EPA has recommended condition B7-1 (4) which ensures there are no indirect impacts from the introduction or spread of weeds.

Cumulative impact assessment for flora and vegetation

The proponent has assessed the cumulative effects of the Optimised Mardie Project by considering this Optimised Mardie Project in addition to related projects within the local area (from west to east), including (Preston Consulting 2022):

- Ashburton Salt Project (proposed)
- Onslow Salt (existing)
- Mardie Project (existing / expansion proposed)
- Cape Preston Port (existing)
- Cape Preston East Port (proposed)
- Eramurra Salt (proposed)
- Dampier Salt (existing)
- Balla Balla Port (proposed)
- Port Hedland surrounds (existing); and
- Port Hedland Salt (existing).

The proponent assessed the cumulative impacts of the Optimised Mardie Project to mostly occur in three vegetation associations 127: bare areas, 'mud flats', '600: Sedgeland', and '601: Mosaic: Sedgeland'. Most of the disturbance from the Optimised Mardie Project will occur within '127: Bare areas, mud flats' which currently extends to 159,595 ha. This vegetation association extends over a large portion of the Pilbara coast and intersects with the projects listed above. Cumulatively 37,837 ha of '127: Bare areas, mud flats' will be cleared if all proposals were to proceed. This represents a cumulative impact of 21.3% on the Pilbara coast which is the appropriate boundary for the assessment (Preston Consulting 2022). The cumulative impact is not likely to be at a significant threshold for the vegetation associations or result in large scale irreversible impacts.

The EPA considers that cumulative impacts from this proposal on the Pilbara coastline are likely to meet the environmental outcomes and be consistent with the EPA objective for flora and vegetation.

2.4.1.0 Summary of key factor assessment and recommended regulation

The EPA has considered the likely residual impacts of the Optimised Mardie Project in the context of the approved proposal (MS 1175) on flora and vegetation environmental values. In doing so, the EPA has considered whether reasonable conditions could be imposed, or other decision-making processes can ensure consistency with the EPA factor objective. The EPA assessment findings are presented in Table 6.

The EPA also notes that the DMIRS can regulate weed hygiene practices, concentrator and crystalliser ponds construction requirements, closure and rehabilitation through the Mining Proposal and Mine closure Plan required under the *Mining Act 1978.*

The EPA has also considered the principles of the EP Act (see Appendix C) in assessing whether the residual impacts will be consistent with its environmental factor objective and whether reasonable conditions can be imposed (see Appendix A).

Table 6: Summary of assessment for flora and vegetation

Residual impact or risk to environmental value		Assessment finding	Recommended conditions and DMA regulation
1.	Clearing of up to 695 ha of native vegetation which occurs in 'Good' to 'Excellent' condition. The combined effect of the approved project (2,319 ha) and the Optimised Mardie Project will be up to 3,014 ha of good to excellent native vegetation cleared.	The clearing of 'Good' to excellent condition vegetation within the Pilbara bioregion is a residual impact. The EPA advises that subject to limitations on clearing and offsets, the residual impact can be counterbalanced, so that the environmental outcome is likely to be consistent with the EPA objective for flora and vegetation.	**Condition A1 (limitations and extent of proposal)** **Condition B9 (Offsets)** Contribution to the Pilbara Environmental Offsets Fund for the clearing of 'Good' to 'Excellent' condition vegetation within the Pilbara bioregion. **DMA regulation** The DMIRS can regulate rehabilitation, including progressive rehabilitation, under the requirements of mining proposal under the *Mining Act 1978.*
2.	The combined effect of the approved project and the Optimised Mardie Project to *M. tridens.*	The EPA advises the significant residual impact to *M. Tridens* is likely to be consistent with the EPA objective for flora and vegetation, subject to recommended conditions.	**Condition B7** Environmental outcome requiring additional surveys and the implementation of the approved research strategy.
3.	Impacts to *Tecticornia* taxa.	The EPA advises there is unlikely to be a residual impact from clearing *Tecticornia* taxa, and the environmental outcome is likely to be consistent with the EPA objective for flora and vegetation.	**Condition B7** Environmental outcomes ensuring no direct or indirect impacts to known locations of the sterile, potentially rare or novel *Tecticornia* Taxa.
4.	Indirect impacts associated with the introduction and spread of weeds.	The EPA advises there is unlikely to be residual impacts from the introduction and spread of weeds and the environmental outcome is	**Condition B7** Environmental outcomes ensuring there are no project attributable indirect

Residual impact or risk to environmental value		Assessment finding	Recommended conditions and DMA regulation
		likely to be consistent with the EPA objective for flora and vegetation.	impacts from introduction or spread of weeds. **DMA regulation** The DMIRS can regulate weed management under the requirements of mining proposal under the *Mining Act 1978.*

2.5 Terrestrial Fauna

2.5.1 Environmental objective

The EPA environmental objective for terrestrial fauna is *to protect terrestrial fauna so that biological diversity and ecological integrity are maintained* (EPA 2021b).

2.5.2 Investigations and surveys

The EPA advises the following surveys and peer reviews were used to inform the assessment of the potential impacts to terrestrial fauna:

- Basic (Level 1) terrestrial fauna survey for the Mardie Salt Project Optimisation Area (Phoenix Environmental 2022)
- Level 2 targeted terrestrial fauna survey for the Mardie Project (Phoenix Environmental 2020)
- Optimised Mardie Project (supplementary report) (Preston Consulting 2022)
- Short – range endemic invertebrate fauna survey for the Mardie Project (Phoenix Environmental, 2021c).

Shorebird surveys were not undertaken for the Optimised Mardie Project as surveys for the Migratory Shorebird Survey Area (MSSA) have investigated the study area and adjacent habitats between 2017 – 2021 (Phoenix Environmental 2022).

The EPA determined it could proceed with its assessment as sufficient information has been provided to inform the assessment.

2.5.3 Assessment context

Ministerial Statement 1175 authorised the following residual impacts related to flora and vegetation:

- clearing no more than 2,562 ha of foraging habitat for the Pilbara leaf-nosed bat
- clearing of no more than 1,132 ha of foraging habitat for the northern coastal free-tailed bat
- clearing of no more than 6 ha of habitat for the Pilbara olive python
- clearing of no more than 64.5 ha of foraging habitat for the northern quoll

- no reduction in the richness and abundance of migratory shorebirds and other shorebirds in the proposal area attributable to the Optimised Mardie Project
- no direct impacts to the habitats of known short range endemic invertebrates unless demonstrated that the taxon occurs outside the impact areas.
- EPA Report 1704 identified the following additional residual impacts and risks associated with changes to terrestrial fauna for the Mardie Project:
- risk of impacts to migratory bird habitat as a result of clearing
- risk of indirect impacts to significant fauna habitats.
- risk of indirect impacts to terrestrial fauna as a result of noise emissions, artificial light emissions, increased fauna strike increased feral animals and pond entrapment.

Physical elements and activities proposed to be constructed or carried out in the Optimised Mardie Project (the proposed change) have the potential to cause greater, lesser or different impacts and changes to terrestrial fauna in the project area than those described above.

Fauna habitat

Fourteen broad fauna habitat types were recorded during the survey. Dominant habitat types recorded were shrubland over tussock grassland (963 ha) and spinifex grasslands (773 ha). The spinifex on rocky hills habitat and shrubland over spinifex grassland were the only habitats in the quarry study area and had the most significant species per habitat (Phoenix Environmental 2022).

Most of the habitat types within the development envelope were identified as being low suitability for Short Range Endemic (SRE) invertebrates. The spinifex grasslands on rocky hills and tussock grassland on island were however identified as being high suitability for SRE invertebrates (Phoenix Environmental 2022).

Significant Fauna

Seventeen species of conservation significant were recorded or had a likelihood of occurring within the study area:

- northern quoll (*Dasyurus hallucatus*) listed endangered under the EPBC Act and BC Act (confirmed).
- grey falcon *(Falco hypoleucos)* listed vulnerable under the BC Act (confirmed).
- line soil-crevice skink (Dampier) (*Notoscincus butleri*) listed as a Priority 4 (DBCA) (confirmed).
- western pebble-mound mouse (*Pseudomys chapmani*) listed Priority 4 (DBCA) (confirmed).
- migratory birds (13 species) listed under EPBC and BC Act (confirmed).
- Previous surveys (Phoenix Environmental 2020) have recorded the following conservation significant species:

- Pilbara leaf-nosed bat (*Rhinonicteris aurantia)* vulnerable listed EPBC and BC Act.
- northern coastal free-tailed bat (*Ozimops cobourgianus*) listed Priority 1 (DBCA).

2.5.4 Consultation

Matters raised during stakeholder consultation and the proponent's responses are provided in section 3.3 of the referral supplementary report (Preston Consulting 2022), and in the response to submissions document (Preston Consulting 2023).

The key issues raised during the public consultation were regarding the increase in clearing of foraging habitat for the Pilbara leaf-nosed bat and the northern quoll. How these issues have been considered in the assessment are described in section 2.5.9.

2.5.5 Potential impacts from the proposal

The Optimised Mardie Project has the potential to significantly impact on terrestrial fauna from:

- loss of important habitat from clearing
- indirect impacts on terrestrial fauna from the generation of noise, artificial light spill during construction and operational activities and potential vehicle strike and entrapment in crystalliser/evaporative ponds
- reduction of habitat health as a result of increased sedimentation during construction and leaks or spillages of hypersaline brine, hydrocarbons or chemicals
- indirect impacts associated with hydrological changes and the risk of spreading Mesquite

The potential impacts to the Pilbara olive python are predicted to remain unchanged from the Mardie Project and is therefore not discussed any further.

The potential impacts to priority fauna species are considered unlikely to be material as impacts were less than 2% and the conservation status is not likely to change from the Optimised Mardie Project, therefore they are not discussed any further.

2.5.6 Avoidance measures

The proponent has designed the Optimised Mardie Project to avoid impacts to terrestrial fauna by aligning the development envelope to avoid mangroves and algal mat habitat types and the avoidance of one SRE species with a 50 m exclusion zone.

2.5.7 Minimisation measures (including regulation by other DMAs)

The proponent has proposed measures to minimise impacts to terrestrial fauna:

1. water or dust suppressants will be applied to disturbed areas and product/transfer/storage areas

2. weed hygiene and management measures/procedures will be implemented to prevent spread of weeds
3. record fauna entrapment within the ponds as an incident to determine whether fauna egress mechanisms will be installed at all trenches, turkeys nests or concentrator and crystalliser ponds
4. vehicle speed limits will be set and enforced, with lower limits imposed within northern quoll foraging habitat
5. develop and implement the revised Long-term Migratory Shorebird Monitoring Program (LMSMP)
6. develop and implement the Illumination Plan
7. concentrator and crystalliser ponds will be designed and constructed to be safe and stable according to *Mines Safety and Inspection Act 1994* administrated by the Department of Mines, Industrial Regulation and Safety (DMIRS)
8. brine pipelines will be fitted with leak detection and water flows will be shut off if leaks are detected.

The EPA has determined in consultation with DMIRS that industry standard fauna management actions including management of vehicle strike, feral animals, and fauna entrapment can be managed through the Mining Proposal required under the *Mining Act 1978*.

The EPA has determined in consultation with DWER that the management of light spill impacts to terrestrial fauna including bats, such as targeting external lighting, use of shields and directional lighting, the use of red or low-pressure sodium lights can be regulated via the required works approvals and operation license conditions under Part V of the EP Act.

2.5.8 Rehabilitation measures

The proponent has proposed all disturbance areas to be revegetated will be respread with topsoil and rehabilitated. Salts will be harvested from each pond prior to closure, concentrator pond walls will be opened up to allow tidal flows to enter the ponds, infrastructure will be removed if not retained by Mardie Station or Pilbara Ports Authority and crystalliser ponds will be rehabilitated to an acceptable landform.

The EPA notes the proponent would be required to submit a Mine Closure Plan consistent with the Statutory Guidelines for Mine Closure Plans (DMIRS 2020) and in accordance with the *Mining Act 1978*.

2.5.9 Assessment of impacts on environmental values

The EPA considered that the key environmental values for terrestrial fauna likely to be impacted by the Optimised Mardie Project is threatened fauna. The potential impact to terrestrial fauna is likely to be a significant residual impact for the Optimised Mardie Project and is assessed further in this section.

Clearing of terrestrial fauna habitat

Northern quoll

Northern quoll was recorded from surveys from motion camera traps. There were three records from the spinifex grasslands on rocky hills habitat type 1 km north of the quarry development envelope outside the survey area. Due to the proximity of the records of this species, the quarry development envelope is considered foraging habitat for the northern quoll. There is no recorded denning or shelter habitat within the terrestrial development envelope or quarry development envelope (Phoenix Environmental 2022).

The Optimised Mardie Project will clear up to 15.5 ha or 1.7% (combined effect of 8.7%) of northern quoll foraging habitat. The remaining 859.1 ha is not under threat of disturbance from other proposals (Preston Consulting 2022).

Northern coastal free tailed bat

This species was recorded in the desktop review approximately 3 km from the study area. Previous surveys recorded this species in mangal community and tidal samphire shrubland habitat which suggests this species has a fairly wide-ranging foraging activity (Phoenix Environmental 2020).

There are no additional impacts to mangal community habitat. The Optimised Mardie Project will clear 54 ha or 1% (combined effect of 1,132 ha or 22.8%) of northern coastal free tailed bat foraging habitat.

Pilbara leaf-nosed bat

This species was recorded in previous surveys and is considered likely to occur in the development envelope. Roost sites are unlikely to be present as there are no caves within the development envelope. Mardie Pool is likely to be regularly used as a water source. This area has been excised from the development envelope. Open Woodland (Riparian) fauna habitat (adjacent to Mardie Pool) has high value as foraging habitat. There are no direct impacts predicted for this habitat type (Preston Consulting 2022).

It is noted *Triodia* grasslands includes both spinifex grassland and shrubland over spinifex grassland (Preston Consulting 2022). The Optimised Mardie Project will clear 678 ha (combined effect of 3,240 ha) of *Triodia* grasslands foraging habitat, of which 342 ha or 4.2% is in good to excellent condition, a combined effect of 1,566 ha or 19.2%.

Grey falcon

The Grey falcon was recorded twice in the development envelope which is of high significance given rarity of records of this species in the area. Surveys indicate there are no natural nesting sites in the area, however nesting is likely to occur in a communications tower close to Mardie homestead (Phoenix Environmental 2022).

The grey falcon has a large foraging range and is only restricted by habitat in relation to roosting sites (inland drainage lines, grasslands sparse wooded lowlands, often using old nests and communication towers). This species uses the shrubland over tussock grassland habitat for hunting, although this is not considered critical habitat. This habitat type occurs extensively immediately outside the study area. The Optimised Mardie Project will disturb 0.8 ha or 0.1% (combined effect 147 ha or 21%) of Tussock grassland habitat (Phoenix Environmental 2022).

Due to the large foraging range of this species, the Optimised Mardie Project is likely to disturb 695 ha of good to excellent quality foraging habitat for this species, a combined effect from Mardie Project and the Optimised Mardie Project of 3,014 ha.

Migratory birds

No migratory shorebirds were recorded within the optimised study area or quarry study area during the 2021 field surveys (Preston Consulting 2022). EPA report 1704 states there is a low proportion of migratory birds recorded within the terrestrial development envelope in comparison with the remainder of the Migratory Shorebird Study Area (MSSA). The percentage of significant habitat within the disturbance footprint is low compared to the available habitat within the terrestrial fauna study area and MSSA.

Two habitat types were recorded in the study area, mangal communities and coastal samphire. There are no additional impacts to mangal communities. The Optimised Mardie Project will clear up to 34 ha or 0.82% (combined effect 330 ha or 8%) of coastal samphire migratory shorebird habitat.

The EPA notes the LMSMP (recommended condition B6 - 4) includes mitigation and management responses to be implemented if declining utilisation is attributable to the project (including artificial light spill).

Residual impacts

The EPA has assessed the likely residual impacts of the Optimised Mardie Project on conservation significant fauna to be:

- loss of up to 15.5 ha of foraging and dispersal habitat for northern quoll
- loss of up to 54 ha of foraging and dispersal habitat for the northern coastal free tailed bat
- loss of up to 342 ha of foraging and dispersal habitat for the Pilbara leaf-nosed bat
- loss of up to 695 ha of foraging and dispersal habitat for the grey falcon
- loss of up to 34 ha of foraging and dispersal habitat for the Migratory Shorebirds.

The EPA considers the likely residual impacts to threatened fauna can be regulated through recommended conditions B6-1, A1 and B9, which set the environmental outcomes and the limits of disturbance to important habitat types that provide foraging and dispersal habitat for threatened fauna, and that the loss of important habitat can be counterbalanced by offsets (section 4). Implementation of these conditions would ensure the EPA's objective for terrestrial fauna is met.

SRE invertebrates

EPA report 1704 assessed the residual risk of direct and indirect impacts to conservation significant SRE species can be addressed subject to preclearance surveys and mitigation measures in the event that SRE habitat is identified. Information provided for the SRE surveys satisfied the requirements for condition 8-7 under MS 1175.

Field surveys have been completed for the Optimised Mardie Project. Four potential and one uncertain SRE species were collected from the 'shrubland over spinifex grassland' habitat type. This habitat type is widespread in the study area and extends outside the development envelope, so it is unlikely the SREs are restricted. One of the species found, *Buddelundia 'sp. indet. (mardie 1)*', is known from two locations in the Optimised Mardie Project in the 'shrubland over spinifex grassland' habitat type (Phoenix Environmental, 2021c). As a conservative approach, one record of *Buddelundia* '*sp.indet* will be avoided with a 50 m exclusion zone, although the two locations where the species was found are a reasonable distance apart and the species is not a confirmed SRE.

The EPA has assessed impacts to SRE species and 'shrubland over spinifex grassland' habitat is unlikely to be significant subject to implementation of condition B6 (Terrestrial Fauna). The EPA considers the environmental outcomes are likely to be consistent with the EPA objective for terrestrial fauna.

Indirect impacts to significant fauna habitats

Altered surface water flows, introduction and spread of weeds and leaks or spillages of hypersaline brine, hydrocarbons or chemicals may impact the quality of fauna habitat through vegetation degradation. Potential indirect impacts to vegetation (fauna habitat) are assessed under Flora and Vegetation (section 2.4).

The EPA assessment on the indirect influence of overland freshwater changes have been addressed in section 2.1 (Inland Waters).

Indirect impact to terrestrial fauna

There are potential impacts on terrestrial fauna from the generation of noise, artificial light spill from construction and operational activities and vehicle strike. There will be a small number of vehicles working within the quarry limits, and additional trucks using the access road due to the Optimised Mardie Project, which will increase the risk of the death or injury of individuals due to vehicle strike. During construction the proponent has committed to ensuring that clearing within northern quoll foraging habitat does not take place at night while this nocturnal species is active (Preston Consulting 2022). The EPA has recommended conditions B6-3 (1) and B6-1 (5) requiring vehicles to be limited to 40 km/hr within northern quoll foraging habitat and disturbance of this habitat type to only occur during daylight hours.

The operation of the quarry will result in relatively low levels of noise as most of the works will be conducted only during the construction phase over a relatively short

timeframe. Minimal night works are expected during construction (Preston Consulting 2022).

The EPA has assessed the impacts to fauna associated with vehicle strike, feral animal control and pond entrapment are unlikely to be material subject to regulation by DMIRS via assessment of the Mining Proposal for the Mardie Optimised Project (DMIRS 2020) and associated MCP (DMIRS 2020a) required under the *Mining Act 1978.*

EPA report 1704 considered the noise emissions from the Optimised Mardie Project are unlikely to have a material impact on terrestrial fauna and is not expected to affect the ecological integrity of the species within the terrestrial development envelope or to be inconsistent with the EPA's objective to protect terrestrial fauna. This conclusion was subject to requirement for the proponent to comply with the Environmental Protection (Noise) Mardie Project 73 Environmental Protection Authority Regulations 1997 (EP Noise Regulations). The EPA considers the additional potential impacts from the Optimised Mardie Project are unlikely to be material and can meet EPA's objective for terrestrial fauna.

Artificial light emissions from the laydown area may alter behaviours of terrestrial fauna. The laydown area is close to the coast and will predominately be used during dredging and construction (Preston Consulting 2022). The Illumination Plan for marine and terrestrial fauna incorporates EPA (2010) and DoEE (2020) guidance. The EPA considers that terrestrial artificial light spill from the Optimised Mardie Project is unlikely to have a material impact on terrestrial fauna and can meet EPA's objective for terrestrial fauna subject to condition B6 – 6 development and implementation of the Illumination Management Plan.

Cumulative impact assessment

The EPA notes that on a bioregional scale implementation of this Optimised Mardie Project would contribute to cumulative impacts to threatened fauna species, including northern quoll, Pilbara leaf-nosed bat, northern coastal free-tailed bat and the grey falcon, through habitat loss.

Cumulatively, the impacts are not to a level that would alter the likely environmental outcomes of this Optimised Mardie Project. Should this Optimised Mardie Project be approved with EPA's recommendation for offsets (section 4), it will combine with offset contribution from other projects in the bioregion, to deliver offset project through the Pilbara Environmental Offsets Fund to provide environmental benefits within the Pilbara.

2.5.1.0 Summary of key factor assessment and recommended regulation

The EPA has considered the likely residual impacts of the Optimised Mardie Project in the context of the approved proposal (MS 1175) on Terrestrial Fauna environmental values. In doing so, the EPA has considered whether reasonable conditions could be imposed, or other decision-making processes can ensure consistency with the EPA factor objective. The EPA assessment findings are presented in Table 7.

The EPA has also considered the principles of the EP Act (Appendix C) in assessing whether the residual impacts will be consistent with its environmental factor objective and whether reasonable conditions can be imposed (Appendix A).

Table 7: Summary of assessment for terrestrial fauna

Residual impact or risk to environmental value		Assessment finding	Recommended conditions and DMA regulation
1.	Direct impact to the following habitat types that are important to threatened fauna: • 15.5 ha of northern quoll habitat. The combined effect of the Mardie Project (64.5 ha) and the Optimised Mardie Project will be up to 80 ha. • 34 ha of Migratory Shorebird coastal samphire habitat. The combined effect of the Mardie Project (296 ha) and the Optimised Mardie Project will be up to 330 ha. • 54 ha of northern coastal free tailed bat - tidal samphire shrubland habitat. The combined effect of the Mardie Project (1,132 ha) and the Optimised Mardie Project will be up to 1,186 ha. • 342 ha of PLNB good to excellent condition Triodia grasslands habitat. The combined effect of the Mardie Project (882 ha) and the Optimised Mardie Project will be up to 1,566 ha. • 695 ha of foraging and dispersal habitat for the grey falcon. The combined effect of the Mardie Project (2,319 ha) and the Optimised Mardie Project will be	Significant residual impacts are likely to be able to be regulated through reasonable conditions and counterbalanced by offsets, so the environmental outcome is likely to be consistent with the EPA objective for terrestrial fauna.	**Condition 1 (Limitations and extent of proposal)** **Condition B6 (Terrestrial fauna)** Sets limits of disturbances to important fauna habitat types. **Condition B6 (Terrestrial fauna)** Implementation of the Long-term Migratory Shorebird Monitoring and Management Plan. **Condition B9 (Offsets)** Contribution to the Pilbara Environmental Offsets Fund for clearing threatened fauna habitat. **Condition B10 (intertidal and subtidal research offsets)** Contribution to WAMSI led Mardie Marine Intertidal Research Study.

Residual impact or risk to environmental value		Assessment finding	Recommended conditions and DMA regulation
	up to 3,014 ha of good to excellent condition vegetation.		
2.	Impacts to SRE invertebrates and habitats.	Likely to be consistent with the with EPA objective for this factor, subject to the implementation of condition B6.	**Condition B6 (Terrestrial fauna)** 50 m exclusion zone around 1 SRE species.
3.	Indirect impacts to threatened fauna through vehicle strike, noise emissions, artificial light feral animals and pond entrapment.	The EPA advises there is unlikely to be residual impacts from vehicle strike, noise emissions, artificial light feral animals and pond entrapment provided that the management and mitigation measures within the Illumination Management Plan, are implemented, and subject to regulation by DWER and DMIRS.	**Condition B6 (Terrestrial fauna)** Sets speeds limits and restricts disturbance to daylight hours near northern quoll foraging habitat. Implementation of the Illumination Management Plan. **DMA legislation** DWER via Operation Licence under Part V of the EP Act. DMIRS as part of mining proposal approval required under *Mining Act 1978*.

2.6 Social Surroundings

2.6.1 Environmental objective

The EPA environmental objective for social surroundings is *to protect social surroundings from significant harm*.

2.6.2 Investigations and surveys

The EPA advises the following investigations were used to inform the assessment of the potential impacts to social surroundings:

- potential impacts on commercial fishing and aquaculture operations resulting from the Mardie Project development (Fishwell Consulting 2021).
- two Aboriginal heritage (ethnographic and archaeological sites and other heritage places) surveys have been completed by Horizon Heritage Management (Horizon Heritage) in 2017 and 2018.
- ongoing archaeological and ethnographic heritage surveys in July and September 2020, January, February, March, May, August and September 2021.

Horizon Heritage Management (Horizon Heritage) is engaged by the Wirrawandi Aboriginal Corporation (WAC) (the Prescribed Body Corporate for Yaburara and Mardudhunera (YM)) to undertake work program clearances of the Optimised Mardie Project with representatives of the YM People and Robe River Kuruma People (RRK) (formally referred to as the KM People or Kuruma Marthudenera People). These works include ongoing archival research, field investigations and reporting (Preston Consulting 2022).

2.6.3 Assessment context: existing environment

Ministerial Statement 1175 for the Mardie Project required the following objective to be met for social surroundings in the project area:

- avoid, where possible, and minimise direct and project attributable indirect impacts to social, cultural, heritage, and archaeological values, visual and amenity impacts and access to traditional lands.

EPA Report 1704 identified the following additional residual impacts and risks associated with changes to social surroundings for the Mardie Project:

- disturbance (including the diversion which will change the hydrological regime) of Peter's creek (DPLH 17429)
- disturbance of part DPLH 17833 Tap Site 2 other heritage site
- disturbance via flooding of DPLH 22932 Hadson 2 and DPLH 22933 Hanson Midden 1 other heritage sites (including Shell Midden 3).

In addition to the residual impacts, EPA report 1704 considered the following for the Mardie Project:

- unlikely to be significant impacts to land use for traditional purposes
- unlikely to be material impacts to visual amenity
- unlikely to be material impacts associated with noise and dust, subject to compliance with EP Noise regulations and Part V of the EP Act
- unlikely to be significant impact to commercial fisheries.

Physical elements and activities proposed to be constructed or carried out in the Optimised Mardie Project have the potential to cause greater, lesser or different impacts and changes to social surroundings in the project area than those described for the Mardie Project.

Aboriginal heritage

The Optimised Mardie Project is within the YM and the Robe River Kuruma People native title claim. In 2012, a Land Access Deed between BCI (parent company of Mardie Minerals) and the YM people was formalised (Preston Consulting 2022).
A total of eight registered Aboriginal sites, six other heritage places and thirteen historical heritage survey reports were identified across the broader project area.

Two of these (DPLH 38637 and DPLH 38638) were recoded within the development envelope. DPLH 38637 is a low-density artefact assemblage consisting of dolerite, basalt and banded ironstone artefacts. DPLH 38638 is a low-density artefact assemblage consisting of dolerite, quartz, mudstone, chert, and banded ironstone artefacts (Preston Consulting 2022).

European heritage

Mardie Station homestead and woolshed complex is a listed European heritage site. Mardie station will not be disturbed as it is located outside the development envelope (approximately 1 km; Preston Consulting 2022).

The EPA considers that no further assessment, or consideration of mitigation measures on the potential impact to European heritage, is required for the Optimised Mardie Project. It is likely that the Optimised Mardie Project will be consistent with EPA objective for social surroundings in regard to European heritage.

Commercial fisheries (economic)

EPA report 1704 stated based on the Fishwell (2021) report there is limited usage of marine waters within the marine and dredge channel development envelope area by the four identified commercial fisheries (Onlsow Prawn Managed Fishery, Mackerel Managed Fishery, Marine Aquarium Fish Managed Fishery and the Specimen Shell Managed Fishery).

Benthic communities and habitats, including macroalgae / seagrass and sandy sediments within the combined Optimised Mardie Project and Mardie Project are recognised as supporting juvenile phases of key commercial fisheries stocks including bluespotted emperor and prawn species. The potential impacts to commercial fisheries are associated with impacts to sub tidal benthic communities and habitats and are addressed under section 2.2 BCH. Given the relatively small (1% and 6%) predicted cumulative impact to sandy sediment and macroalgae / seagrass habitats, potential impacts to BCH will be managed through the BCHMMP and GMMP. Further, contingency offsets recommended consistent with condition B10 to ensure that research into the link between BCH and fisheries are further investigated. The EPA considers that no further assessment, or consideration of mitigation measures on the potential impact to commercial fisheries, is required. It is likely that the Optimised Mardie Project will be consistent with EPA objective for social surroundings with regard to commercial fisheries.

2.6.4 Consultation

Matters raised during stakeholder consultation and the proponent's responses are provided in section 3.3 of the referral supplementary report (Preston Consulting 2022), and in the response to submissions document (Preston Consulting 2023).

The key issues raised during the public consultation were regarding aquatic resources, recreational fishing amenity and commercial fishing operations. These issues have been addressed in section 2.2 Benthic Communities and Habitats section 2.3 Marine Fauna and section 2.6.3 Social Surroundings.

2.6.5 Potential impacts from the proposal

The Optimised Mardie Project has the potential to significantly impact on social surroundings from:

- indirect impact to two 'other' heritage places located within the development envelope
- direct impacts to land used for traditional purposes (1,111 ha of Spinifex grasslands shrubland and woodland areas)
- indirect impacts to the amenity of Mardie Homestead residents and visitors.

2.6.6 Avoidance measures

The proponent has designed the Optimised Mardie Project to avoid impacts to:

- three registered sites, Mt Salt (DPLH 6346), Wiruwandi Plain (DPLH 10351) and Mardie Pool (DPLH 26578).
- the Mardie Station homestead and woolshed complex
- vegetated BCH with a reduced in direct impact from Original Mardie Project despite a 10 ha increase in direct impacts to sub tidal BCH Mardie Pool.

2.6.7 Minimisation measures (including regulation by other DMAs)

The proponent outlined the following minimisation measures to reduce both direct and indirect impacts to social surroundings:

- implement access agreement with Pastoral Management Pty Ltd (PMPL)
- undertaking Aboriginal Heritage survey and salvage across areas to be cleared and Aboriginal monitors will be present during clearing activities where the likelihood of artefacts being uncovered is high
- apply for and comply with section 18 approvals obtained under the *Aboriginal Heritage Act 1978* (AH Act) for any Aboriginal Heritage sites (or other heritage places that are likely to be sites) that are to be disturbed
- ensure Aboriginal 'cultural salvage areas' are appropriately salvaged prior to disturbance
- Minimise clearing and access restrictions within areas used for traditional purposes
- ensure demarcation of Aboriginal heritage sites in accordance with the Heritage Survey Reports and Cultural Heritage Management Plan (CHMP)
- revise and implement a CHMP in consultation with the YM People and Robe River Kuruma (RRK) People
- maintain and improve Traditional Owners' access to land for traditional uses
- develop and implement Cultural Awareness Training in consultation with the YM People and RRK People.

2.6.8 Rehabilitation measures

The proponent has committed to the following mitigation measures:

- salts will be harvested from each pond prior to closure.
- concentrator pond walls will be flattened or opened up to allow tidal flows to enter the ponds.
- all infrastructure will be removed, if not retained by Mardie Station or PPA.
- all disturbance areas to be revegetated will be respread with topsoil and rehabilitated.
- all crystalliser ponds will be rehabilitated to an acceptable landform; the proponent will examine inundated demarcation sites and remediate to the satisfaction of the YM and RRK People.
- ensure YM People and RRK People are integral stakeholders for closure planning and the confirmation of suitable post-mining land uses.

The EPA notes the proponent would be required to submit a Mine Closure Plan consistent with the Statutory Guidelines for Mine Closure Plans (DMIRS 2020) and in accordance with the *Mining Act 1978*.

2.6.9 Assessment of impacts to environmental values

The EPA considered that the key social surroundings values likely to be impacted by the Optimised Mardie Project is Aboriginal cultural heritage.

Aboriginal heritage

The Optimised Mardie Project will impact two ‘other heritage places’ namely DPLH sites 38637 and DPLH 38638. Artefacts will be salvaged and relocated to one of the keeping places. YM People have chosen four demarcated keeping places and an exclusion zone, which is outside the development envelope, and outlined in the CHMP. The YM People will use Mardie Salt 03, NS Road Keeping Place, Mardie Creek Burial Site and Island 5 as the keeping place for any artefactual material requiring cultural salvage from other areas within the development envelopes (Preston Consulting 2022).

EPA report 1704 discusses the Mardie Project disturbed and relocated DPLH 17833 Tap Site 2 and disturbed part of DPLH 17429 Nyungarrarra (Peter’s creek). Disturbance via flooding of DPLH 22932 Hadson 2 and DPLH 22933 Hanson Midden 1 other heritage sites (including Shell Midden 3) will also occur through the implementation of the Mardie Project.

Mardie Pool is a lodged DPLH ‘Other Heritage Place’. The pool was historically used by Aboriginal people as a water and a food resource. In more recent times it was used by Aboriginal station workers for recreational activities. Mardie Pool has been excluded from the development envelope.

To ensure that the Optimised Mardie Project is managed to be consistent with the EPA objective for social surroundings, the EPA recommends condition B8 requiring

the proponent to implement the CHMP in consultation with the appropriate Traditional Owner group, prior to ground disturbing activities that may result in any impact to Aboriginal cultural heritage.

Land use for traditional purposes

The existing Mardie Project impacted 2,401 ha of land used for traditional purposes (Spinifex grassland, shrubland and woodland areas). The Optimised Mardie Project will disturb 1,111 ha (combined total of 3,512 ha) of Spinifex grassland, shrubland and woodland areas (more than 80% of their pre-European extent will remain) (Preston Consulting 2022).

Based on the above, clearing of up to 1,111 ha disturbance of Spinifex grassland, shrubland and woodland areas, is not expected to have a significant impact of the land use for traditional purposes within the development envelope and would be consistent with the EPA's objectives for social surroundings.

Visual amenity

EPA report 1704 states due to the remote location of the Optimised Mardie Project, and adjacent mud flats access to the terrestrial development envelope rarely occurs. There has been no frequent usage (camping or fishing) within or adjacent to the terrestrial and marine development envelope. There is no public access through Mardie station (CITIC Pacific and Pastoral Management Pty Ltd- holder of the Mardie Station Pastoral lease (PMPL)) as entrance to the station consists of locked gates.

Mardie homestead is located approximately 1 km away from the ponds within the development envelope. There are no direct impacts to Mardie Station, however, the SoP plant and ponds may be visible from the homestead. The proponent and PMPL have negotiated an access agreement which addresses amenity issues. The access agreement documents that PMPL accepts all potential impacts to Mardie Station operations as a result of the Optimised Mardie Project, including amenity impacts (Preston Consulting 2022).

The EPA concludes that since the impact of the Optimised Mardie Project on visual amenity is addressed in the above-mentioned access agreement, EPA objectives for this factor will be met.

Noise and dust

The Optimised Mardie Project includes the relocation of crystalliser ponds approximately 1 km north, further away from Mardie Homestead. The supplementary report discusses construction of the Optimised Mardie Project will result in relatively low levels of additional noise as most of the works will be conducted in narrow strips on soft mudflats (for the pond walls) (Preston Consulting 2022). There is a requirement for the proponent to comply with the EP Noise Regulations.

The supplementary report discusses water or dust suppressants will be applied to disturbed areas and product transfer / storage areas as required to minimise dust generation (Preston Consulting 2022).

The EPA concludes noise and dust impacts from the implementation of the Optimised Mardie Project are not expected to have a significant impact and would be consistent with the EPA's objectives for social surroundings.

Cumulative Impacts

The EPA has considered the combined impacts of the Mardie Project and Mardie Optimised Project, as well as the cumulative impacts of other reasonably foreseeable projects within the region including Ashburton Infrastructure Project, Ashburton Salt Farm and Erramura Salt Farm. The social surroundings values located within the Optimised Mardie Project area are unlikely to be impacted by other developments in the region, and the EPA considers potential impacts to social surroundings environmental values can be managed through the setting of appropriate environmental outcomes and conditions.

2.6.9 Summary of key factor assessment and recommended regulation

The EPA has considered the likely residual impacts of the Optimised Mardie Project in the context of the approved proposal (MS 1175) on social surroundings environmental values. In doing so, the EPA has considered whether reasonable conditions could be imposed, or other decision-making processes can ensure consistency with the EPA factor objective. The EPA assessment findings are presented in Table 8.

The EPA understands the proponent has re-designed the disturbance in the RRDMMA which also affects Peter's Creek. The new design will avoid disturbance to Peter's Creek and will be submitted to the CEO for approval under recommended condition B3-4 (previously condition 2). The EPA also recommends condition B8 require an exclusion area for Peter's Creek to ensure significant ACH values are protected.

The EPA has also considered the principles of the EP Act (see Appendix C) in assessing whether the residual impacts will be consistent with its environmental factor objective and whether reasonable conditions can be imposed (see Appendix A).

Table 8: Summary of assessment for social surroundings

Residual impact		Assessment finding	Recommended conditions and DMA regulation
1.	Disturbance to two 'other heritage places' DPLH site 38637 and DPLH 38638. Combined effect of the Mardie Project (4	Aboriginal cultural heritage is likely to be managed through the implementation of recommended conditions, so that it is consistent with the EPA objective for social surroundings.	**Condition B8 (Aboriginal cultural heritage)** Requirement for a Cultural Heritage Management Plan to be implemented. Require an exclusion area for Peter's Creek to ensure

Residual impact		Assessment finding	Recommended conditions and DMA regulation
	disturbed DPLH sites) and the Optimised Mardie Project will be 6 DPLH Aboriginal heritage sites.		significant ACH values are protected.
2.	Disturbance of land used for traditional purposes. Up to 1.111 ha of Spinifex grassland, shrubland and woodland areas. The combined effect of the Mardie Project (2,401 ha) and the Optimised Mardie Project will be up to 3,512 ha.	The EPA considers that the Optimised Mardie Project is unlikely to have a material impact on land used for traditional purposes or to be inconsistent with the EPA's objective to protect social surroundings.	**Condition A1 (limitations and extent)**
3.	Visual amenity.	The EPA considers that the Optimised Mardie Project is unlikely to have a material impact on visual amenity and the environmental outcome is consistent with the objective for this factor.	N/A
4.	Noise and dust emissions.	Not likely to be a material impact as there is a requirement for the proponent to comply with the EP Noise and Dust Regulations	**DMA legislation** The DWER via licence conditions under Part V of the EP Act.

3 Holistic assessment

While the EPA assessed the impacts of the Optimised Mardie Project against the key environmental factors and environmental values individually in the key factor assessments above, given the link between Inland Waters, Benthic Communities and Habitats, Marine Fauna, Flora and Vegetation, Terrestrial Fauna and Social Surroundings, the EPA also considered connections and interactions between them to inform a holistic view of impacts to the whole environment.

Figure 5 illustrates the connections and interactions between the key environmental factors and the relevant other environmental factors described in Appendix D, to inform the EPA's holistic assessment.

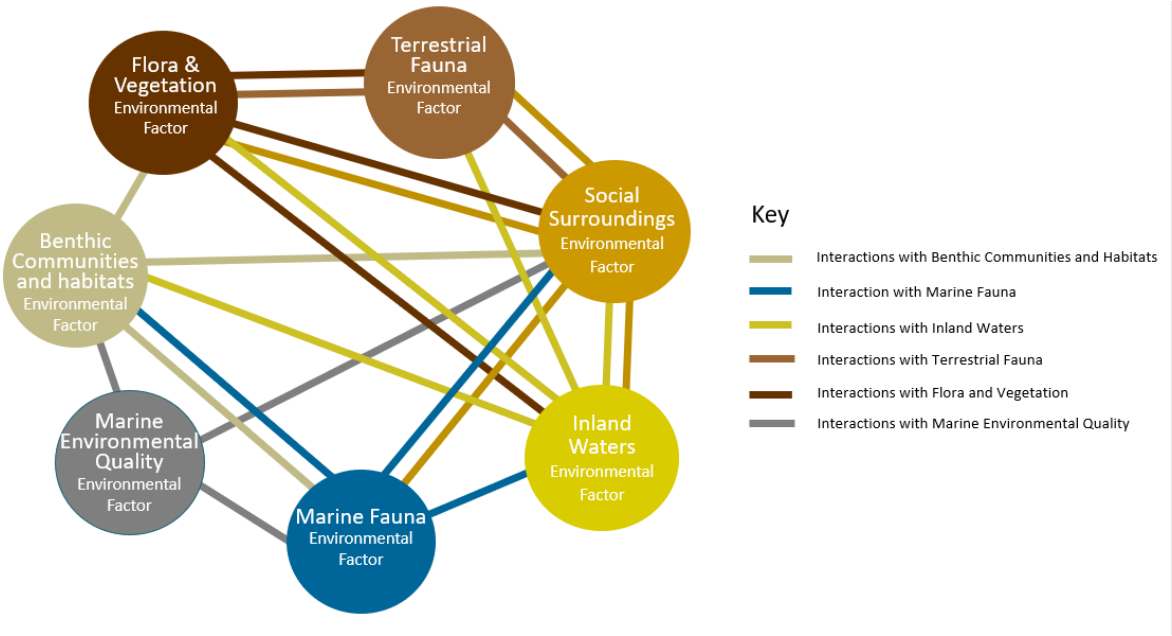

Figure 5: Intrinsic interactions between environmental factors

Benthic Communities and Habitat – Inland Waters

There is a high level of connectivity between benthic communities and habitat in the project area. Intertidal benthic habitat in the project area, including coastal samphire, and ecologically significant mangrove and algal mat communities are reliant on a delicate balance between freshwater flooding and tidal inundation to maintain optimal hydration and pH levels for survival. There is potential for both tidal inundation and freshwater inundation of these communities to facilitate nutrient cycling within and between these communities and the marine environment.

The EPA considers that the proposed mitigation and management measures, and recommended conditions, including outcome-based conditions and environmental management plans that relate specifically to the relevant receptors in the intertidal zone, and strong connections between the required GMMP and BCHMMP provide greater confidence that impacts to inland waters and benthic communities and

habitats will be managed appropriately to ensure that the ecological function of these factors is not compromised.

The connection between inland waters and Benthic communities and habitat has been considered throughout the assessment of both factors.

Benthic Communities and Habitat – Marine Environmental Quality – Marine Fauna

There is a high level of connectivity between marine environmental quality, benthic communities and habitats and marine fauna. The maintenance of marine environmental quality supports healthy benthic communities and habitats. These benthic communities and habitats provide important habitat and resources for threatened marine fauna including the green sawfish, sea snakes and marine turtles.

Dredging activities and bitterns discharge have the potential to impact directly on marine environmental quality and both directly and indirectly on benthic communities and habitats. Through the proponent's application of appropriate avoidance and minimisation measures, and with the implementation of reasonable conditions it is expected that potential impacts to these factors can be managed such that they continue to provide key environmental values. The inclusion of outcome-based conditions provides greater confidence that impacts to marine environmental quality and benthic communities and habitats will be managed appropriately to ensure that the ecological function of these factors is not compromised.

The EPA considers that the proposed mitigation and management measures and recommended conditions for impacts to benthic communities and habitat, and marine environmental quality will also mean the inter-related impacts to the health of other factors of the environment including the values associated with marine fauna would be consistent with the EPA environmental factor objectives.

Flora and Vegetation – Terrestrial Fauna – Inland Waters – Social Surroundings

There is a high level of connectivity between the environmental factors of flora and vegetation, terrestrial fauna, inland waters and social surroundings. Flora and vegetation provides habitat for threatened fauna, including northern quoll, grey falcon, northern coastal free tailed bat and Pilbara leaf-nosed bat. Surface water flows into the culturally significant Mardie Pool. This pool is regularly used for foraging by threatened fauna species.

The EPA considers that the proposed mitigation and management measures, and recommended conditions for impacts and offsetting of significant residual impacts to flora and vegetation and terrestrial fauna will also mean the inter-related impacts to other environmental factors, including the values associated with inland waters and social surroundings, will be consistent with the EPA environmental factor objectives.

Summary of holistic assessment

When separate environmental factors and values affected by the Optimised Mardie Project were considered together in a holistic assessment, the EPA formed the view that the impacts from the Optimised Mardie Project would not alter the EPA's views about consistency with the EPA's factor objectives as assessed in section 2.

The EPA recommends that a ten yearly environmental performance report should be required in implementation conditions from the proponent, given the interconnected environmental values in the area likely to be affected by the Optimised Mardie Project, and the 63-year life of the Optimised Mardie Project. This environmental performance reporting will provide the proponent and the Minister with renewed and current information about the performance of the Optimised Mardie Project with respect to environmental values over the life on the project.

Given the cumulative nature of many impacts in the area likely to be affected by the Optimised Mardie Project, the EPA recommends the proponent be permitted to prepare the report in whole or part with other proponents who are implanting similar proposals in the Region.

4 Offsets

Environmental offsets are actions that provide environmental benefits which counterbalance the significant residual impacts of a proposal.

Consistent with the *WA Environmental Offsets Guidelines* (Government of Western Australia 2014), the EPA may consider the application of environmental offsets to a proposal where it determines that the residual impacts of a proposal are significant, after avoidance, minimisation and rehabilitation have been pursued.

Terrestrial offsets – PEOF

The EPA considers that the clearing of native vegetation and impacts on other associated environmental values in the Pilbara IBRA bioregion is significant where the cumulative impact may reach critical levels if not managed (EPA 2014). The Pilbara's unique land tenure hampers the delivery of offsets, and the Pilbara Environmental Offsets Fund (PEOF) has been established to a provide strategic landscape-scale approach that builds on regional programs to deliver environmental offset outcomes greater than can be achieved by individual proposals.

The PEOF's Governance Framework establishes transparent decision-making processes, clarity of roles and responsibilities, and guidance for project delivery. DWER administers the PEOF with involvement from an Implementation Advisory Group made up of key stakeholders and experts and a Project Recommendation Group made up of representatives from State and Australian governments. The Minister for Environment is the primary decision-maker for the PEOF and approves projects that will address significant residual impacts and receive monies from the PEOF.

The Optimised Mardie Project is located within the Roebourne subregion and Chichester subregion of Pilbara IBRA bioregion.

In the case of this Optimised Mardie Project, likely (and potential) significant impacts are:

- flora and vegetation values
- significant fauna habitat values

In applying the residual impact significance model (Government of Western Australia 2014), the EPA considers the Optimised Mardie Project would result in a significant residual impact to:

- 'Good; to 'Excellent' condition native vegetation
- supporting habitat (foraging and dispersal) habitat for the Pilbara leaf-nosed bat
- supporting habitat (foraging and dispersal) habitat for the northern quoll
- supporting habitat (foraging and dispersal) habitat for the grey falcon
- supporting habitat (foraging and dispersal) habitat for the northern coastal free tailed bat

The EPA has concluded that the clearing of habitat is a significant residual impact on its own, in the context of the Optimised Mardie Project, and in the context of the biological diversity and ecological integrity in the local area, as it provides habitat for threatened fauna species.

Due to the remaining quantity and quality of habitat types in the local area and region, the EPA considers that the significant residual impact could be counterbalanced in accordance with the WA Environmental Offsets Guidelines by a contribution to the PEOF. The EPA considers PEOF future projects are expected to be able to counterbalance the significant impacts from the clearing of native vegetation (including conservation significant ecological communities) and critical fauna habitat of the proposal. The EPA notes that PEOF Governance Framework (August 2019) states that projects will aim to counterbalance the significant residual impacts that have been identified in Ministerial Statements with projects that are designed to deliver enduring and long-term strategic conservation outcomes in the Pilbara. PEOF Implementation Plans identify the significant residual impacts for which contributions to the Fund have been made and how they will be addressed.

The EPA recommends condition B9 ‘Offsets under the PEOF’ be imposed on the proponent to provide an offset in the form of a contribution to the PEOF, to counterbalance the significant residual impacts of the Optimised Mardie Project.

The EPA recommends that the following offset rates (calculated on the 2021-2022 calendar year) should apply in the form of a contribution to PEOF for landscape-scale actions to protect biodiversity in the Pilbara:

- $890 AUD (excluding GST) per hectare of ‘Good’ to ‘Excellent’ condition native vegetation, cleared as a result of the Optimised Mardie Project within the Roebourne IBRA subregion.
- $841 AUD (excluding GST) per hectare of ‘Good’ to ‘Excellent’ condition native vegetation, cleared as a result of the Optimised Mardie Project within the Chichester IBRA subregion.
- $890 AUD (excluding GST) per hectare for supporting habitat for Pilbara leaf-nosed bat cleared as a result of the Optimised Mardie Project.
- $890 (excluding GST) per hectare of supporting habitat for northern quoll cleared as a result of the Optimised Mardie Project.
- $890 (excluding GST) per hectare of supporting habitat for grey falcon cleared as a result of the Optimised Mardie Project.
- $890 AUD (excluding GST) per hectare of supporting habitat for northern coastal free tailed bat cleared as a result of the Optimised Mardie Project.

PEOF has confirmed it is reasonably likely to be able to offset the required habitat, including the material increases in foraging habitat for the northern quoll and the Pilbara leaf-nosed bat as a result of additional impacts due to the Optimised Mardie Project.

Marine and intertidal offsets

In applying the residual impact significance model (Government of Western Australia 2014), the EPA considers that the Optimised Mardie Project would have a significant residual impact to intertidal and marine values from disturbance of up to 34 ha of intertidal coastal samphire habitat. The proponent has proposed an offset strategy (Preston Consulting 2022) including research programs that would improve efforts to protect intertidal and subtidal BCH and its associated values in the region. The draft offset strategy (Preston Consulting 2022) covers significant residual impacts from both the Mardie Project (MS1175) and the Optimised Mardie Project. The EPA has considered the proponent's offset strategy and has proposed research outcomes that the EPA believes are relevant and commensurate to the scale of the impact associated with additional direct disturbance of coastal samphire, coral and macroalgal habitats. The EPA considers it appropriate that the offset strategy includes maintenance of contingency funds for targeted research into subtidal BCH and the ecological values it supports. Including:

- completion of mapping of samphire extent on the West Pilbara coast (defined as the area from the bottom of the Exmouth gulf to Karratha), in order to provide an understanding of the regional extent and distribution of this habitat.
- research programs to understand the effects of climate change on subtidal BCH that can guide the conservation and management of high value BCH habitats within the region.
- maintenance of a contingency fund for the purposes of funding research with the aim of identifying the ecological roles, values and functions of subtidal BCH on the west Pilbara coast and the connectivity between subtidal habitats.

The EPA notes that the research fund to be maintained as specified in condition B10 includes provision for further financial contributions for research should where proposal-attributable impacts are identified beyond what the outcomes allow. This is required so the actual significant residual impacts of the proposal are offset, regardless of what the current assessment concludes, and regardless of whether there is a compliance issue as a result of the proponent not achieving a required outcome. The outcomes of these offsets are to ensure the ecological values overall will be supported, and this will in turn ensure that ecological role of these habitats in supporting migratory birds and fish stocks is maintained.

For the approved Mardie Project, the EPA obtained advice from the Western Australian Marine Science Institute (WAMSI) regarding the cost of achieving the above outcomes with respect to coastal samphire to guide the quantification of offsets for intertidal BCH. In considering the likely cost of achieving the required outcomes, and the amount of intertidal BCH to be directly impacted by the Optimised Mardie Project, the EPA has concluded that, in this instance, the quantification of offsets for impacts associated with direct disturbance of intertidal BCH for this Optimised Mardie Project would be:

- $2102 per hectare of coastal samphire lost as a result of direct disturbance or project-attributable indirect impacts. The residual impacts of the Optimised Mardie Project on coastal samphire equate to 34 ha of direct loss from the Optimised Mardie Project (The combined impact to be offset is 330 ha).

The EPA considers that where indirect impacts are identified that are attributable to the Optimised Mardie Project, these should also be offset at the above-mentioned rate.

Where an area of habitat contains two values that are to be offset, the higher offset amount would apply. Offsets would not be applied twice for the same area of land. In this case, samphire which are offset for intertidal values would not also be subject to offset for good to excellent native vegetation, however the higher of the two rates would apply.

In considering the principles of the WA Environmental Offsets Guidelines (Government of Western Australia 2014), the EPA prefers offsets which include actions that directly improve the level of protection, extent or condition of the value to be offset. While research is usually included as only a small part of a balanced offset strategy, in this instance, research is likely to comprise the entirety of the offset proposed.

Research projects applied as offsets under Part IV of the EP Act must be reasonably related to the impacts. Research projects can add significant value to the outcomes of on-ground strategic protection and the understanding of the environmental values being impacted. The research projects will need to be in addition to the required monitoring and management plans that are to be implemented as part of the project approval. The outcomes of the research projects should work in relationship to these monitoring and management plans to achieve the objectives above.

For the Mardie Project, the EPA was of the view that research offsets for impacts to algal mat, coastal samphire and mangroves are appropriate due to the uncertainty regarding impacts to these values, and the lack of available options for direct offsets to be undertaken. The EPA considers as this is an Optimised Mardie Project, the additional 34 ha of coastal samphire to be disturbed can be appropriately managed through research offsets. There is no need for further offsets for algal mat, mangroves or subtidal BCH as there has been a net reduction in impacts to these habitats and as the full offset amount associated with the predicted residual impacts under MS1175 have already been paid, there is no further offset required.

The EPA recommends condition B10 ‘Intertidal and Subtidal Research Offsets’ requiring the proponent to provide an offset in the form of a contribution to the WAMSI led Mardie Marine Intertidal Research Study, to counterbalance the significant residual impacts of the Optimised Mardie Project.

5 Matters of national environmental significance

The Commonwealth Minister for the Environment has determined that the Optimised Mardie Project (2022/9169) is a controlled action under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) as it is likely to have a significant impact on one or more Matters of National Environmental Significance (MNES). It was determined that the proposed action is likely to have a significant impact on the following matters protected by the EPBC Act:

- listed threatened species and communities (sections 18 and 18A)
- listed migratory species (sections 20 and 20A)
- Commonwealth marine area (sections 23 and 24A)

The EPA has assessed the controlled action on behalf of the Commonwealth as an accredited assessment under the EPBC Act.

This assessment report is provided to the Commonwealth Minister for Environment who will decide whether or not to approve the Optimised Mardie Project under the EPBC Act. This is separate from any Western Australian approval that may be required.

Commonwealth policy and guidance

The EPA had regard to the following relevant Commonwealth guidelines, policies and plans during its assessment:

- Commonwealth EPBC Act Environmental Offsets Policy (Commonwealth of Australia 2012)
- Commonwealth of Australia 2015. Wildlife Conservation Plan for Migratory Shorebirds, Department of the Environment, Canberra, ACT.
- Department of the Environment (015. EPBC Act Policy Statement 3.21 - Industry Guidelines for avoiding, assessing and mitigating impacts on EBBC Act listed migratory shorebird species (Department of the Environment, 2015).
- Department of the Environment 2015. Threat abatement plan for predation by feral cats, Commonwealth of Australia, Canberra, ACT.
- Department of the Environment 2015. EPBC Act Policy Statement 3.21 - Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species, Department of the Environment, Canberra, ACT.
- Department of the Environment 2016. EPBC Act Referral guideline for the endangered northern quoll (*Dasyurus hallucatus*), Department of the Environment, Canberra, ACT.
- Department of the Environment and Energy 2017. National Strategy for Mitigating Vessel Strike of Marine Mega-fauna.

- Department of the Environment and Energy 2020. Light Pollution Guidelines: National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds.
- DEWHA 2008a. Approved Conservation Advice for *Liasis olivaceus barroni* (Olive Python – Pilbara subspecies), Department of the Environment, Water, Heritage and the Arts, Canberra, ACT.
- DEWHA 2008b. Threat abatement plan for predation by the European red fox, Department of the Environment, Water, Heritage and the Arts, Canberra, ACT.
- DEWHA 2009. Significant impact guidelines for 36 migratory shorebird species, Department of the Environment, Water, Heritage and the Arts, Canberra, ACT.
- Hill, B.M. & S.J. Ward 2010, National recovery plan for the Northern quoll (*Dasyurus hallucatus*), Department of Natural Resources, Environment, The Arts and Sport, Darwin, NT.
- Threatened Species Scientific Committee 2005, Commonwealth Listing Advice on Northern quoll (*Dasyurus hallucatus*).
- Threatened Species Scientific Committee 2005, Commonwealth Conservation Advice on Northern quoll (*Dasyurus hallucatus*).
- Threatened Species Scientific Committee 2016, Conservation Advice *Calidris canutus* red knot, Department of the Environment, Canberra, ACT.

EPA assessment

Impacts to the environment relating to MNES are also covered under the key environmental factors of inland waters, benthic communities and habitat, marine fauna, flora and vegetation, terrestrial fauna and social surroundings of this report.

Listed threatened species and communities (sections 18 and 18A)

Minuria tridens

The proponent was required to undertake pre-clearance targeted surveys (under MS 1175) in vegetation type AcAjTE which potentially provides habitat for *M. Tridens*. The Optimised Mardie Project will not directly impact *M.tridens*. The combined effect is expected to be the same as the approved Mardie Project (Preston Consulting 2023).

It is noted a *M. Tridens* research strategy has been approved in accordance with MS 1175 condition 5-3 (2) (b). In accordance with EPBC 2018/8236 condition 25.b.iii, the proponent also submitted an offset strategy to DCCEEW on 30 January 2023.

The EPA advises the significant residual impact is likely to be consistent with the EPA objective for flora and vegetation through continued implementation of the offset strategy.

Northern quoll

The northern quoll was recorded from three records from the spinifex grasslands on rocky hills habitat type 1 km north of the quarry development envelope outside the survey area. Due to the proximity of the records of this species the quarry development envelope is considered foraging habitat for the northern quoll. There is no recorded denning or shelter habitat within the terrestrial development envelope or quarry development envelope (Phoenix Environmental 2022).

The Optimised Mardie Project will clear up to 15.5 ha or 1.7% (combined effect of 8.7%) of northern quoll foraging habitat. The remaining 859.1 ha is not under threat of disturbance from other proposals (Preston Consulting 2022).

Pilbara leaf-nosed bat

Pilbara leaf-nosed bat roost sites are unlikely to be present as there are no caves within the development envelope. Mardie Pool is likely to be regularly used as a water source or foraging habitat. This area has been excised from the development envelope. Open Woodland (Riparian) fauna habitat (adjacent to Mardie Pool) has high value as foraging habitat. There are no direct impacts predicted for this habitat type (Preston Consulting 2022).

Clearing and disturbance of up to 678 ha of Pilbara leaf-nosed bat foraging habitat (*Triodia* grasslands), of which 342 ha or 4.2% is in good to excellent condition, a combined effect of 1,566 ha or 19.2%.

The EPA has assessed the impacts of the Optimised Mardie Project to northern quoll and Pilbara leaf-nosed bat and considers there will be a significant residual impact from the clearing of conservation significant habitat. The EPA recommended condition A1 (limitations and extent on Optimised Mardie Project), B6 (terrestrial fauna) and B9 (offsets) which takes into account the significant residual impact to these species.

Grey falcon

The grey falcon has a large foraging range and is only restricted by habitat in relation to roosting sites (inland drainage lines, grasslands sparse wooded lowlands, often using old nests and communication towers). This species uses the shrubland over tussock grassland habitat for hunting, although is not considered critical habitat. This habitat type occurs extensively immediately outside the study area. The Optimised Mardie Project will disturb 0.8 ha or 0.1% (combined effect 147 ha or 21%) of Tussock grassland habitat (Phoenix Environmental 2022).

The Optimised Mardie Project will disturb 695 ha of good to excellent quality foraging habitat for this species, a combined effect of 3,014 ha.

The EPA has assessed the impacts of the Optimised Mardie Project to the grey falcon. The EPA recommended condition A1 (limitations and extent on Optimised Mardie Project) and B6 (terrestrial fauna).

Green sawfish

The green sawfish, listed as threatened and marine, may be present in the development envelope and may utilise creeks and mangroves in the area as nursery habitat. The Optimised Mardie Project has the potential to impact on the green sawfish through indirect impacts to habitat, underwater noise and artificial light.

While the impacts of artificial light on sawfish are uncertain, it is expected that the development of the illumination plan to minimise impacts to marine turtles will also serve to minimise the potential for impacts to the green sawfish. Similarly, underwater noise mitigation measures including soft starts will serve to minimise impacts from anthropogenic noise.

The Optimised Mardie Project has been designed to minimise impacts to subtidal and intertidal BCH that supports green sawfish and the BCHMMP and GMMP will ensure that impacts are monitored and managed appropriately.

The EPA has assessed the impacts of the Optimised Mardie Project to green sawfish and considers that residual impacts can be managed through recommended conditions B5-1 (environmental outcomes for marine fauna), B5-2 (environmental objectives for marine fauna), B5-6 (noise mitigation for pile driving) and B5-7 (noise mitigation for dredging).

Short-nosed sea snake

The short-nosed sea snake may occur within the project envelope. Despite very little understanding of the potential for impacts to sea snakes, it is assumed that indirect impacts may results from the change in intertidal and subtidal BCH and that underwater noise may also impact on the short-nosed sea snake.

The EPA has assessed the impacts of the Optimised Mardie Project to green sawfish and considers that residual impacts can be managed through recommended conditions B5-1 (environmental outcomes for marine fauna), B5-2 (environmental objectives for marine fauna), B5-6 (noise mitigation for pile driving) and B5-7 (noise mitigation for dredging).

Humpback whale

Humpback whales are listed as threatened, migratory and marine and may occur in the shallow coastal waters offshore of the Optimised Mardie Project and may be impacted by underwater noise emissions associated with construction and operations of the Optimised Mardie Project. Long term operation of the Optimised Mardie Salt Project will also increase the risk of vessel strike.

The EPA notes the Dredging Management Plan (DMP) includes mitigation and management actions to be implemented to reduce the risk of underwater noise impacts and vessel strike from construction.

The EPA has assessed the impacts of the Optimised Mardie Project to humpback whales and considers that residual impacts can be managed through recommended

conditions B5-1 (environmental outcomes for marine fauna), B5-2 (environmental objectives for marine fauna), B5-5 (vessel speed limits), B5-6 (noise mitigation for pile driving) and B5-7 (noise mitigation for dredging).

Loggerhead, Green, Flatback and Hawksbill turtles

Loggerhead, green, flatback and hawksbill turtles (hereafter referred to as marine turtles) are listed as threatened, migratory and marine under the EPBC Act and are likely to occur within the development area and utilise waters and islands offshore of the project. Marine turtles may be impacted by underwater noise and artificial light associated with the construction and operation of the Optimised Mardie Project. Marine turtles are also at risk from vessel strike. Seawater intake, dredging, and alterations of ground and surface water flows have the potential to impact on marine turtle habitat within the development envelope and offshore area.

The EPA notes the Dredging Management Plan (DMP) includes mitigation and management actions to be implemented to reduce the risk of underwater noise impacts and vessel strike from construction. The EPA also noted that the proponent is developing an illumination plan that will be submitted to DWER for approval that demonstrates consistency with the National light Pollution Guidelines. Indirect impacts to marine turtles as a result of changes in habitat have been addressed through proposed management and recommended conditions for benthic communities and habitats and marine environmental quality.

The EPA has assessed the impacts of the Optimised Mardie Project to marine turtles and considers that residual impacts can be managed through recommended conditions A1 (limitations of extent for seawater intake), B5-1 (environmental outcomes for marine fauna), B5-2 (environmental objectives for marine fauna), B5-5 (vessel speed limits), B5-6 (noise mitigation for pile driving) and B5-7 (noise mitigation for dredging).

Listed migratory species (sections 20 and 20A)

Migratory birds

A total of 45 avifauna species are listed as Migratory under the EPBC Act and BC Act. A complete list of migratory birds which may be impacted by the Optimised Mardie Project is on page 284 (Table 51) of the proponent's supplementary report. No migratory shorebirds were recorded within the optimised study area or quarry study area during the 2021 field surveys (Preston Consulting 2022). EPA report 1704 states there is a low proportion of migratory birds recorded within the terrestrial development envelope in comparison with the remainder of the Migratory Shorebird Study Area (MSSA). The percentage of significant habitat within the disturbance footprint is low compared to the available habitat within the terrestrial fauna study area and MSSA.

Coastal samphire was widespread within the MSSA. The coastal samphire habitat to be impacted by the Optimised Mardie Project is unlikely to make a significant difference to the maintenance of ecological functions and diversity across the MSSA (O2 Marine 2020a).

The Optimised Mardie Project will clear up to 34 ha or 0.82% (combined effect 330 ha or 8%) of coastal samphire migratory shorebird habitat.

The EPA notes the Long-term Migratory shorebird Monitoring and Management Plan (LMSMP) includes mitigation and management responses to be implemented if declining utilisation is attributable to the project (including artificial light spill).

The EPA has assessed the impacts of the Optimised Mardie Project to migratory shorebirds and considers there will be a significant residual impact from the clearing of shorebird habitat. The EPA recommended condition A1 (limitations and extent on proposal), B6 (terrestrial fauna) and B10 (intertidal and subtidal research offsets) which takes into account the significant residual impact to migratory shorebirds.

Dugong

Dugong are listed as migratory and marine under the EPBC Act. Dugongs may occur in the shallow coastal waters offshore of the Optimised Mardie Project and may be impacted by underwater noise emissions associated with construction and operations of the Optimised Mardie Project. Long term operation of the Optimised Mardie Salt Project will also increase the risk of vessel strike.

The EPA notes the Dreding Management Plan (DMP) includes mitigation and management actions to be implemented to reduce the risk of underwater noise impacts and vessel strike from construction.

The EPA has assessed the impacts of the Optimised Mardie Project to dugongs and considers that residual impacts can be managed through recommended conditions B5-1 (environmental outcomes for marine fauna), B5-2 (environmental objectives for marine fauna), B5-5 (vessel speed limits), B5-6 (noise mitigation for pile driving) and B5-7 (noise mitigation for dredging).

Humpback dolphin

Humpback dolphins are listed as migratory and marine under the EPBC Act and may occur in the shallow coastal waters offshore of the Optimised Mardie Project and may be impacted by underwater noise emissions associated with construction and operations of the Optimised Mardie Project. Long-term operation of the Optimised Mardie Project will also increase the risk of vessel strike.

The EPA notes the Dreding Management Plan (DMP) includes mitigation and management actions to be implemented to reduce the risk of underwater noise impacts and vessel strike from construction.

The EPA has assessed the impacts of the Optimised Mardie Project to humpback dolphins and considers that residual impacts can be managed through recommended conditions B5-1 (environmental outcomes for marine fauna), B5-2 (environmental objectives for marine fauna), B5-5 (vessel speed limits), B5-6 (noise mitigation for pile driving) and B5-7 (noise mitigation for dredging).

Reef manta ray

The reef manta ray is listed as migratory and marine under the EPBC Act and may occur in the marine footprint of the Optimised Mardie Project. Reef manta ray's may be impacted by underwater noise associated with the construction and operation of the Optimised Mardie Project.

The EPA notes the Dredging Management Plan (DMP) includes mitigation and management actions to be implemented to reduce the risk of underwater noise impacts and vessel strike from construction.

The EPA has assessed the impacts of the Optimised Mardie Project to manta rays and considers that residual impacts can be managed through recommended conditions B5-1 (environmental outcomes for marine fauna), B5-2 (environmental objectives for marine fauna), B5-5 (vessel speed limits), B5-6 (noise mitigation for pile driving) and B5-7 (noise mitigation for dredging).

Noise emissions and artificial light spill

EPA report 1704 considered the noise emission from the Optimised Mardie Project are unlikely to have a material impact on terrestrial fauna and is not expected to affect the ecological integrity of the species within the terrestrial development envelope or to be inconsistent with the EPA's objective to protect terrestrial fauna subject to requirement for the proponent to comply with the Environmental Protection (Noise) Mardie Project 73 Environmental Protection Authority Regulations 1997 (EP Noise Regulations). The EPA considers the additional potential impacts from the Optimised Mardie Project are unlikely to be material and can meet EPA's objective for terrestrial fauna.

Underwater noise emissions have the potential to impact on marine fauna, their behaviours and habitat use. The EPA considers that impacts of underwater noise emissions are manageable subject to the implementation of the DMP (O2 Marine 2023) and can meet the EPA's objective for marine fauna subject to reasonable conditions.

Artificial light emissions from the laydown area may alter behaviours of terrestrial fauna. The laydown area is close to the coast and will predominately be used during dredging and construction (Preston Consulting 2022). The Illumination Plan for marine and terrestrial fauna incorporates EPA (2010) and DoEE (2020) guidance and will be reviewed by DWER prior to acceptance.

The EPA has assessed terrestrial artificial light spill from the Optimised Mardie Project is unlikely to have a material impact on terrestrial fauna and can meet EPA's objective for terrestrial fauna subject to condition B6-6 development and implementation of the illumination management plan. The EPA has assessed that impacts to marine fauna artificial light spill from the Optimised Mardie Project is manageable through the implementation of an illumination plan that is to be submitted to and approved by DWER and can meet the EPA's objective for marine fauna subject to reasonable conditions.

Summary

The EPA recommends the following environmental conditions to minimise impacts on MNES:

- limit the authorised extent of the clearing of native vegetation in good to excellent condition to 695 ha in A1 (Limitations and Extent of Proposal)
- condition B7 (flora and vegetation), with particular regard to *Minuria tridens*
- condition B6 (terrestrial fauna) sets limits of disturbance to important fauna habitat types
- condition B6 (terrestrial fauna) sets speeds limits and restricts disturbance to daylight hours near northern quoll foraging habitat.
- condition B6 (terrestrial fauna) implementation of the LMSMP and the Illumination Plan
- condition B9 (environmental offsets)
- condition B10 (intertidal and subtidal research offsets)

The EPA considers that there will be a significant residual impact from the disturbance of foraging habitat for listed species. The EPA has recommended an offset in condition B9 (see section 4) which takes into account the significant residual impact to conservation significant vegetation communities and fauna habitat due to implementation of the Optimised Mardie Project.

The EPA's view is that the impacts from the Optimised Mardie Project on the above-listed MNES are therefore not expected to result in an unacceptable or unsustainable impact on listed threatened species and communities.

6 Recommendations

The EPA has taken the following into account in its assessment of the Optimised Mardie Project:

- environmental values which may be significantly affected by the Optimised Mardie Project.
- assessment of key environmental factors, separately and holistically (this has included considering cumulative impacts of the Optimised Mardie Project where relevant).
- likely environmental outcomes which can be achieved with the imposition of conditions.
- consistency of environmental outcomes with the EPA's objectives for the key environmental factors.
- EPA's confidence in the proponent's proposed mitigation measures.
- whether other statutory decision-making processes can mitigate the potential impacts of the Optimised Mardie Project on the environment.
- principles of the EP Act.

The EPA recommends that the Optimised Mardie Project may be implemented subject to the conditions recommended in Appendix A.

7 Other advice

The EPA may, if it sees fit, include other information, advice or recommendations relevant to the environment in its assessment reports, even if that information has not been considered by the EPA in its assessment of an Optimised Mardie Project.

The EPA provides the following information for consideration by the Minister.

- The EPA notes that the following aspects of the Optimised Mardie Project can be regulated through Part V of the EP Act:
  - licensing of emissions and discharges (including noise, dust, light spill) from prescribed premises.
  - regulation of spills including brine, chemicals and hydrocarbons.
  - runoff from onshore dredge disposal.
  - operation and management of the landfill and sewage disposal associated with the Optimised Mardie Project.
  - spillages of product of hydrocarbons to the marine environment during bulk loading processes
- The assessment of the mine closure plan by the DMIRS under the *Mining Act 1978* considers the decommissioning, rehabilitation and closure of mining and associated activities, so that it is physically safe, geo-technically stable, geo-chemically non-polluting/non-contaminating, and capable of sustaining an agreed post mining land use without unacceptable liability to the State. It is the EPA's view that decommissioning, rehabilitation and closure of key aspects of this Optimised Mardie Project can be adequately regulated through the *Mining Act 1978*, rather than requiring additional conditions under part IV of the EP Act, to achieve an environmental outcome where the rehabilitated land is safe, stable, resilient, with appropriate hydrology and comprising habitats capable of supporting biodiversity.
- The EPA notes that the following aspects of the Optimised Mardie Project can be regulated through the *Mining Act 1978*:
  - mesquite and other weed management
  - fire risk management
  - terrestrial fauna management
    - feral animal control
    - fauna vehicle strike
    - entrapment of fauna in ponds
  - exclusion areas (no uncontrolled access to migratory shore bird habitat) outside terrestrial and marine development envelope
  - integrity and stability of associated infrastructure including evaporation pond, including lateral seepage and pond wall breaches
  - erosion and scouring as a result of drainage and surface water diversion structures

  - ongoing re-assessment of dredge spoil and sediments for acid sulphate soils risk
  - decommissioning of infrastructure and rehabilitation of terrestrial areas following closure of the project
- Associated approvals such as section 18 under the AH Act or ACH Act and associated Heritage Management Plans for the Optimised Mardie Project (that is, disturbance to two 'other heritage sites') will be sought by the proponent.
- Bushfire requirements will be addressed through the provisions within the *Planning and Development Act 2005, Bushfire Act 1954* and the Western Australian Planning Commission (2015) State Planning Policy 3.8 Planning in Bushfire Prone Areas and Guidelines for Planning in Bushfire Prone Areas. The relevant approvals are regulated via City of Karratha (Local Government Authority) and Department of Fires and Emergency Services.
- The EPA notes in assessing the Optimised Mardie Project and Mardie Project, the EPA has had consideration for the cumulative impacts to intertidal benthic habitat and communities in the region. The EPA advises that all future salt proposals on the West Pilbara Coast (defined as the area from the bottom of the Exmouth Gulf to Karratha) which have the potential to impact tidal samphire mudflats habitat, algal mat and mangrove habitat will need to assess potential regional and cumulative impacts to these habitats.
- The EPA noted in Other Advice in Report 1704 that assessment of sea level rise would be required for all future assessments. In respect of the Optimised Mardie Project, the EPA notes that EPA report 1704 assessed this issue for the impact of the original Mardie Project. The EPA considered the risk could be counterbalanced by offsets including research, plus ongoing performance reporting. No additional assessment has been done for the Optimised Mardie Project as there hasn't been enough time to get results of research, the proposal doesn't increase the risk because the development envelope has been moved further inland, increasing the distance between salt ponds and the high tide line.
- The EPA's recommended conditions for the existing proposal limits on the proposal in context of its broader study area and its regional setting, and to reflect the EPA's objective to ensure ecological protection and resilience of high ecological values in the region could be achieved even with some uncertainty during assessment. These conditions included impacts of no more than 7.2% samphire in the study area (which will now be 8.2%), no more than 25% algal mat in the study area, and no more 8% of Pilbara Coast. These conditions have now been replaced with more specific, measurable outcomes utilising the additional studies that have been done for the Optimised Mardie Project.

The EPA advises that future proposals must also have clear consideration of the broader study area and its regional setting, including that the existing Mardie Project has already been approved (and the relevant approval state of the Optimised project). The EPA expects that, to reflect the EPA's objective to ensure ecological protection and resilience of high ecological values in the region could be achieved, proponents will ensure:

- maximum effort and consideration are given to the avoidance impacts in the first place

- areas already identified as significant for regional environmental protection (such as the RRDMMA) are given significant weight when considering project design, mitigation and management options
- outcomes of research and management recommendations under condition B10 are fully considered
- where there is uncertainty in the ecological role or value of a habitat, assume high ecological values where appropriate
- cumulative impacts from existing and reasonably foreseeable projects are considered in a qualitative and quantitative manner.

Appendix A: Recommended conditions

Section 44(2)(b) of *Environmental Protection Act 1986* specifies that the EPA's report must set out (if it recommends that implementation be allowed) the conditions and procedures, if any, to which implementation should be subject. This appendix contains the EPA's recommended conditions and procedures.

STATEMENT THAT A PROPOSAL MAY BE IMPLEMENTED
***(Environmental Protection Act 1986*)**

OPTIMISED MARDIE PROJECT

Proposal:	The proposal is to develop a solar salt and sulphate of potash production plant and associated export facility at Mardie, approximately 80 km south-west of Karratha. The proposal includes two seawater intakes, brine discharge, evaporation and crystalliser ponds, processing plant, causeway, trestle jetty with associated dredge channel, and supporting infrastructure.
Proponent:	Mardie Minerals Pty Ltd Australian Company Number 152 574 457
Proponent address:	Level 1, 1 Altona Street West Perth WA 6005
Assessment number:	2336

Report of the Environmental Protection Authority: 1740

Introduction: The Proposal is a significant amendment to the existing Mardie Project which was agreed to be implemented under Ministerial Statement 1175. The EPA's Report for the existing Mardie Project is Report 1704, EPA Assessment Number 2167.

Pursuant to section 45 of the *Environmental Protection Act 1986,* it is now agreed that:

1. the significant amendment proposal described and documented in the proponent's Proposal Content Document (28 February 2022), may be implemented;

2. Ministerial Statement 1175 for the existing Mardie Project is superseded under section 40AA (6) (b) of the *Environmental Protection Act 1986;* and

3. the implementation of the significantly amended proposal (the existing approved proposal as amended by the significant amendment proposal) is subject to the following implementation conditions and procedures.

Conditions and procedures

Part A: Proposal extent

Part B: Environmental outcomes, prescriptions, and objectives

Part C: Environmental management plans and monitoring

Part D: Compliance and other conditions

PART A: PROPOSAL EXTENT

A1 Limitations and extent of proposal

A1-1 The proponent must ensure that the proposal is implemented in such a manner that the following limitation or maximum extents / capacities / ranges are not exceeded:

Proposal element	Location	Maximum extent
Physical elements		
Development envelope	Figure 1 Figure 4	Terrestrial development envelope not to exceed 19,645 **ha.** Marine development envelope not to exceed 53 **ha.** Dredge development envelope not to exceed 307.5 **ha.** Combined area of concentrator ponds and crystalliser ponds not to exceed 11,368 **ha**.
Disturbance footprint	Figure 1	Terrestrial disturbance not to exceed 13,476 **ha** within 19,645 **ha** development envelope.
Direct disturbance of native vegetation	Figure 1	Clearing of no more than 3,014 **ha** vegetation in **'good' to 'excellent' condition native vegetation.** Clearing of no more than 863 **ha landward samphire.** Clearing of no more than 330 **ha** of **coastal samphire.**

Impacts on PEC and Mangrove Habitat	Figure 2	No more than 145 **ha** direct and 20 **ha** indirect impacts to Horseflat **PEC.** No more than 13 **ha** of direct disturbance to mangrove habitat outside of the **RRDMMA.** No more than 4 **ha** of clearing within the **RRDMMA** inclusive of any clearing conducted by the proponent prior to the issue of this statement and clearing conducted by the proponent under any other approval mechanism subject to the requirements of conditions B3-4 and C1-1.
Direct disturbance to Algal mats	Figure 4	No more than 880 **ha** of direct impact to algal mats.
Dredging	Figure 3	No more than 800,000 cubic metres, directly disturbing no more than 65 **ha** within the 307.5 **ha** dredge development envelope.
Foraging habitat for the Pilbara leaf-nosed bat (*Rhinonicteris aurantia*)	Figure 1	Clearing no more than 3,254 **ha.**
Foraging habitat for the Northern coastal free-tailed bat (*Ozimops cobourgianus*)	Figure 1	Clearing no more than 1,186 **ha.**
Habitat for the Pilbara Olive Python (*Liasis olivaceus barroni*)	Figure 1	Clearing no more than 6 **ha.**
Foraging habitat for the Northern Quoll (*Dasyurus hallucatus*)	Figure 1	Clearing no more than 80 **ha.**

Zone of High Impact (e.g. marine)	Figure 3	Marine **zone of high impact** to be limited to 186 **ha** within the 307.5 **ha** dredge footprint.
Level of ecological protection areas (marine environmental quality)	Figure 4	**Moderate ecological protection area** (MEPA) not to exceed 53.9 **ha.** **Low ecological protection area** (LEPA) not to exceed 20.2 **ha.**
Distance between crystallisers and Mardie pool	Figure 1	Minimum distance of 1000 metres to be maintained between crystalliser ponds and Mardie pool.
Drainage corridors	Figure 1	Minimum of two drainage corridors of a minimum of 200 metres wide to be established and aligned with existing natural drainage lines.
Operational elements		
Groundwater abstraction	-	No dewatering of groundwater for any reason except to meet the requirements of condition B3-2.
Marine discharge rate	Figure 4	Brine discharge not to exceed 5.5 **GL per annum** with a specific gravity of no more than 1.25 via diffuser.
Seawater intake	-	Seawater intakes to be fitted with four-sided screens designed to ensure a rate not exceeding 0.15 metres per second through the screen. Primary seawater intake is to not exceed 180 **GL per annum.**

Timing elements		
Mine life	-	Up to 63 years from issue of this statement.
Seawater intake	-	Abstract seawater from primary and secondary intake only when tides are at or **above Mean Sea Level.**

PART B – ENVIRONMENTAL OUTCOMES, PRESCRIPTIONS AND OBJECTIVES

B1 Benthic Communities and Habitats

B1-1 The proponent must ensure the implementation of the proposal achieves the following environmental outcomes:

(1) no direct loss of benthic communities and habitats outside of the dredge disturbance footprint defined in Figure 3;

(2) no **irreversible loss** of benthic communities and habitats outside of the authorised **Zone of High Impact** as spatially defined in Figure 3;

(3) no **detectable** change from the baseline state of benthic communities and habitats outside of the **Zone of High Impact** and authorised **Zone of Moderate Impact** as spatially defined in Figure 3;

(4) no change in the health, extent of coverage, or species diversity of intertidal benthic communities more than 100 m seaward of the pond walls as shown in Figure 2; and

(5) **adverse impacts** to intertidal benthic communities are limited to an area within 100 m of the pond wall defined in Figure 2.

B1-2 The proponent shall ensure the implementation of the proposal achieves the following environmental outcomes:

(1) no development that would have an **adverse impact** on the ecological function of the **RRDMMA** or the maintenance of ecological processes which sustain mangrove habitats within the **RRDMMA** (shown in figure 2);

(2) no development that would have an **adverse impact** on the ecological function of intertidal and subtidal benthic communities and habitats;

(3) no long-term (greater than five (5) years) net **detectable** loss of algal mat outside of the proposal footprint;

(4) no loss of subtidal benthic communities and habitat (including subtidal algae) within the area specified in condition A1-1 and outside the Zones of impact authorised in condition A1-1; and

(5) no development that would have an **adverse impact** on the ecological processes or habitats that sustain the bluespotted emperor (*Lethrinus punctulatus*) fishery.

B1-3 The proponent must implement the proposal to meet the following environmental objectives:

(1) minimise impacts to subtidal habitats;

(2) changes to the health, diversity, and extent of benthic communities and habitat (including subtidal macroalgae) as a result of changes to surface water, groundwater quality, groundwater regimes, and marine environmental quality associated with the proposal are detected as early as possible; and

(3) **adverse impacts** to benthic communities and habitat (including subtidal macroalgae) are addressed using best-practice available management mitigation and **contingency measures.**

B1-4 The proponent must:

(1) implement the Benthic Communities and Habitat Monitoring and Management Plan environmental management plan (BCHMMP Rev C, O2 Marine March 2023), with the purpose of ensuring the benthic communities and habitat environmental outcomes in condition B1-1 (1) to (5), B1-2 (1) to (5), the objectives in B1-3 (1) to (3) and the requirements of B3-4 is achieved, monitored and substantiated;

(2) review the BCHMMP environmental management plan (Rev C, O2 Marine March 2023), within one (1) year of the date of this statement to include:

a) specific measures to monitor the health and species diversity of benthic communities, in addition to monitoring of extent;

b) specific measures to monitor, whether there are **adverse impacts** on ecological process or habitats that sustain the bluespotted emperor (*Lethrinus punctulatus*) fishery and prawn fishery;

c) proven **contingency measures** and remediation actions, including commitments to amend and reduce operations to ensure environmental outcomes are achieved; and

d) the relationship between the BCHMMP environmental management plan and the Groundwater Monitoring Management Plan and how these plans work together to ensure overlapping and holistic impacts are managed and monitored, to ensure the environmental outcomes and objectives relevant to both plans are achieved;

(3) commission an independent expert peer review of the BCHMMP environmental management plan (Rev C, O2 Marine, March 2023) within three years or once preliminary results from the Mardie Intertidal Offsets Program have been released, whichever occurs sooner, for the purpose of reviewing whether the plan remains fit for purpose for achieving, monitoring and substantiating outcomes specified in condition B1-3(2) to (5) and B1-4 and objectives in B1-3 (1) to (3); and

(4) Update the BCHMMP environmental management plan in accordance with the recommendations of the peer review.

B2 Marine Pests

B2-1 The proponent must ensure the implementation of the proposal achieves the following environmental outcomes:

(1) no introduction or establishment of **marine pests** in the State Waters as a result of the proposal.

B2-2 The proponent must implement the Marine Pest Management Procedure (Rev 1, dated 1 September 2022) environmental management plan, with the purpose of ensuring the environmental outcomes in condition B1-1 (the benthic community and habitat) and B2-1 are achieved, monitored and substantiated.

B3 Inland Waters

B3-1 The proponent must ensure the implementation of the proposal achieves the following environmental outcomes:

(1) no **adverse impact** to water levels or **water quality** in Mardie Pool as a result of changes to groundwater regimes or groundwater quality;

(2) no **adverse impact** to water levels or **water quality** in Mardie Pool as a result of surface water flows associated with the proposal;

(3) no changes to the extent of surface water flooding during a one (1)-year **ARI** or changes to tidal inundation as a result of the construction of the intertidal causeway that are greater than predicted in *Causeway Tidal Inundation Assessment – technical memorandum* (Advisian 2022);

(4) no changes to the health, extent or diversity of intertidal benthic communities and habitat, including mangrove, **coastal samphire** and algal mat as a result of changes to groundwater regimes or groundwater quality associated with the proposal;

(5) decreased freshwater inundation attributable to the project of no more than fifty-two (52) **ha** of **coastal samphire;**

(6) decreased freshwater inundation attributable to the project of no more than thirteen (13) **ha** mangroves within the **RRDMMA;**

(7) decreased freshwater inundation attributable to the project of no more than 130 **ha** mangroves outside of the **RRDMMA**, subject to the requirements of condition A1-1; and

(8) no changes to the health, extent or diversity of intertidal benthic communities and habitat, including mangrove, **coastal samphire** and algal mat as a result of erosion.

B3-2 The proponent must:

(1) implement the Groundwater Monitoring and Management Plan (GMMP; Rev F, submitted March 2023), with the purpose of ensuring the benthic communities and habitat environmental outcomes in condition B3-1 (1) and (4) and condition B1-2 are achieved, monitored, substantiated and satisfy the requirements of conditions C4 and condition C5; and

(2) review the GMMP environmental management plan (Rev F, submitted March 2023); within one (1) year of the date of this statement to include:

(a) the relationship between the GMMP environmental management plan and the BCHMMP environmental management plan, and how these plans work together to ensure overlapping and holistic impacts are managed and monitored, to ensure the environmental outcomes and objectives relevant to both plans are achieved.

B3-3 The GMMP (Rev F, submitted March 2023) environmental management plan required by condition B3-2 is to be updated with project specific trigger values at the completion of baseline data collection.

B3-4 The proponent shall submit a revised design for disturbance within the **RRDMMA** to the **CEO** which meets the outcome of condition B1-2(1). The revised design shall include the following:

(1) evaluation of how the mangrove habitat in the **RRDMMA** will be affected by the direct and indirect impacts associated with the revised design of the proposal (including consideration of mangrove habitats, dependent habitats, ecological function and ecological processes which sustain the mangrove habitat, and worst-case scenarios);

(2) evaluation of the significance of the effects determined in accordance with condition B3-4(1);

(3) consideration of the following in conditions B3-4(1) and B3-4(2):

(a) quantification of the cumulative impacts of the proposal within the **RRDMMA**, including direct and indirect impacts, and impacts to mangrove capacity to adapt to sea-level rise;

(b) modelling of changes to surface water flows as a result of the proposal, including impacts to drainage lines or hydrological features that may support mangroves; and

(c) any seepage recovery infrastructure that could be required within the area under condition C4 and C5;

(4) demonstration that the implementation of the proposal will not have an **adverse impact** on the ecological function of the **RRDMMA** and the maintenance of ecological processes which sustain the mangrove habitats;

(5) demonstration that the proposal includes best practice design, management, monitoring and **contingency measures** to achieve the outcome of condition B1-2(1);

(6) maps of the **RRDMMA** which may be directly or indirectly affected by the proposal showing in detail:

(a) the location of mangroves;

(b) all drainage lines and other hydrological and ecological features that may support mangrove habitat; and

(c) areas which may be directly or indirectly affected by the proposal, including reasonable buffer area, as agreed by the **CEO**, to account for extent of indirect impacts;

(7) a peer review of the design, and evaluation required by conditions B3-4(1) and B3-4(2) carried out by an independent person or independent persons with relevant expertise determined by the **CEO**, that provides an analysis of whether the revised design would meet the outcome of condition B1-2(1).

B4 Marine Environmental Quality

B4-1 The proponent must ensure the implementation of the proposal achieves the following environment objective:

(1) no impacts on the environmental values of Ecosystem Health, Fishing and Aquaculture, Recreation and Aesthetics, Industrial Water Supply, Cultural and Spiritual.

B4-2 The proponent must ensure the implementation of the proposal achieves the following environmental outcome:

(1) the levels of ecological protection to be achieved inside of the:

(a) **Low Ecological Protection Area** shown in Figure 4 and described in the spatial data in schedule 1;

(b) **Moderate Ecological Protection Area** shown in Figure 4 and described in the spatial data in schedule 1;

(c) **High Ecological Protection Area** described in the spatial data in schedule 1; and

(d) Maximum Ecological Protection Area described in the spatial data in schedule 1, is consistent with the method for deriving **Environmental Quality Guidelines** and **Environmental Quality Standards** for the corresponding level of ecological protection described in Appendix 1, Table 1 EPA Technical Guidance - *Protecting the Quality of Western Australia's Marine Environment* (EPA 2016).

B4-3 The proponent must:

(1) implement the Marine Environmental quality Monitoring Management Plan environmental management plan (Rev 8 O2 Marine, submitted March 2023), with the purpose of ensuring the Marine Environmental Quality environmental objectives in conditions B4-1 and outcomes in B4-2 are achieved, monitored and substantiated and satisfies the requirements of conditions C4 and condition C5; and

(2) if directed by the **CEO**, in consultation with **DWER**, revise the trigger and threshold values, EQG and EQS within the MEQMMP environmental management plan required under condition B4-3(1) to ensure they are defined in a manner consistent with the EPA Technical Guidance - *Protecting the Quality of Western Australia's Marine Environment* (EPA 2016).

B4-4 Within five (5) years of the end of the mine life, the proponent shall ensure that all infrastructure associated with the proposal including the trestle jetty, bitterns diffuser, boat launching facilities and loading facilities that:

(1) are not located on a mining tenement administered under the *Mining Act 1978*; and

(2) have not been agreed by notice in writing from the **CEO** to be retained through transfer of responsibility to a responsible authority or operator, is safely decommissioned and removed from the development envelopes for disposal.

B5 Marine Fauna

B5-1 The proponent shall implement the proposal to achieve the following environmental outcomes:

(1) no mortality, injury, disturbance or displacement of humpback whales (*Megaptera novaeangliae*) within the migration of the **biologically important area;**

(2) no change in marine turtle nesting beach utilisation, nesting success or hatchling emergence metrics as a result of artificial light emissions at both sandy beach habitat adjacent to the development and Long Island, Sholl Island and the Passage Islands (Angle, Middle and Round); and

(3) **significant marine fauna** are not prevented/deterred from undertaking critical behaviours in **biologically important areas**.

B5-2 The proponent shall implement the proposal to achieve the following environmental objectives:

(1) minimise the risk of physical injury or mortality from vessel strike on **significant marine fauna**; and

(2) minimise the risk of behavioural changes, health impacts, physical injury or mortality from underwater noise emissions from construction or operations to **significant marine fauna** (including temporary or permanent hearing loss).

B5-3 The proponent must in consultation with **DWER**:

(1) develop and implement a Mardie Illumination Plan environmental management plan that satisfy the requirements of condition C4 and demonstrates how achievement of the **significant marine fauna** outcomes in B5-1(2-3) will be monitored and substantiated, and submit it to the **CEO;** and

(2) implement the Marine Turtle Monitoring Program (rev 3, submitted, May 2023) environmental management plan that satisfy the requirements of condition C4 and demonstrates how achievement of the **significant**

marine fauna outcomes in B5-1(2-3) will be monitored and substantiated, and submit it to the **CEO.**

B5-4 The proponent must implement the Dredge Management Plan environmental management plan (Rev 6, O2 Marine March 2023) with the purpose of ensuring that Marine Fauna environmental outcomes in conditions B5-1(1) and objectives in conditions B5-2 are achieved, monitored and substantiated.

B5-5 The proponent must impose a speed limit of eight (8) knots on all **project related vessels** and export vessels within a five (5) kilometre approach of the export jetty.

B5-6 The proponent must undertake the following during pile driving activities:

(1) soft start-up procedures for a period of at least thirty (30) minutes prior to the commencement of each pile driving event, including recommencement after suspension of piling activities;

(2) pile driving activities to take place during daylight hours only;

(3) implement a **significant marine fauna** observation zone consisting of at least a two (2) kilometre radius from the noise emitting source whereby a suitably qualified and experienced marine fauna observer must undertake continuous **significant marine fauna** observation for a minimum of thirty (30) minutes prior to the commencement of pile driving and at all times during pile driving activities;

(4) implement an exclusion zone consisting of at least one (1) kilometre radius from the noise emitting source whereby:

(a) pile driving cannot commence should **significant marine fauna** be within the exclusion zone; and

(b) pile driving activities to cease should **significant marine fauna** enter the exclusion zone during pile driving are not to recommence until the animal(s) have moved outside the exclusion zone.

(5) must engage suitably **qualified** and **experienced** marine fauna observer(s) who have a demonstrated knowledge of **significant marine fauna** in the North-West region to undertake continuous observations in the observation zone and exclusion zone;

(6) maintain a log of recorded sightings, locations and behaviours indicative of stress or disturbance of **significant marine fauna**, and submit these to the National Cetacean Sighting Database; and

(7) document and report to **the CEO, DCCEEW** and **DBCA** any incidents relating to **significant marine fauna** injury / mortality.

B5-7 During dredging, spoil disposal and seabed levelling activities, the proponent shall:

(1) implement measures to avoid vessel strikes with **significant marine fauna;**

(2) implement measures to minimise direct entrainment impacts to **significant marine fauna**, including not operating dredge pumps during transit and dredge cutterhead lowered to surface before commencement of soft start procedure;

(3) install overflow screen on dredgers to visually assess for turtles and/or turtle remains that may have been entrained during dredging after each load;

(4) implement a **significant marine fauna** observation zone consisting of a at least three (3) kilometre radius from the dredging activity whereby an observer must undertake **significant marine fauna** observation for a minimum of thirty (30) minutes prior to the commencement of dredging and at all times during dredging activities;

(5) implement an exclusion zone consisting of at least 500 metre radius from the dredging activity whereby:

(a) dredging cannot commence should a **significant marine fauna** be within the exclusion zone; and

(b) dredging activities to cease should a **significant marine fauna** enter the exclusion zone during dredging and are not to recommence until the **significant marine fauna** have moved outside the exclusion zone;

(6) must engage a suitably qualified and experienced marine fauna observer who has a demonstrated knowledge of **significant marine fauna** in the North- West region to undertake observations in the observation zone and exclusion zone;

(7) maintain a log of recorded sightings, locations and behaviours indicative of stress or disturbance of **significant marine fauna** and submit these to the National Cetacean Sighting Database; and

(8) document and report to relevant regulators:

(a) any incidents relating to **significant marine fauna** injury / mortality; and

(b) where turtles are a consideration the effectiveness of mitigation measures to prevent turtle injury and mortality.

B5-8 The proponent shall not conduct dredging during the period October–March (inclusive) or pile driving during the period September–January (inclusive).

B5-9 Clearing in the fauna habitat type identified as low-quality turtle nesting habitat (sandy beach habitat) in the Mardie Project – Environmental Review Document (June 2020) is limited to a width of fifty (50) metres, parallel to the high water mark.

B6 Terrestrial Fauna

B6-1 The proponent must ensure the implementation of the proposal achieves the following environmental outcomes:

(1) no change in the abundance and diversity of migratory shorebirds utilising **coastal samphire** and mudflat habitats;

(2) no change in the nesting density of grey falcons (*Falco hypoleucos*);

(3) maintain habitat connectivity, retention of a vegetation corridor between exclusion zone/s and similar habitat outside the impact area fifty (50) m exclusion zone around one (1) record of short range endemic fauna as shown in Figure 5;

(4) no direct or indirect disturbance within the fifty (50) m short range endemic exclusion zone as shown in Figure 5; and

(5) disturbance within the northern quoll (*Dasyurus hallucatus*) foraging habitat to only occur during daylight hours;

B6-2 The proponent must implement the proposal to meet the following environmental objectives:

(1) minimise the risk of physical injury or mortality from construction or operation on native fauna.

B6-3 During construction and operation, vehicle and machinery speed limits shall not exceed:

(1) forty (40) **km/hr** within the northern quoll (*Dasyurus hallucatus*) foraging habitat on Mardie Road from dusk to dawn and sixty (60) **km/hr** during daylight hours.

B6-4 The proponent must, in consultation with **DWER, DCCEEW** and a biostatistician who is nominated or approved by the **CEO**, prepare a Migratory Shorebird Monitoring and Management plan (environmental management plan) that satisfies the requirements of condition C4 and demonstrates how achievement of the Terrestrial Fauna environmental outcomes in condition B6-1(1) will be monitored and substantiated, and submit it to the **CEO**.

B6-5 The proponent must develop and implement the Mardie Illumination Plan with the purpose of ensuring that Terrestrial Fauna environmental outcomes in condition B6-1(1), B6-1(2) are achieved, monitored and substantiated and that condition B5-3(1) is met.

B6-6 The proponent shall avoid clearing any areas designated as having moderate or high prospectivity for short range endemic invertebrates in the Mardie Project – Response to Submissions (March 2021), until the **CEO** has **confirmed** by notice in writing that:

(1) the proponent has demonstrated avoidance and minimisation of impacts to any **confirmed** short range endemic habitat such that the outcome of condition B6-1(4) has been met including:

(a) avoidance of taking construction material from any mudflat islands **confirmed** to be habitat for short range endemic species.

B7 Flora and Vegetation

B7-1 The proponent must implement the proposal to meet the following environmental outcomes:

(1) no more than 165 **ha** of cumulative impacts to the Horseflat **PEC** as a result of the proposal, including direct impacts of no more than 145 **ha**;

(2) no direct or indirect impacts to the known locations of Minnie Daisy (*Minuria tridens)* identified in the Phoenix – Targeted Pre-clearance Survey (2021), unless the **CEO** has **confirmed** by notice in writing that further investigations have demonstrated that the specimens represent adequately widespread species such that disturbance of the known specimens would not be inconsistent with the EPAs objective for Flora and Vegetation;

(3) no direct impacts or indirect impacts to any known locations of the sterile, potentially rare or novel *Tecticornia* Taxa, identified within Phoenix – Detailed Flora and Vegetation Survey for the Mardie Project (2020), unless the **CEO** has **confirmed** by notice in writing that further investigations have demonstrated that that the specimens represent

adequately widespread species such that disturbance of the known specimens would not be inconsistent with EPA's objective for Flora and Vegetation;

(4) ensure there are no **indirect impacts** from the introduction or spread of **environmental weeds** compare with pre-construction condition;

(5) no disturbance associated with the proposal to more than thirty (30) per cent of the currently mapped extent (256 ha) of the **landward samphire** vegetation described in Mardie Project – Response to Submissions (March 2021), until the **CEO** has **confirmed** by notice in writing that:

(a) the supplementary surveys have mapped additional vegetation consistent with the description of the **landward samphire** in Mardie Project – Response to Submissions (March 2021); and

(b) the additional *Tecticornia* vegetation mapped in the supplementary surveys is sufficiently widespread in the region that clearing of up to 863 **ha** of this vegetation would not be inconsistent with the EPA's objectives for Flora and Vegetation.

B7-2 The proponent shall implement the approved *Minuria tridens* research strategy (Version approved 20 September 2022)

B8 Aboriginal Cultural Heritage

B8-1 The proponent must implement the proposal to meet the following environmental outcomes:

(1) no direct disturbance of the **Aboriginal cultural heritage** exclusion zones for Peters Creek as shown in Figure 5 and described in the spatial data in schedule 1; and

(2) subject to reasonable health and safety requirements, no interruption of ongoing access to land utilised for traditional use or custom by the Yaburara and Mardudhunera People and Robe River Kuruma People.

B8-2 The proponent must implement the proposal to meet the following environmental objectives:

(1) avoid, where practicable, and otherwise minimise direct disturbance to **Aboriginal Cultural Heritage** sites;

(2) avoid, where possible, and otherwise minimise indirect impacts to **Aboriginal Cultural Heritage** within and surrounding the development envelope;

(a) visual and amenity impacts to social and cultural places and activities; and

(3) ongoing consultation and engagement with Traditional Owners about achievement of the outcomes in condition B8-1 and objectives in condition B8-2 for the life of the proposal.

B8-3 The proponent must, in consultation with **DWER**, and in collaboration with the Yaburara and Mardudhunera People, and Robe River Kuruma People prepare an environmental management plan that demonstrates how achievement of the **Aboriginal Cultural Heritage** environmental outcomes in condition B8-1 will be monitored and substantiated, how the **Aboriginal Cultural Heritage** objectives in condition B8-2 will be achieved, and satisfies the requirements of conditions C4 and C5, and submit it to the **CEO**.

B9 Pilbara Environmental Offset Fund

B9-1 The proponent must contribute funds to the **Pilbara Environmental Offsets Fund** calculated pursuant to condition B9-2, to achieve the objective of counterbalancing the significant residual impacts to:

(1) **'Good' to 'Excellent' condition native vegetation;**

(2) Priority 3 **PEC** - Horseflat Land System of the Roebourne Plains;

(3) critical habitat for the Pilbara olive python (*Liasis olivaceus barroni*) riparian and freshwater pool habitat; and

(4) supporting habitat for northern quoll (*Dasyurus hallucatus*), grey falcon (*Falco hypoleucos)*, northern coastal freetail bat (*Ozimops cobourgianus*), Pilbara leaf-nosed bat (*Macroderma gigas*).

B9-2 The proponent's contribution to the **Pilbara Environmental Offsets Fund** must be paid biennially, with the amount to be contributed calculated based on the clearing undertaken in each year of the biennial reporting period in accordance with the rates in condition B9-3. The first biennial reporting period must commence from **ground disturbing activities** of the environmental value(s) identified in condition B9-3.

B9-3 Calculated on the 2021–2022 financial year, the contribution rates are:

(1) $890 AUD (excluding GST) per hectare of **'Good' to 'Excellent' condition native vegetation** cleared as a result of the proposal within the Roebourne **IBRA** subregion and Chichester **IBRA** subregion;

(2) $1,753 AUD (excluding GST) per hectare of Priority 3 PEC - Horseflat Land System of the Roebourne Plains cleared or indirectly impacted for the proposal within the Roebourne **IBRA** subregion;

(3) $1780 (excluding GST) per hectare of the following values cleared as a result of the proposal:

(a) Pilbara olive python (*Liasis olivaceus barroni*) critical habitat

(4) $890 AUD per hectare of the following values cleared as a result of the proposal:

(a) Pilbara leaf-nosed bat (*Macroderma gigas*) supporting habitat;

(b) northern quoll (*Dasyurus hallucatus*) supporting habitat;

(c) grey falcon (*Falco hypoleucos*) supporting habitat; and

(d) northern coastal freetailed bat (*Ozimops cobourgianus*) supporting habitat.

B9-4 The rates in condition B9-3 change annually each subsequent financial year in accordance with the percentage change in the **CPI** applicable to that financial year.

B9-5 Where offsets are required for an area of land under condition B10 that is also subject to offsets under condition B9-3, the higher amount shall apply.

B9-6 To achieve the objective in condition B9-1, the proponent must implement the Mardie Project Impact reconciliation Procedure (Rev 1, 29 August 2022). This procedure must:

(1) spatially define the environmental value(s) identified in condition B9-1

(2) spatially define the areas where offsets required by condition B9-1 are to be exempt;

(3) include a methodology to calculate the amount of clearing undertaken during each year of the biennial reporting period for each of the **environmental values** identified in condition B9-3;

(4) state that clearing calculation for the first biennial reporting period will commence from **ground disturbing activities** in accordance with condition B9-2 and end on the second 30 June following commencement of **ground disturbing activities**;

(5) state that clearing calculations for each subsequent biennial reporting period will commence on 1 July of the required reporting period, unless otherwise agreed by the **CEO;**

(6) indicate the timing and content of the Impact Reconciliation Reports; and

(7) be prepared in accordance with Instructions on how to prepare *Environmental Protection Act 1986* Part IV Impact Reconciliation Procedures and Impact Reconciliation Reports (or any subsequent revisions).

B9-7 The proponent must submit an Impact Reconciliation Report in accordance with the **confirmed** Impact Reconciliation Procedure in condition B9-6.

B9-8 The Impact Reconciliation Report required pursuant to condition B9-7 must provide the location and spatial extent of the clearing undertaken as a result of the proposal during each year of each biennial reporting period.

B9-9 The proponent may apply in writing and seek the written approval of the **CEO** to reduce all or part of the contribution payable under condition B9-3 where:

(1) a payment has been made to satisfy a condition of an approval under the *Environment Protection and Biodiversity Conservation Act 1999* in relation to the proposal; and

(2) the payment is made for the purpose of counterbalancing impacts of the proposal on matters of national environmental significance.

B9-10 The **CEO** may grant approval to discount the amount payable under condition B9-1 (2), condition B9-1(3) and condition B9-1 (4) if the **CEO** is satisfied that the payment will offset the significant residual impacts of the proposal.

B9-11 Condition C2 applies to the **confirmed** Impact Reconciliation Procedure required by condition B9-6 as if it were an environmental management plan.

B9-12 Failure to implement a **confirmed** Impact Reconciliation Procedure or submit an Impact Reconciliation Report as required by condition B9-7 represents a non-compliance with these conditions.

B10 Intertidal and Subtidal Research Offsets

B10-1 Given the significant residual impacts and risks of the proposal to mangroves, algal mat, and **coastal samphire**, and the potential for indirect impacts to subtidal habitats, the proponent shall undertake the following offset measures for the purpose of guiding the strategic protection and management of the ecological values of these habitats on the **west Pilbara coast**, which include

migratory bird habitat and ecological maintenance of marine fauna habitat, consistent with the financial, governance and accountability arrangements described in schedule 2:

(1) contribution to the Mardie Project Marine Intertidal Research Offset Program, on the basis described in schedule 2 (Project A) which has the purpose of mapping the original and current extent of **coastal samphire** and Algal mat on the **west Pilbara coast**;

(2) contribution to a relevant scientific initiative, on the basis described in schedule 2 (Project B), which has the aim of identifying and quantifying the potential effects of sea level rise on the values of mangroves, **coastal samphire**, and Algal mat on the **west Pilbara coast**, and identifying the significance of salt projects in preventing the adaptation of intertidal Benthic Communities and Habitat to sea-level rise;

(3) contribution to a relevant scientific initiative, on the basis described in schedule 2 (Project C(ii)), for the purposes of funding research with the aim of identifying the ecological roles, values and functions of intertidal benthic communities and habitat;

(4) maintenance of relevant scientific initiative, on the basis described in schedule 2 (Project B), which has the aim of identifying and quantifying the potential effects of sea level rise on the values of mangroves, **coastal samphire**, and algal mat on the **west Pilbara coast**, and identifying the significance of salt projects in preventing the adaptation of intertidal Benthic Communities and Habitat to sea-level rise;

(5) maintenance of relevant scientific initiative, on the basis described in schedule 2 (Project C (ii)) for the purposes of funding research with the aim of identifying the ecological roles, values and functions of intertidal Benthic Communities and Habitat, to be paid in the event that loss of intertidal Benthic Communities and Habitat, or loss of health, percent cover or diversity of intertidal Benthic Communities and Habitat is identified by the BCHMMP environmental management plan required by condition B1-4;

(6) maintenance of a contingency fund, on the basis described in schedule 2 (Project C (ii)) for the purposes of funding research with the aim of identifying the potential impacts to bluespotted emperor (*Lethrinus punctulatus*), to be paid in the event that loss of intertidal and subtidal benthic communities and habitat, or loss of health, percent cover or diversity of intertidal and subtidal benthic habitat and communities is identified by the BCHMMP environmental management plan required by condition B1; and

(7) contribution to a relevant scientific initiative, on the basis described in schedule 2 (Project C (iii) for the purposes of funding research with the aim of identifying the ecological roles, values and functions of intertidal benthic habitat, to be paid in the event that disturbance to mangrove habitat in the **RRDMMA** occurs subject to the requirements of condition B1-2.

B10-2 The proponent shall ensure that the real funding for Projects A, B and C will be maintained through indexation to the Perth consumer price index (**CPI**) with the first indexation occurring on 30 June 2021.

B10-3 The proponent shall select a third party to carry out the work required to meet the outcomes of condition B10-1 to the satisfaction of the **CEO**, on advice of **DPIRD** and **DBCA**. In applying to the **CEO** for endorsement of the selected third parties, the proponent shall provide:

(1) demonstration of the track record, experience, qualifications and competencies of the proposed third party to carry out the work and achieve the outcomes in the intertidal and marine environment.

B10-4 The proponent shall ensure that the financial arrangements described in schedule 2 and under condition B10-2 are maintained to achieve the outcomes of Projects A, B and C to the extent that:

(1) funding between projects is transferred as agreed by the **CEO**;

(2) additional funds up to a maximum of ten (10) per cent are contributed to complete project outcomes;

(3) provide the objectives, timing (deliver outcomes within three (3) years of issue of Ministerial Statement or as otherwise agreed with the **CEO**), milestones and methodology of the proposed research and management programs to meet the outcomes in condition B10-1;

(4) prior to the commencement of **ground disturbing activities**, unless otherwise agreed by the **CEO**, the proponent shall prepare and submit to the **CEO** a Summary Offset Plan, on advice of **DPIRD** and **DBCA**, that provides the design for the proposed research and management programs and completion criteria for each project to meet the outcomes of condition B10-1;

(5) set out that the Summary Offset Plan will be made available publicly, within a reasonable time period in a manner agreed by the **CEO**; and

(6) identify how outcomes of the proposed programs will be made available publicly.

PART C – ENVIRONMENTAL MANAGEMENT PLANS AND MONITORING

C1 Environmental Management Plans: Conditions Related to Commencement of Implementation of the Proposal

C1-1 The proponent must not undertake:

(1) **dredging activities** until the **CEO** has **confirmed** in writing that the environmental management plan required by condition B1-4 and condition B5-4 meets the requirements of that condition and condition C4;

(2) **dredging activities, marine construction or operations** associated with the **Mardie Project** until the **CEO** has **confirmed** in writing that the environmental management plan required by condition B5-3 meet the requirements of that condition and condition C4;

(3) **transfer of seawater, brine and/or waste product** associated with the **Mardie Project** until the **CEO** has **confirmed** in writing that the environmental management plan required by condition B3-2 has been updated in accordance with condition B3-3 and meets the requirements of condition C4;

(4) **ground disturbing activities** associated with the significant amendment of the **Mardie Project** until the **CEO** has **confirmed** in writing that the environmental management plan required by condition B6-4 has been updated in accordance with C4:

(5) **marine construction or operations** associated with the **Mardie Project** until the **CEO** has **confirmed** in writing that the environmental management plan required by condition B2-2 meets the requirements of that condition and condition C4:

(6) **ground disturbing activities** associated with the **Mardie Project** within the **RRDMMA** until the **CEO** has **confirmed** in writing that the **RRDMMA** revised design required by condition B3-4 and B1-4 meets the requirements of that condition and condition C4;

(7) **ground disturbing activities** associated with the significant amendment of the **Mardie Project** until the **CEO** has **confirmed** in writing that the Impact Reconciliation Procedure required by condition B9-6 meets the requirements of that condition:

(8) **ground disturbing activities** associated with the significant amendment of the **Mardie Project** until the **CEO** has **confirmed** in

writing that the environmental management plan required by Condition B8-3 meets the requirements of that condition and condition C5: and

(9) **brine discharge** to the marine environment associated with the **Mardie Project** until the **CEO** has **confirmed** in writing that the baseline data collection outlined in the environmental management plan (BCHMMP Rev C, O2 Marine March 2023) required by condition B1-4 has been completed.

C2 Environmental Management Plans: Conditions Relating to Approval, Implementation, Review and Publication

C2-1 Upon being required to implement an environmental management plan under Part B, or after receiving notice in writing from the **CEO** under condition C1-1 that the environmental management plan(s) required in Part B satisfies the relevant requirements, the proponent must:

(1) implement the most recent version of the **confirmed** environmental management plan; and

(2) continue to implement the **confirmed** environmental management plan referred to in condition C2-1(1) other than for any period which the **CEO confirms** by notice in writing that it has been demonstrated that the relevant requirements for the environmental management plan have been met, or are able to be met under another statutory decision-making process, in which case the implementation of the environmental management plan is no longer required for that period.

C2-2 The proponent:

(1) may review and revise a **confirmed** environmental management plan provided it meets the relevant requirements of that environmental management plan, including any consultation that may be required when preparing the environmental management plan;

(2) must review and revise a **confirmed** environmental management plan and ensure it meets the relevant requirements of that environmental management plan, including any consultation that may be required when preparing the environmental management plan, as and when directed by the **CEO**: and

(3) must revise and submit to the **CEO** the **confirmed** environmental management plan if there is a material risk that the outcomes or objectives it is required to achieve will not be complied with, including but not limited to as a result of a change to the proposal.

C2-3 Despite condition C2-1, but subject to conditions C2-4 and C2-5, the proponent may implement minor revisions to an environmental management plan if the revisions will not result in new or increased **adverse impacts** to the environment or result in a risk to the achievement of the limits, outcomes or objectives which the environmental management plan is required to achieve.

C2-4 If the proponent is to implement minor revisions to an environmental management plan under condition C2-3, the proponent must provide the **CEO** with the following at least twenty (20) business days before it implements the revisions:

(1) the revised environmental management plan clearly showing the minor revisions;

(2) an explanation of and justification for the minor revisions; and

(3) an explanation of why the minor revisions will not result in new or increased **adverse impacts** to the environment or result in a risk to the achievement of the limits, outcomes or objectives which the environmental management plan is required to achieve.

C2-5 The proponent must cease to implement any revisions which the **CEO** notifies the proponent (at any time) in writing may not be implemented.

C2-6 **Confirmed** environmental management plans, and any revised environmental management plans under condition C2-4(1), must be published on the proponent's website and provided to the **CEO** in electronic form suitable for on-line publication by the **DWER** within twenty (20) business days of being implemented, or being required to be implemented (whichever is earlier).

C3 Conditions Related to Monitoring

C3-1 The proponent must undertake monitoring capable of:

(1) substantiating whether the proposal limitations and extents in Part A are exceeded; and

(2) **detecting** and substantiating whether the environmental outcomes identified in Part B are achieved (excluding any environmental outcomes in Part B where an environmental management plan is expressly required to monitor achievement of that outcome).

C3-2 The proponent must submit as part of the Compliance Assessment Report required by condition D2, a compliance monitoring report that:

(1) outlines the monitoring that was undertaken during the implementation of the proposal;

(2) identifies why the monitoring was capable of substantiating whether the proposal limitation and extents in Part A are exceeded;

(3) for any environmental outcomes to which condition C3-1(2) applies, identifies why the monitoring was scientifically robust and capable of **detecting** whether the environmental outcomes in Part B are met;

(4) outlines the results of the monitoring;

(5) reports whether the proposal limitations and extents in Part A were exceeded and (for any environmental outcomes to which condition C3-1 (2) applies) whether the environmental outcomes in Part B were achieved, based on analysis of the results of the monitoring; and

(6) reports any actions taken by the proponent to remediate any potential non-compliance.

C3-3 details of reporting requirements in the event that any changes to individuals and populations of Minnie Daisy (*Minuria tridens*) are detected, including requirements to provide mitigation measures to protect this species.

C4 Environmental Management Plans: Conditions Relating to Monitoring and Adaptive Management for Outcomes Based Conditions

C4-1 The environmental management plans required under condition B1-4, condition B2-2, condition B3-2, condition B4-3, condition B5-3, condition B5-4, condition B6-4, condition B6-6 and condition B8-3 must contain provisions which enable the substantiation of whether the relevant outcomes of those conditions are met, and must include:

(1) **threshold criteria** that provide a limit beyond which the environmental outcomes are not achieved;

(2) **trigger criteria** that will provide an early warning that the environmental outcomes are not likely to be met;

(3) monitoring parameters, sites, control/reference sites, methodology, timing and frequencies which will be used to measure **threshold criteria** and **trigger criteria**. Include methodology for determining alternative monitoring sites as a contingency if proposed sites are not suitable in the future;

(4) baseline data;

(5) data collection and analysis methodologies;

(6) adaptive management methodology;

(7) **contingency measures** which will be implemented if **threshold criteria** or **trigger criteria** are met; and

(8) reporting requirements.

C4-2 The environmental management plan required under condition B5-3 is also required to:

(1) be updated to include **management actions**, **management targets** and **contingency measures** that will establish whether the proposal is having a **detectable** difference on marine turtle orientation, sea finding success, and nesting beach utilisation as described in condition B5-1(2).

(2) include a commitment to annually compare cumulative results against the baseline assessment (Pendoley Environmental 2019, Mardie Salt Project Marine Turtle Monitoring Program 2018/2019. Rev 0, Report No. RP-59001);

(3) Include a monitoring plan that is in accordance with the recommendations published in the National Light Pollution Guidelines (2020);

(4) provide criteria for when the Mardie Illumination Plan required by condition B6-6 will be revised in response to outcomes of the monitoring required by condition B5-3; and

(5) Continue to be implemented until the **CEO** has **confirmed** by notice in writing, on advice from **DBCA** and **DWER**, that the outcome of condition B5-1(1-3) has been, and will continue to be met.

C4-3 The environmental management plan required under condition B6-4 is also required to:

(1) be conducted at the ponds and in proximity to the trestle jetty (impact areas) and in representative habitats in control areas, as per the requirements of the EPBC Act Policy Statement 3.21 – Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species;

(2) continue for a minimum of five (5) years to capture construction and post construction phases of the project;

(3) include a commitment and timing for the results of each completed survey to be submitted to the ‘Shorebirds 2020’ initiative, **DCCEEW** and **DBCA**;

(4) include trigger and **threshold criteria** and **management actions** to be implemented if change in the richness and abundance of migratory shorebirds and other birds are identified; and

(5) unless otherwise agreed by the **CEO**, the proponent shall not commence any construction of evaporation ponds, crystalliser ponds, intertidal causeway or trestle jetty until the **CEO** has **confirmed** by notice in writing that the Migratory Shorebird Monitoring Program (environmental management plan) meets the requirements of condition B6-4.

C4-4 The environmental management plan required under condition B3-2 is also required to:

(1) when implemented, substantiate and ensure that the outcome of conditions B3 -1 (1) and B3-1 (4) will be met;

(2) provide the details, including timing, of hydrogeological investigations to be carried out that will:

(a) provide a detailed understanding of the hydrological regime in the project area;

(b) inform the final design of monitoring that will meet the requirement of condition C4-1;

(c) inform the final design of management and mitigation actions that will be implemented to meet the outcomes of conditions B3 -1 (1) and B3-1 (4); and

(3) detail the timing of monitoring bore installation and collection of baseline data, providing justification to demonstrate that data will represent baseline where it is collected after the commencement of operations.

C4-5 Without limiting condition C3-1, failure to achieve an environmental outcome, or the exceedance of a **threshold criteria**, regardless of whether threshold **contingency measures** have been or are being implemented, represents a non-compliance with these conditions.

C5 Environmental Management Plans: Conditions Related to Management Actions and Targets for Objective Based Conditions

C5-1 The environmental management plans required under condition B6-6 and condition B8-3 must contain provisions which enable the achievement of the relevant objectives of those conditions and substantiation of whether the objectives are reasonably likely to be met, and must include:

(1) **management actions**;

(2) **management targets**;

(3) **contingency measures** if **management targets** are not met; and

(4) reporting requirements.

C5-2 The environmental management plan required under condition B8-3 are also required to include:

(1) a map that shows the geographic extent of the area of **Aboriginal Cultural Heritage** identified and agreed to by the relevant Traditional Owners;

(2) a map that shows the areas or site of **Aboriginal Cultural Heritage** significance that will be avoided;

(3) a framework for consultation with Traditional Owners (Yaburara and Mardudhunera People and Robe River Kuruma People) and other relevant stakeholders during the life of the proposal;

(4) a commitment that, in the instance of any previously unrecorded heritage places being identified within the development envelope, the proponent shall avoid the area and must contact the Yaburara and Mardudhunera People and the Robe River Kuruma People and DPLH within ten (10) days of discovery, prior to implementing mitigation actions required; and

(5) a commitment to ensure that staff and contracting personnel are made fully aware of their obligations under the *Aboriginal Heritage Act 1972*.

C5-3 Without limiting condition C2-1, the failure to achieve an environmental objective, or implement a **management action**, regardless of whether **contingency measures** have been or are being implemented, represents a non-compliance with these conditions.

C5-4 Without limiting condition C3-1, the failure to achieve an environmental objective, or implement a **management action**, regardless of whether contingency actions have been or are being implemented, represents a non-compliance with these conditions.

PART D – OTHER CONDITIONS

D1 Non-compliance Reporting

D1-1 If the proponent becomes aware of a potential non-compliance, the proponent must:

(1) report this to the **CEO** within seven (7) days;

(2) implement **contingency measures**;

(3) investigate the cause;

(4) investigate environmental impacts;

(5) advise rectification measures to be implemented;

(6) advise any other measures to be implemented to ensure no further impact; and

(7) provide a report to the **CEO** within twenty-one (21) days of being aware of the potential non-compliance, detailing the measures required in conditions D1-1(1) to D1-1(6) above.

D1-2 Failure to comply with the requirements of a condition, or with the content of an environmental management required under a condition, constitutes a non-compliance with these conditions, regardless of whether the contingency, rectification or other measures in condition D1-1 above have been or are being implemented.

D2 Compliance Reporting

D2-1 The proponent must provide an annual Compliance Assessment Report to the **CEO** for the purpose of determining whether the implementation conditions are being complied with.

D2-2 Unless a different date or frequency is approved by the **CEO**, the first annual Compliance Assessment Report must be submitted within fifteen (15) months of the date of this Statement, and subsequent plans must be submitted annually from that date.

D2-3 Each annual Compliance Assessment Report must be endorsed by the proponent's Chief Executive Officer, or a person approved by proponent's Chief Executive Officer to be delegated to sign on the Chief Executive Officer's behalf.

D2-4 Each annual Compliance Assessment Report must:

(1) state whether each condition of this Statement has been complied with, including:

(a) exceedance of any proposal limits and extents;

(b) achievement of environmental outcomes;

(c) achievement of environmental objectives;

(d) requirements to implement the content of environmental management plans

(e) monitoring requirements;

(f) requirements to implement adaptive management; and

(g) reporting requirements;

(2) include the results of any monitoring (inclusive of any raw data) that has been required under Part C in order to demonstrate that the limits in Part A, and any outcomes or any objectives are being met;

(3) provide evidence to substantiate statements of compliance, or details of where there has been a non-compliance;

(4) include the corrective, remedial and preventative actions taken in response to any potential non-compliance;

(5) be provided in a form suitable for publication on the proponent's website and online by the Department of Water and Environmental Regulation;

(6) be prepared and published consistent with the latest version of the Compliance Assessment Plan required by condition D2-5 which the **CEO** has **confirmed** by notice in writing satisfies the relevant requirements of Part C and Part D;

(7) an outline of the success of implementation of Projects A, B and C, including progress against completion criteria; and

(8) the details of payments made with consideration for the requirement of conditions B10-2 and B10-4.

D2-5 The proponent must prepare a Compliance Assessment Plan which is submitted to the **CEO** at least six (6) months prior to the first Compliance Assessment Report required by condition D2-2, or prior to implementation of the proposal, whichever is sooner.

D2-6 The Compliance Assessment Plan must include:

(1) what, when and how information will be collected and recorded to assess compliance;

(2) the methods which will be used to assess compliance;

(3) the methods which will be used to validate the adequacy of the compliance assessment to determine whether the implementation conditions are being complied with;

(4) the retention of compliance assessments;

(5) the table of contents of Compliance Assessment Reports, including audit tables; and

(6) how and when Compliance Assessment Reports will be made publicly available, including usually being published on the proponent's website within sixty (60) days of being provided to the **CEO**.

D2-7 The proponent shall submit a ten (10) yearly Environmental Performance Report to the **CEO** within three (3) months of the expiry of the ten (10) year period commencing from the date of substantial commencement of the proposal, or such other time as may be approved in writing by the **CEO**.

D2-8 Each Environmental Performance Report shall report on proposal impacts on the following **environmental values**:

(1) state of algal mats;

(2) state of mangroves inside and outside the **RRDMMA**;

(3) state of groundwater;

(4) state of surface water;

(5) holistic assessment of proposal impacts against **environmental values**, including a comparison of the state of each environmental value at the beginning and end of the ten (10)-year period; and

(6) proposed adaptive management and continuous improvement strategies.

D2-9 The Environmental Performance Report may be in whole or part prepared in conjunction with other proponents where there are cumulative impacts from their proposals.

D3 Contact Details

D3-1 The proponent must notify the **CEO** of any change of its name, physical address or postal address for the serving of notices or other correspondence within

twenty-eight (28) days of such change. Where the proponent is a corporation or an association of persons, whether incorporated or not, the postal address is that of the principal place of business or of the principal office in the State.

D4 Time Limit for Proposal Implementation

D4-1 The proposal must be substantially commenced within five (5) years from the date of this Statement.

D4-2 The proponent must provide to the **CEO** documentary evidence demonstrating that they have complied with condition D5-1 no later than fourteen (14) days after the expiration of period specified in condition D5-1.

D4-3 If the proposal has not been substantially commenced within the period specified in condition D4-1, implementation of the proposal must not be commenced or continued after the expiration of that period.

D5 Public Availability of Data

D5-1 Subject to condition D5-2, within a reasonable time period approved by the **CEO** upon the issue of this Statement and for the remainder of the life of the proposal, the proponent must make publicly available, in a manner approved by the **CEO**, all validated environmental data collected before and after the date of this Statement relevant to the proposal (including sampling design, sampling methodologies, monitoring and other empirical data and derived information products (e.g. maps)), environmental management plans and reports relevant to the assessment of this proposal and implementation of this Statement.

D5-2 If:

(1) any data referred to in condition D5-1 contains trade secrets; or

(2) any data referred to in condition D5-1 contains particulars of confidential information (other than trade secrets) that has commercial value to a person that would be, or could reasonably be expected to be, destroyed or diminished if the confidential information were published.

D5-3 The proponent may submit a request for approval from the **CEO** to not make this data publicly available and the **CEO** may agree to such a request if the **CEO** is satisfied that the data meets the above criteria.

D5-4 In making such a request the proponent must provide the **CEO** with an explanation and reasons why the data should not be made publicly available.

D6 Independent Audit

D6-1 The proponent must arrange for an independent audit of compliance with the conditions of this statement, including achievement of the environmental outcomes and/or the environmental objectives and/or environmental performance with the conditions of this statement, as and when directed by the **CEO**.

D6-2 The independent audit must be carried out by a person with appropriate qualifications who is nominated or approved by the **CEO** to undertake the audit under condition D6-1.

D6-3 The proponent must submit the independent audit report with the Compliance Assessment Report required by condition D2, or at any time as and when directed in writing by the **CEO**. The audit report is to be supported by credible evidence.

D6-4 The independent audit report required by condition D6-1 is to be made publicly available in the same timeframe, manner and form as a Compliance Assessment Report, or as otherwise directed by the **CEO**.

Table 1: Abbreviations and definitions

Acronym or abbreviation	Definition or term
Aboriginal Cultural Heritage	Means the tangible and intangible elements that are important to the Aboriginal people of the State, and are recognised through social, spiritual, historical, scientific or aesthetic values, as part of Aboriginal tradition to the extent they directly affect or are affected by physical or biological surroundings.
Adverse impact/ adversely impacted	Negative change that is neither trivial nor negligible that could result in a reduction in health, diversity or abundance of the receptor/s being impacted, or a reduction in environmental value. **Adverse impacts** can arise from direct or indirect impacts, or other impacts from the proposal.
ARI	Annual Recurrence Interval.
Biologically important area (BIA)	Spatially defined areas where aggregations of individuals of a species are known to display biologically important behaviour such as breeding, foraging, resting or migration.
Brine discharge	The release of brine (hypersaline water) to the environment.
CEO	The Chief Executive Officer of the Department of the Public Service of the State responsible for the administration of section 48 of the *Environmental Protection Act 1986*, or the **CEO's** delegate.
Confirmed	In relation to a plan required to be made and submitted to the **CEO**, means, at the relevant time, the plan that the **CEO confirmed**, by notice in writing, meets the requirements of the relevant condition. In relation to a plan required to be implemented without the need to be first submitted to the **CEO**, means that plan until it is revised, and then means, at the relevant time, the plan that the **CEO confirmed**, by notice in writing, meets the requirements of the relevant condition.
Coastal Samphire	Samphire described as coastal in Mardie Project: Response to Submissions (29 March 2021).
Contingency measures	Planned actions for implementation if it is identified that an environmental outcome, environmental objective, **threshold criteria, Environmental Quality Standard** or **management target** are likely to be, or are being, exceeded. **Contingency measures** include changes to operations or reductions in disturbance **or adverse impacts** to reduce impacts and must be decisive actions that will quickly bring the impact to below any relevant threshold,

	management target and to ensure that the environmental outcome and/or objective can be met.
CPI	The All Groups Consumer Price Index numbers for Perth compiled and published by the Australian Bureau of Statistics.
DBCA	The government agency responsible for the administration of the *Biodiversity and Conservation Act 2016*, which at the time of publication of this Ministerial Statement is the Department of Biodiversity, Conservation and Attractions.
DCCEEW	Department of Climate Change, Energy, the Environment and Water.
Detecting/ Detectable	The smallest statistically discernible effect size that can be achieved with a monitoring strategy designed to achieve a statistical power value of at least 0.8 or an alternative value as determined by the **CEO**.
DPIRD	The Western Australian Department of Primary Industries and Regional Development, or any of its successors responsible for the administration of the *Fish Resources Management Act 1994.*
Dredging activities	An activity or process that involves removing sediment or material from bodies of water.
DWER	The Western Australian Department of Water and Environmental Regulation, or any of its successors responsible for the administration of section 48 of the *Environmental Protection Act 1986.*
Environmental values	A beneficial use, or ecosystem health condition (*from EP Act*) Particular value or uses of the environment that are important for a healthy ecosystem or for public benefit, welfare, safety or health and which require protection from the effects of pollution, waste discharges and deposits as defined in the Technical Guidance *Protecting the Quality of Western Australia's Marine Environment*, as amended from time to time, and available at www.epa.wa.gov.au.
Environmental weeds	Any plant declared under section 22(2) of the *Biosecurity and Agriculture Management Act 2007*, any plant listed on the Weeds of National Significance List and any weeds listed on the Department of Biodiversity, Conservation and Attractions' Wheatbelt Impact and Invasiveness Ratings list, as amended or replaced from time to time.
Environmental Quality	Threshold numerical values or narrative statements which if met indicate there is a high degree of certainty that the associated environmental quality objective has been achieved.

Guidelines (EQG)	
Environmental Quality Standards (EQS)	Threshold numerical values or narrative statements that indicate a level which if not met indicates there is a significant risk that the associated environmental quality objective has not been achieved and a management response is required.
GL per annum	Gigalitres per annum.
'Good' to 'Excellent' condition native vegetation	Means the condition of native vegetation rated in accordance with the Technical Guidance – *Flora and Vegetation surveys* for environmental impact assessment (EPA 2016) including any revision to this technical guidance.
Ground disturbing activities	Any activity or activities undertaken in the implementation of the proposal, including any clearing, civil works or construction.
Ha	Hectare
High Ecological Protection Area	All of the proximal coastal waters outside of areas defined as **Low Ecological Protection Area**s and **Moderate Ecological Protection Area**s and shown (red) in Figure 4.
IBRA	Interim Biogeographic Regionalisation for Australia.
Intertidal and subtidal research offsets	Western Australian Marine Science Institution (WAMSI) intertidal and subtidal research program or other suitable scientific initiative.
Irreversible loss	**Adverse impact** which is unlikely to or does not return to pre-impact state within five (5) years following the completion of proposal related activities that are likely to have an impact on **benthic communities and habitats**.
Km/hr	Kilometres per hour.
Landward Samphire	Samphire described as landward in Mardie Project: Response to Submissions (29 March 2021).
Low Ecological Protection Area	The area shown in (blue) in Figure 4 as 'Mardie Project **Low Ecological Protection Area**' and defined in the spatial data in schedule 1.
Mardie Project	The existing Mardie Project and the significant amendment (Optimised Mardie Project).
Marine pests	Marine species not native to the environment of the **west Pilbara coast**, that do or may threaten biodiversity. The information from www.marinepests.gov.au and advice from the Department of

	Primary Industries and Regional Development will guide interpretation of this definition.
Management action/s	The identified actions implemented with the intent of to achieving the environmental objective.
Management target	A type of indicator to evaluate whether an environmental objective is achieved.
Marine construction or operations	All operations to do with the construction of the marine aspects of the proposal including piling, dredging and vessel movements.
Moderate Ecological Protection Area	The area shown in (green) in Figure 4 as 'Mardie Project **Moderate Ecological Protection Area**' and defined in spatial data in schedule 1.
PEC	Priority ecological community.
Project Related Vessels	Vessels related to the construction and operation of the project, including the transhipment barge.
Qualified and experienced Marine Fauna Observers (MFO)	In the context of MFO's it is expected that at least one MFO will hold an Internationally recognised MFO qualification in accordance with industry standards and at least five (5) years' experience in Australian waters.
RRDMMA	The Robe River Delta Mangrove Management Area as shown in Figure 2.
Significant marine fauna	Includes turtles, cetaceans, dugongs, sawfish and other marine fauna species listed under state or Commonwealth legislation.
Transfer of seawater, brine and/or waste product	Transfer of seawater, brine and/or waste product to the marine environment.
Trigger criteria	Indicators that have been selected for monitoring to provide a warning that if exceeded the environmental outcome may not be achieved. They are intended to forewarn of the approach of the **threshold criteria** and trigger response actions.
Threshold criteria	The indicators that have been selected to represent limits of impact beyond which the environmental outcome is not being met.
Zone of high impact	The zone described in the Dredge Management Plan, Revision 5 (Report number R190043) as '**Zone of High Influence**' and referred to in Figure 3 of this document.

Zone of moderate impact	The zone described in the Dredge Management Plan, Revision 5 (Report number R190043) as '**Zone of Moderate Influence**' and referred to in Figure 3 of this document.
ZOI Proposed High Influence	Zone of high impact (see definition above).
ZOI Proposed Medium Influence	Zone of moderate impact (see definition above).
West Pilbara coast	The extent of the Pilbara coast from the bottom of the Exmouth Gulf to Karratha.

Figures (attached)

Figure 1 Proposal location and development envelopes (This map is a representation of the co-ordinates referenced in Schedule 1)

Figure 2 Benthic communities and habitats within the significant amendment and original proposal area

Figure 3 Dredge envelope with zones of influence

Figure 4 Level of ecological protection areas around diffuser location

Figure 5 Short Range Endemic fauna exclusion zones and Aboriginal Cultural Heritage exclusion zone for Peters Creek

Schedule 1

Figures

All coordinates are in metres, listed in Map Grid of Australia Zone 50 (MGA Zone 50), datum of Geocentric Datum of Australia 1994 (GDA94).

Spatial data depicting the figures are held by the Department of Water and Environmental regulation. Record no. DWERDT775686.

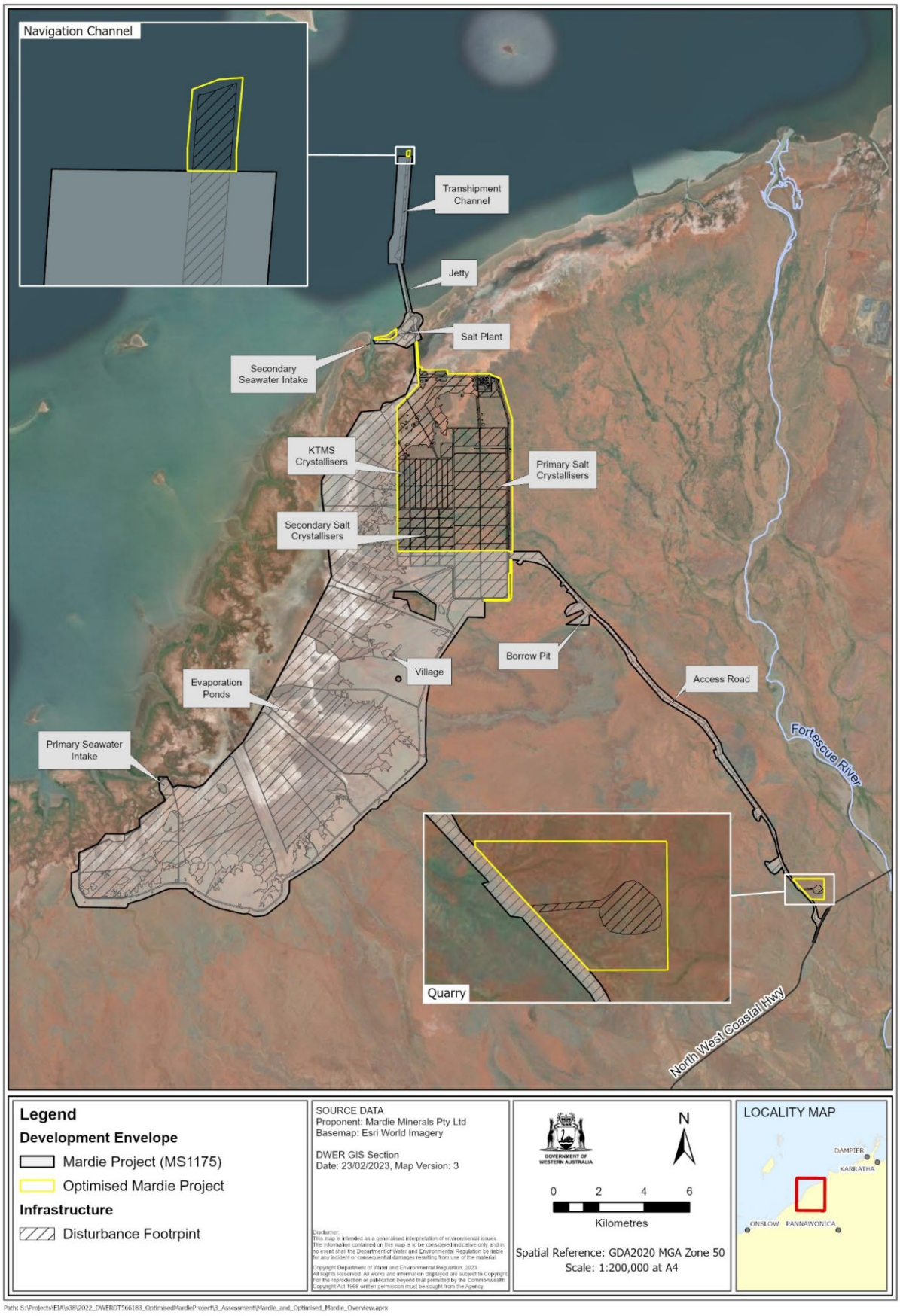

Figure 1: Proposal location and development envelopes

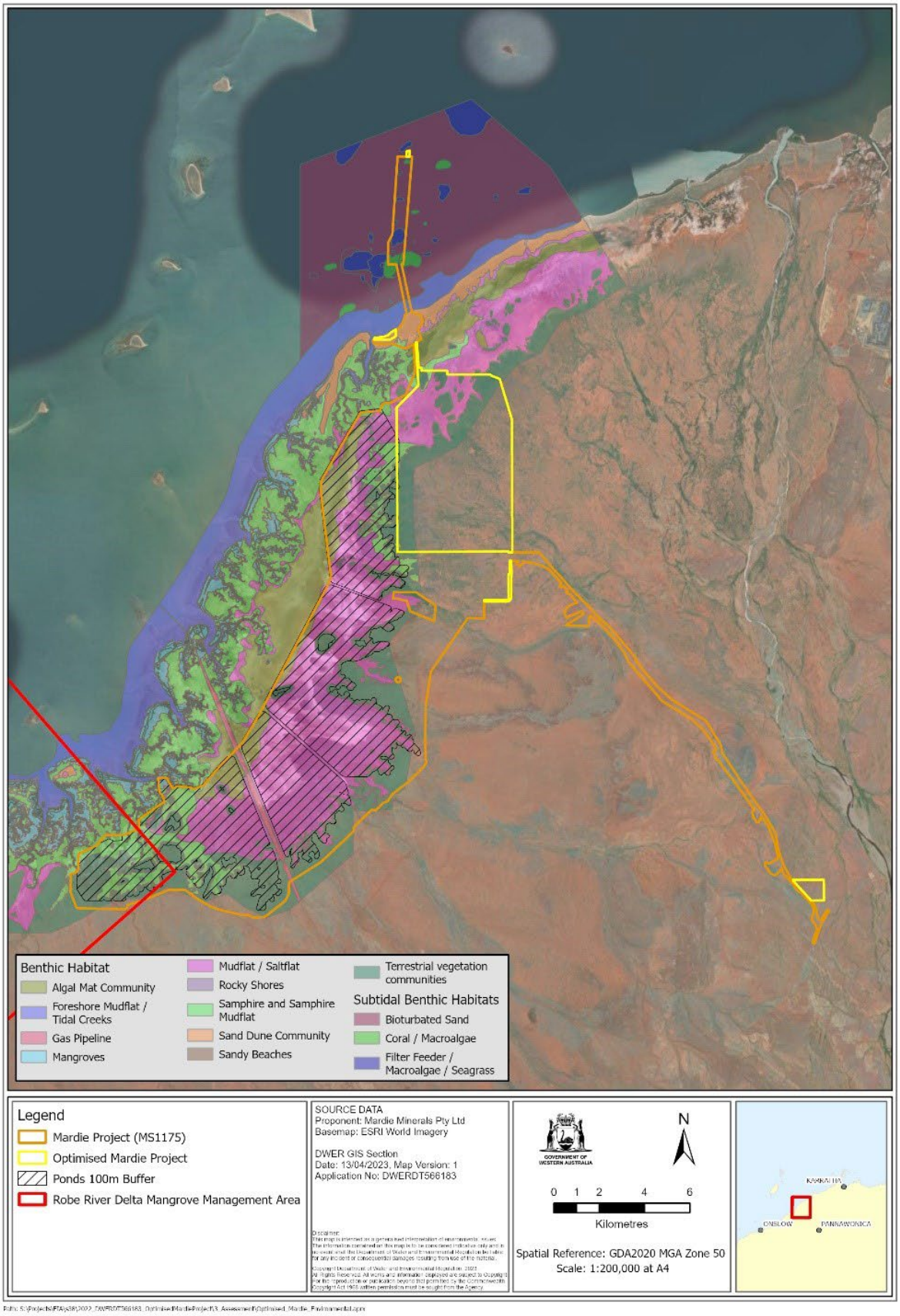

Figure 2: Benthic communities and habitats within the significant amendment and original proposal area

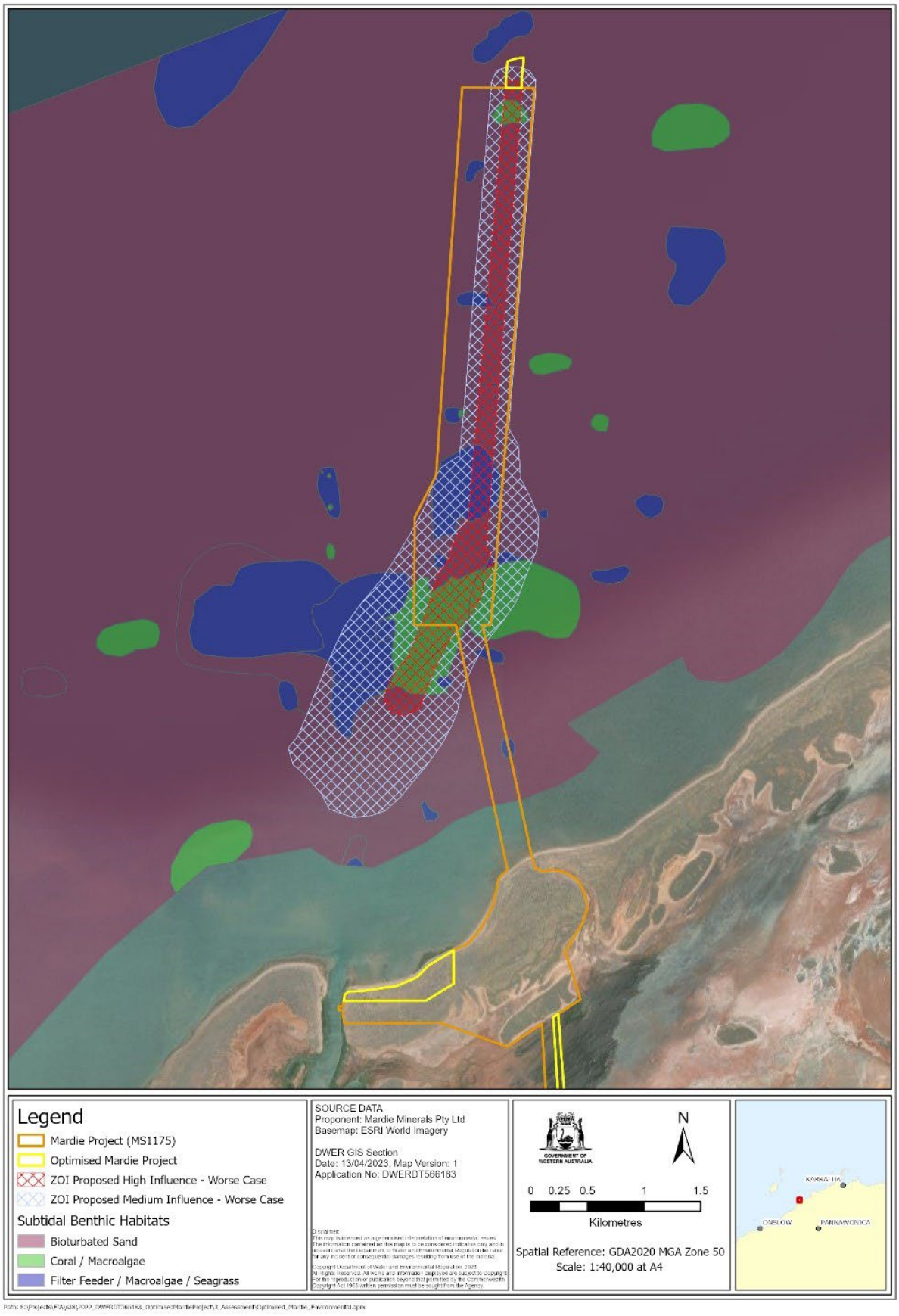

Figure 3: Dredge envelope with zones of influence

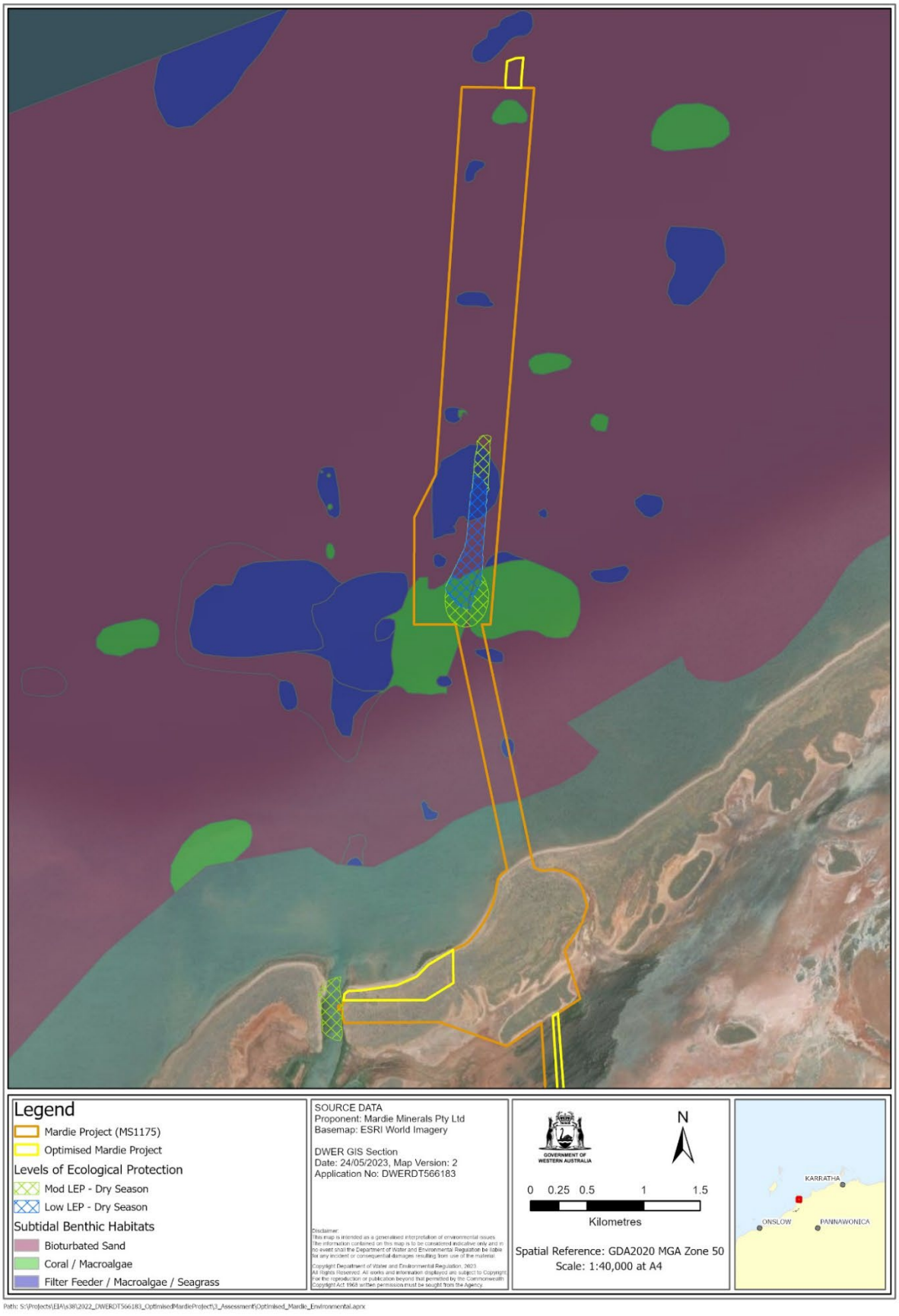

Figure 4: Level of ecological protection areas around diffuser location

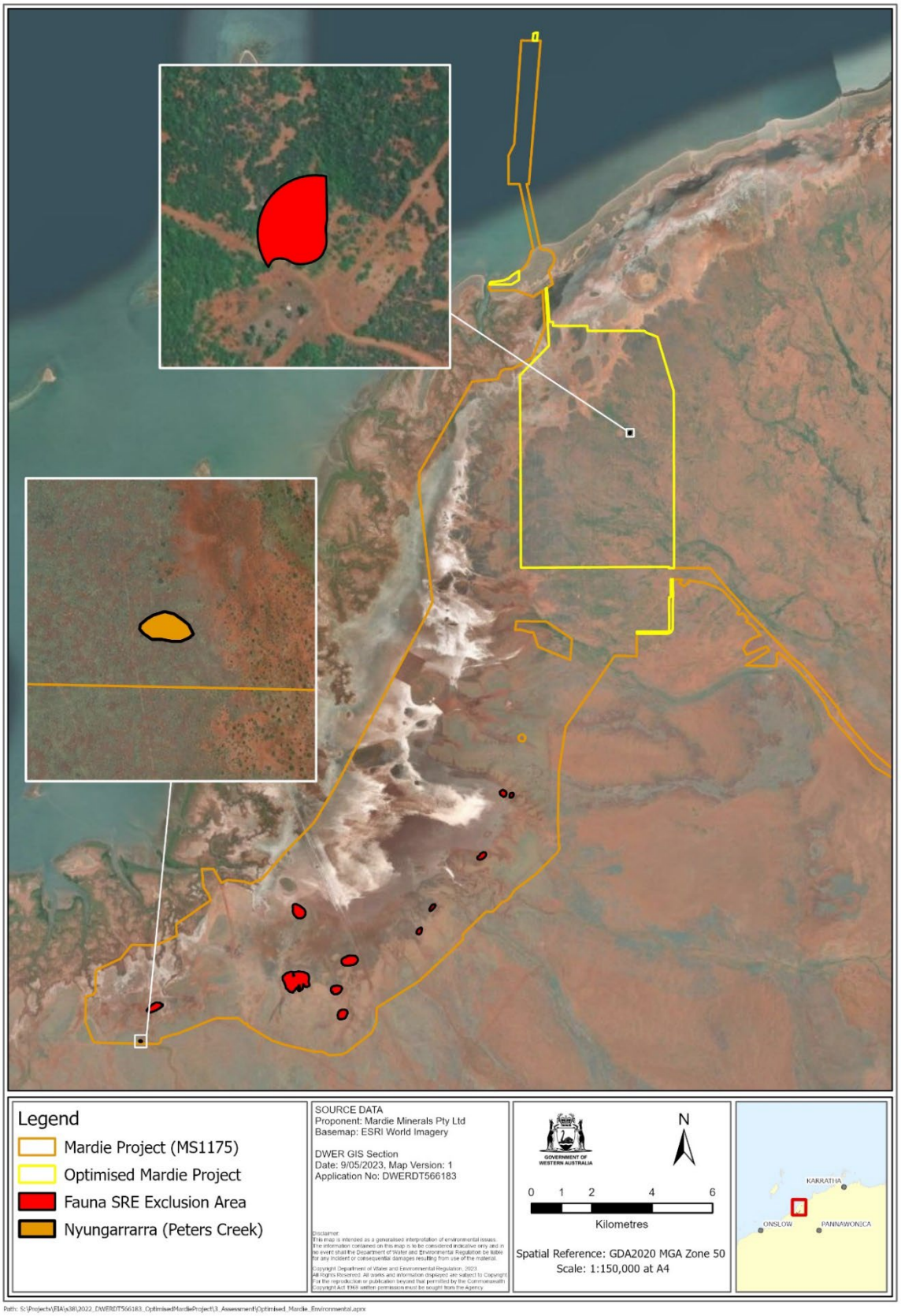

Figure 5: Short Range Endemic fauna exclusion zones and Peters Creek exclusion zone

Schedule 2

Proponent residual Impacts and Risk Management Measures – Optimised Mardie Project (Condition B10)

Project	Value and Timeframe	Cost
Project A	Mapping of the original and current extent of Samphire and Algal mat on the west Pilbara Coast.	$1,500,000 prior to the commencement of construction.
Project B	Identify and quantify the potential effects of sea level rise on mangroves, samphire and algal mat on the west Pilbara Coast.	$500,000 prior to the commencement of construction.
Project C(i)	Identify the ecological roles, values and functions of algal mat on the west Pilbara coast.	$500,000 prior to the commencement of construction.
Project C(ii)	Identify the ecological roles, values and functions of intertidal benthic communities and habitat on the west Pilbara coast.	$2,102 per hectare of algal mat, coastal samphire or mangroves that monitoring indicates has been lost due to project-attributable indirect impacts, or subject to loss of health, per cent cover or diversity of intertidal within 3 months of the loss being identified.
Project C(iii)	Identify the ecological roles, values and functions of intertidal benthic communities and habitat on the west Pilbara coast.	$2,102 per hectare of mangroves within the RRDMMA, that the CEO has approved to be disturbed, prior to the commencement of disturbance within the RRDMMA.
Project D		Provision of $300,000 (adjusted yearly for CPI) to fund research and management programs (through WAMSI, DBCA or independently - for example the RAD project referred to in Section 4.2.1) to preserve, maintain and grow high value sub-tidal BCH in the region. $500,000 held in reserve (adjusted yearly for CPI) to extend the research and management programs described above if indirect impacts are greater than predicted and attributed to the Proposal.

Appendix B: Decision-making authorities

Table B1: Identified relevant decision-making authorities for the proposal

Decision-Making Authority	Legislation (and approval)
1. Minister for Aboriginal Affairs	*Aboriginal Heritage Act 1972* section 18 consent to impact a registered Aboriginal heritage site) *Aboriginal Cultural Heritage Act 2021*
2. Minister for Environment	*Biodiversity Conservation Act 2016* section 40 authority to take or disturb threatened species and section 45 authority to modify occurrence of a threatened ecological community
3. Minister for Mines and Petroleum	*Mining Act 1978* - granting of a new mining lease - approval to lease, transfer or otherwise dispose of land under the Land Administration Act (note: applies when land is leased or disposed of under the LAA)
4. Minister for Ports	*Port Authorities Act 1999* lease/licence/easement of land within control of Port Authority (term exceeding 5 years) approval for Port Authority to sell port land that is Crown land
5. Minister for Water	*Rights in Water and Irrigation Act 1914* - permit to interfere with beds and banks - licence to construct or alter a well - permit to take water - dewatering licence
6. Chief Executive Officer, Department of Biodiversity, Conservation and Attractions	*Biodiversity Conservation Act 2016* - authority to take flora and fauna (other than threatened species)
7. Chief Health Officer, Department of Health	*Health Act 1911* Health (Treatment of Sewage and Disposal of Effluent and Liquid Waste) Regulation 1974
8. Chief Dangerous Goods Officer Department of Mines, Industry Regulation and Safety	*Dangerous Goods Safety Act 2004* storage and handling of dangerous goods security risk substance storage licence
9. Executive Director Resource and Environmental Compliance, Department of Mines, Industry Regulation and Safety	*Mining Act 1978* - mining proposal - mine closure plan

10. Director General, Department of Transport	*Jetties Act 1926* construction of jetty *Marine Navigational Aids Act 1973* *Navigable Waters Regulations 1958* Reg 8 Permission to throw into or place things in port, harbour or navigable waters
11. Chief Executive Officer, Department of Water and Environmental Regulation	*Environmental Protection Act 1986* - part V works approval and licence - part V clearing permit
12. Chief Executive Officer, Pilbara Ports Authority	*Port Authorities Act 1999* Lease/license/easement of land within control of Port Authority
13. Commissioner for Main Roads	*Road Traffic (Vehicles) Act 2012* - heavy haulage approval
14. Chief Executive Officer Shire of Karratha	*Local Government Act 1995* development approval and scheme amendment *Building Act 2011* - permit for worker accommodation *Planning and Development Act 2005* - extractive industries licence

Appendix C: Environmental Protection Act principles

Table C1: Consideration of principles of the *Environmental Protection Act 1986*

EP Act principle	Consideration
1. The precautionary principle *Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.* *In application of this precautionary principle, decisions should be guided by –* *(a) careful evaluation to avoid, where practicable, serious or irreversible damage to the environment; and* *(b) an assessment of the risk-weighted consequences of various options.*	The EPA has considered the precautionary principle in its assessment and has had particular regard to this principle in its assessment of inland waters, social surroundings, terrestrial fauna, marine fauna, and benthic communities and habitats. The assessment of these impacts is provided in this report. For social surroundings and terrestrial fauna, the proponent relocated the quarry away from Aboriginal heritage sites and northern quoll denning/shelter habitat. The EPA is satisfied that these additional actions, if implemented, would mean that the Optimised Mardie Project is not likely to be inconsistent with the EPA's objectives and that the measures are consistent with the precautionary principle.
2. The principle of intergenerational equity *The present generation should ensure that the health, diversity and productivity of the environment is maintained and enhanced for the benefit of future generations.*	The EPA has considered the principle of intergenerational equity in its assessment and has had particular regard to this principle in its assessment of benthic communities and habitats, marine fauna, flora and vegetation, terrestrial fauna and social surroundings. The EPA is of the view that consistency with this principle could be achieved with the implementation of its recommended conditions, which requires the proponent to: • implement the cultural heritage management plan and engage in ongoing consultation with Traditional Owners. • implementation of the marine turtle monitoring plan and illumination environmental management plan. • maintain levels of ecological protection within the marine environment. • limit the extent of disturbance to flora, vegetation, and fauna habitat types. • contribute to the PEOF for future landscape-scale environmental offset projects, to counterbalance the significant residual impact to vegetation and threatened fauna habitats within the Pilbara.

EP Act principle	Consideration
	• contribute to the WAMSI led Mardie Marine Intertidal Research Study. The EPA has concluded that the environmental values will be protected, and the health, diversity and productivity of the environment will be maintained for the benefit of future generations.
3. The principles of the conservation of biological diversity and ecological integrity *Conservation of biological diversity and ecological integrity should be a fundamental consideration.*	The EPA has considered the principle of conservation of biological diversity and ecological integrity in its assessment, and has had particular regard to this principle in its assessment of flora and vegetation, terrestrial fauna, marine fauna and benthic communities and habitat. The EPA has considered to what extent the potential impacts from the Optimised Mardie Project to these environmental factors can be ameliorated, to ensure consistency with this principle, including by provision of offsets. Surveys have been used to confirm the range and status of environmental values within the vicinity of the Optimised Mardie Project. Disturbance within areas of noted higher biological diversity (i.e., mangroves, creek lines, rocky outcrops etc.) has been avoided or minimised. Priority has been given to maintaining natural ecological and landscape processes wherever practicable (Preston Consulting 2022). The EPA has concluded that given the nature of the impacts, the proposed offset of contributing to the Pilbara Environmental Offset Funds, are likely to counterbalance the impacts of the loss of terrestrial biological diversity and ecological integrity. The EPA has concluded that the actions to avoid and minimise impact to marine fauna and benthic communities and habitat, which are also recommended as conditions (contribution to the WAMSI led Mardie Marine Intertidal Research Study), will likely conserve marine biological diversity and ecological integrity, so that environmental outcomes are achieved.
4. Principles relating to improved valuation, pricing and incentive mechanisms • Environmental factors should be included in the valuation of assets and services. • The polluter pays principle — those who generate pollution and waste should bear the cost of containment, avoidance or abatement.	In considering this principle, the EPA notes that the proponent will bear the costs relating to implementing the Optimised Mardie Project to achieve environmental outcomes, and management and monitoring of environmental impacts during construction, operation and decommissioning of the Optimised Mardie Project. The EPA has had particular regard to this principle in considering the residual impacts of the Optimised Mardie Project on inland waters, marine fauna, benthic communities and habitats, flora and vegetation, terrestrial fauna and social surroundings.

EP Act principle	Consideration
• The users of goods and services should pay prices based on the full life cycle costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any wastes. • Environmental goals, having been established, should be pursued in the most cost-effective way, by establishing incentive structures, including market mechanisms, which enable those best placed to maximise benefits and/or minimise costs to develop their own solutions and responses to environmental problems.	
5. The principle of waste minimisation *All reasonable and practicable measures should be taken to minimise the generation of waste and its discharge into the environment.*	The EPA has considered the principle of waste minimisation in its assessment and has had particular regard to this principle in its assessment. The EPA notes the proponent is proposing to minimise the discharge of waste into the environment by: • processing of bitterns to extract SoP and other by products. • utilising the desalination plant waste brine by adding it to the evaporation pond sequence, where suitable. • targeting land with low permeability soils to avoid the requirement for pond liners at all concentrator and crystalliser ponds. • utilising cut-and-fill construction methods for the pond walls. Accordingly, the Optimised Mardie Project is considered to meet the objectives of the 'Principle of Waste Minimisation'.

Appendix D: Other environmental factors

Table D1: Evaluation of other environmental factors

Environmental factor	Description of the proposal's likely impacts on the environmental factor	Government agency and public comments	Evaluation of why the factor is not a key environmental factor
Sea			
Marine environmental quality	Marine environmental quality may be impacted by: • additional 10 ha (65 ha combined total) of dredging area. No change in dredge volume (up to 800,000 m^3) • change in sedimentation impacts associated with the revised dredge channel • increase turbidity due to 20% increase in vessel movements • increased risk of spills of salt products during transfer to port vessels • hydrocarbon spills from vessels • increase in brine (bitterns) discharge from 3.6 to 5.5 GL/a (53%) • inclusion of new seawater intake and increase in seawater intake from 150 to 180 GL/a (20%).	Department of Primary Industries and Regional Development considered the need for nearshore subtidal monitoring to assess the status of habitats.	Marine environmental quality was not identified as a preliminary key environmental factor when the EPA set the level of assessment. The assessment of marine environmental quality within the Optimised Mardie Project area concluded that: • The Optimised Mardie Project has avoided additional marine environmental quality impacts by locating the additional seawater intake within the existing HEPA boundary • Works approval and license to be issued under Part V of the EP Act (includes bitterns disposal) • Development application to be approved under the *Port Authorities Act 1999* for activities within PPA-managed lands and waters. • The implementation of the MEQMMP, DMP and BCHMMP to monitor and mitigate impacts • The proponent's mitigation measures for unintentional spillage or seepage of brine are sufficient • Concentrator and crystalliser ponds will be designed and constructed to be safe and stable according to DMIRS requirements

Environmental factor	Description of the proposal's likely impacts on the environmental factor	Government agency and public comments	Evaluation of why the factor is not a key environmental factor
			• Lower indirect sedimentation impacts on BCH from dredging activities, and reduced size of ZoMI and ZoHI (discussed in DMP) • Changes to MEPA extent with a 3.5 ha increase in sparse to low BCH impact, but 4.4 ha reduction in moderate cover BCH (discussed in MEQMMP). Potential impacts of the Optimised Mardie Project that is associated with sedimentation on BCH from dredging activities and changes to the MEPA extent is assessed and discussed under inland waters (section 2.1), and benthic communities and habitats (section 2.2). It is not likely that the Optimised Mardie Project will have significant impact on marine environmental quality, and the Optimised Mardie Project is likely to be consistent with this factor. Accordingly, the EPA did not consider marine environmental quality to be a key environmental factor at the conclusion of its assessment.
Air			
Greenhouse gas emissions	Estimated GHG emissions have been modelled as Scope 1 - 64,798 tCO2-e (annual average, estimated Scope 1 emissions)	No comments were received for this factor during consultation.	Greenhouse gas was not identified as a preliminary key environmental factor when the EPA set level of assessment. The Mardie Project was predicted to contribute 45,760 tCO_2-e of scope 1 emissions (over the first two years from vegetation clearing) and 53,292 tCO_2-e per year of scope 2 emissions (from natural gas and diesel consumption) during operations, to produce 4.4 Mtpa of salt. The Optimised Mardie Project will increase production to 5.35 Mtpa (21.5%). The EPA notes that the Optimised Mardie Project will increase Scope 1 emissions to 64,798 tCO_2-e per year. Given the low export volumes and product transport distances within Australia, Scope 3 emissions are not expected to be significant (Preston Consulting 2022).

Environmental factor	Description of the proposal's likely impacts on the environmental factor	Government agency and public comments	Evaluation of why the factor is not a key environmental factor
			Having regard to: • the significance considerations in the Statement of Environmental Principles, Factors and Objectives (EPA 2020) • the scope 1 emissions do not exceed 100,000 tpa CO_2-e per annum • Environmental Factor Guideline – Greenhouse Gas Emissions (EPA 2020) the passive nature of the Optimised Mardie Project (evaporative solar project that utilises seawater to produce raw salts) the EPA considers it is unlikely the Optimised Mardie Project would have a significant impact on greenhouse gas emissions and that the impacts to this factor are manageable. Accordingly, the EPA did not consider greenhouse gas emissions to be a key environmental factor at the conclusion of its assessment.

Appendix E: Relevant policy, guidance and procedures

The EPA had particular regard to the policies, guidelines and procedures listed below in the assessment of the Optimised Mardie Project.

- *Environmental factor guideline – Air quality* (EPA 2020)
- *Environmental factor guideline – Benthic communities and habitats* (EPA 2016)
- *Environmental factor guideline – Coastal processes* (EPA 2016)
- *Environmental factor guideline – Flora and vegetation* (EPA 2016)
- *Environmental factor guideline – Greenhouse gas emissions* (EPA 2020)
- *Environmental factor guideline – Inland waters* (EPA 2018)
- *Environmental factor guideline – Marine environmental quality* (EPA 2016)
- *Environmental factor guideline – Marine fauna* (EPA 2016)
- *Environmental factor guideline – Social surroundings* (EPA 2016)
- *Environmental factor guideline – Terrestrial fauna* (EPA 2016)
- *Environmental impact assessment (Part IV Divisions 1 and 2) procedures manual* (EPA 2021)
- *WA Environmental Offsets Policy* (Government of Western Australia 2011)
- *WA Environmental Offsets Guidelines* (Government of Western Australia 2014)
- *Statement of environmental principles, factors, objectives and aims of EIA* (EPA 2021)
- Environmental impact assessment (Part IV Divisions 1 and 2) administrative procedures 2021 (State of Western Australia 2021)
- *Technical guidance – Environmental impact assessment of marine dredging proposals* (EPA 2021)
- *Technical guidance – Flora and vegetation surveys for environmental impact assessment* (EPA 2016)
- *Technical guidance – Protection of benthic communities and habitats* (EPA 2016)
- *Technical guidance – Sampling of short-range endemic invertebrate fauna* (EPA 2016)
- *Technical guidance – Terrestrial vertebrate fauna surveys for environmental impact assessment* (EPA 2020).

Appendix F: List of submitters

7-day comment on referral

Organisations and public

- Four public submissions were received from two organisations and two individuals

Government agencies

- None

Public review of proponent information

Organisations and public

- Six public comments from two organisations and three individuals

Government agencies

- One public comment from one government agency

Appendix G: Assessment timeline

Date	Progress stages	Time (weeks)
28 April 2022	EPA decided to assess – level of assessment set	
15 July 2022	EPA requested additional information	11
16 August 2022	EPA received additional information	4
5 September 2022	EPA released additional information for public review	3
4 October 2022	Public review period for additional information closed	4
23 March 2023	EPA received proponent's Response to Submissions	24
27 April 2023	EPA completed its assessment (s. 44(2b))	5
15 May 2023	EPA accepted proponent's Response to Submissions	2
14 June 2023	EPA provided report to the Minister for Environment	5
19 June 2023	EPA report published	3 days
10 July 2023	Appeals period closed	3

Timelines for an assessment may vary according to the complexity of the proposal and are usually agreed with the proponent soon after the EPA decides to assess the proposal and records the level of assessment.

In this case, the EPA met its timeline objective to complete its assessment and provide a report to the Minister.

Appendix H

Ministerial condition	Environmental factor	Proposed change	Assessment and evaluation of proposed changes: will the change ensure the combined proposal (existing proposal with Optimised Mardie Project) can be implemented consistently with the EPA objectives?
Condition 1 Proposal implementation	N/A	Delete condition and replace with consolidated contemporary style condition.	Recommended condition A1. EPA recommends condition 1 is replaced with a new condition setting the maximum limits on proposal characteristics which will ensure the implementation of the proposal is consistent with the EPA's objectives. This condition reflects contemporary conditions setting approach recommended by the EPA.
Condition 2 RRDMMA	Inland Waters/Benthic Communities and Habitats	Delete condition and replace with consolidated contemporary style condition.	Condition 2 relates to the RRDMMA. The EPA has reviewed each proponent commitment and considers they fall into the following categories: • Requirements addressed in conditions B1-2(1), B3-1 and B3-4 • Requirements addressed in condition B10 • Requirements addressed in condition C1-6
Condition 3	Inland Waters	Delete condition and replace with consolidated contemporary style condition.	Recommended condition B3, C4 and C5. The design of the intertidal causeway satisfied the outcomes of condition 3-1 (3) and 3-2 on 4 August 2022. The GMMP is still relevant for the Optimised Mardie Project. The approved plan is required to be implemented through recommended condition B3-2.

Ministerial condition	Environmental factor	Proposed change	Assessment and evaluation of proposed changes: will the change ensure the combined proposal (existing proposal with Optimised Mardie Project) can be implemented consistently with the EPA objectives?
			The requirements of this condition are still relevant and will be retained consistent with contemporary condition setting approach recommended by the EPA.
Condition 4 Marine Environmental Quality (Operations)	Marine Environmental Quality	Delete condition and replace with consolidated contemporary style condition.	Recommended condition B4, C4 and C5. The MEQMMP is still relevant for the Optimised Mardie Project. The approved plan is required to be implemented through recommended condition B4-3. The requirements of this condition are still relevant and will be retained consistent with contemporary condition setting approach recommended by the EPA.
Condition 5	Flora and Vegetation	Delete condition and replace with consolidated contemporary style condition.	Recommended condition A1 and B7. MS 1175 conditions which have been met: • Condition 5-2 and condition 5-3(1) pre-clearance surveys were completed. • Condition 5-3(2) (b) requiring development of a research strategy was approved on 20 September 2022. Recommended condition B7-1(4) provides an outcome to ensure no project attributable indirect impacts from the introduction or spread of environmental weeds.

Ministerial condition	Environmental factor	Proposed change	Assessment and evaluation of proposed changes: will the change ensure the combined proposal (existing proposal with Optimised Mardie Project) can be implemented consistently with the EPA objectives?
			The requirements of this condition are still relevant and will be retained consistent with contemporary condition setting approach recommended by the EPA.
Condition 6 Benthic communities and habitat monitoring and management plan	Benthic Communities and Habitats	Delete condition and replace with consolidated contemporary style condition.	Recommended condition A1, B1 and C4. Recommended condition B1-2(5) provides an outcome to ensure no adverse impact on the ecological processes or habitats that sustain the bluespotted emperor fishery. The BCHMMP is still relevant for the Optimised Mardie Project. The approved plan is required to be implemented through condition B1-4. The requirements of this condition are still relevant and will be retained consistent with contemporary condition setting approach recommended by the EPA.
Condition 7 Benthic communities and habitat and marine environmental quality	Marine Fauna Dredge Management Plan	Delete condition and replace with consolidated contemporary style condition.	Recommended condition B5 and C4. The DMP is still relevant for the Optimised Mardie Project. The approved plan is required to be implemented through B5-4 and C4. The requirements of this condition are still relevant and will be retained consistent with contemporary condition setting approach recommended by the EPA.
Condition 7	Marine Fauna	Delete condition and replace with consolidated	Recommended condition B2.

Ministerial condition	Environmental factor	Proposed change	Assessment and evaluation of proposed changes: will the change ensure the combined proposal (existing proposal with Optimised Mardie Project) can be implemented consistently with the EPA objectives?
Benthic communities and habitat and Marine environmental quality	Marine Pest Management Procedure	contemporary style condition.	The Marine Pest Management Procedure (MPMP) is still relevant for the Optimised Mardie Project. The MPMP was approved on 13 September 2022 and is required to be implemented through recommended condition B2-2. The requirements of this condition are still relevant and will be retained consistent with contemporary condition setting approach recommended by the EPA.
Condition 8	Terrestrial Fauna	Delete condition and replace with consolidated contemporary style condition.	Recommended condition B6. Grey falcons were not recorded in the original proposal but were recorded for the Optimised Mardie Project. The EPA has recommended condition B6-1(2) ensure there is no change in the nesting density of grey falcons. Condition 8-6 SRE preclearance surveys were submitted and condition 8-7(2) demonstrated avoidance and minimisation of impacts –approved on 2 March 2022 The requirements of this condition are still relevant and will be retained consistent with contemporary condition setting approach recommended by the EPA.
Condition 9 Illumination and lighting	Marine Fauna and Terrestrial Fauna	Delete condition and replace with consolidated contemporary style condition.	Recommended condition B6-6, C1-1(2) and C4-2 A staged approach has been approved for the Illumination Plan noting that for each stage the proponent is required to get the

Ministerial condition	Environmental factor	Proposed change	Assessment and evaluation of proposed changes: will the change ensure the combined proposal (existing proposal with Optimised Mardie Project) can be implemented consistently with the EPA objectives?
			updated Illumination Management Plan approved prior to commencing ground disturbing activities for that stage. The requirements of this condition are still relevant and will be retained consistent with contemporary condition setting approach recommended by the EPA.
Condition 10	Marine Fauna	Delete condition and replace with consolidated contemporary style condition.	Recommended conditions B5 and A1. The EPA has reviewed each proponent commitment and considers they fall into the following categories: • B5-1(1) and B5-1(3) includes outcomes to protect marine fauna • B5-5 imposes speed limits on all project related vessels and export vehicles • B5-6 ensures the proponent undertakes certain activities during pile driving • B5-7 ensures the proponent undertakes certain activities during dredging • B5-8 ensures the proponent shall not conduct dredging or pile driving during the period October to January (inclusive). The requirements of this condition are still relevant and will be retained consistent with contemporary condition setting approach recommended by the EPA.
Condition 11	Social Surroundings	Delete condition and replace with consolidated contemporary style condition.	Recommended condition B8, C4 and C5.

Ministerial condition	Environmental factor	Proposed change	Assessment and evaluation of proposed changes: will the change ensure the combined proposal (existing proposal with Optimised Mardie Project) can be implemented consistently with the EPA objectives?
			CHMP has been updated to incorporate the Optimised Mardie Project and submitted to DWER, however is still under assessment. The CHMP is regulated through condition B8-3. The requirements of this condition are still relevant and will be retained consistent with contemporary condition setting approach recommended by the EPA.
Condition 12 Monitoring and adaptive management program	N/A	Delete condition and replace with consolidated contemporary style condition.	Recommended condition C4. The Monitoring and Adaptive Management Plan was submitted, although is required to be updated to include the Optimised Mardie Project. The requirements of this condition are still relevant and will be retained consistent with contemporary condition setting approach recommended by the EPA.
Condition 13 Terrestrial offsets	N/A	Delete condition and replace with consolidated contemporary style condition.	Recommended condition B9 and A1. The requirements of this condition are still relevant and will be retained consistent with contemporary condition setting approach recommended by the EPA. Condition 13-6 (impact reconciliation procedure) was approved on 21 December 2022. The EPA has recommended B9-3(4) requiring offsets for clearing supporting habitat for conservation significant species

Ministerial condition	Environmental factor	Proposed change	Assessment and evaluation of proposed changes: will the change ensure the combined proposal (existing proposal with Optimised Mardie Project) can be implemented consistently with the EPA objectives?
			which were not impacted by the original proposal but will be impacted by the Optimised Mardie Project. Contribution rates have been updated for the original proposal.
Condition 14 Marine and intertidal research offsets	N/A	Delete condition and replace with consolidated contemporary style condition.	Recommended condition B10. Conditions 14-1 (payments for offset fund), condition 14-2 (WAMSI offset plan), 14-3 (financial arrangements) and 14-5 (providing documentation of agreement) has been met for the Mardie Project. The EPA notes the summary offsets plan will need to be updated to incorporate the Optimised Mardie Project. The EPA has recommended condition B10-1(4) requiring funding research for the bluespotted emperor. The requirements of this condition are still relevant and will be retained consistent with contemporary condition setting approach recommended by the EPA.
Condition 15 Environmental performance report	N/A	Delete condition and replace with consolidated contemporary style condition.	Recommended condition D2 The requirements of this condition are still relevant and will be retained consistent with contemporary condition setting approach recommended by the EPA.

Ministerial condition	Environmental factor	Proposed change	Assessment and evaluation of proposed changes: will the change ensure the combined proposal (existing proposal with Optimised Mardie Project) can be implemented consistently with the EPA objectives?
Condition 16 Contact details	N/A	Delete condition and replace with consolidated contemporary style condition.	Recommended condition D3 The requirements of this condition are still relevant and will be retained consistent with contemporary condition setting approach recommended by the EPA.
Condition 17 Time limit for proposal implementation	N/A	Delete condition and replace with consolidated contemporary style condition.	Recommended condition D4 The requirements of this condition are still relevant and will be retained consistent with contemporary condition setting approach recommended by the EPA.
Condition 18 Compliance reporting	N/A	Delete condition and replace with consolidated contemporary style condition.	Recommended condition D2 Condition 18-1 and 18-2 (Compliance Assessment Plan) has been met for the Mardie Project. The requirements of this condition are still relevant and will be retained consistent with contemporary condition setting approach recommended by the EPA.
Condition 19 Public available data	N/A	Delete condition and replace with consolidated contemporary style condition.	Recommended condition D5 The requirements of this condition are still relevant and will be retained consistent with contemporary condition setting approach recommended by the EPA.

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