Yandicoogina Iron Ore Project – Revised Proposal

Response to Submissions

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1 Introduction

1.1 YANDICOOGINA IRON ORE PROJECT – REVISED PROPOSAL

Hamersley Iron – Yandi Pty Limited (a member of the Rio Tinto group of companies) is seeking to develop a new brownfields iron ore mine pit to sustain its existing Yandicoogina Operations (Yandi Operations) in the central Pilbara region of Western Australia (WA). This proposal is referred to as the 'Yandicoogina Pocket and Billiard South Iron Ore Development' (the Proposal) and will involve construction and operation of a new mine pit, waste dumps and associated infrastructure to enable sustained production from the existing Yandi Operations. Collectively, the Proposal and the existing Yandi Operations are referred to as the 'Revised Proposal'. The Proposal is expected to have a total throughput of up to 31 million tonnes per annum (Mtpa), as the existing Yandi Operations are depleted, and is expected to have an operational mine life of approximately 16 years. Hamersley Iron – Yandi Pty Limited is the proponent for the Proposal (Proponent).

The Proposal Area is defined by a specific geographical outer boundary or 'Development Envelope', and is located approximately 90 kilometres (km) north-west of Newman and 300 km south-east of Dampier in the Pilbara region of WA. The Development Envelope covers approximately 19,351 hectares (ha). The existing Yandi Operations include clearing of up to 5,660 ha of vegetation. The Proposal includes vegetation clearing of up to 1,800 ha, including up to 1,300 ha for mining and waste dumps and up to 500 ha for infrastructure.

The reader is referred to the Yandicoogina Iron Ore Project – Revised Proposal Public Environmental Review (PER) document (Eco Logical Australia 2015) for a detailed description of the Proposal. The location of the Development Envelope is provided in Figure 2 of the PER document.

1.2 ASSESSMENT PROCESS

The Proposal was referred to the Western Australian (WA) Environmental Protection Authority (EPA) under Section 38 of the WA *Environmental Protection Act 1986* (EP Act) on 4 July 2014. The EPA determined that the Proposal required environmental assessment at the level of Public Environmental Review (PER) with a six week public review period, whereby the Proponent must fulfil the requirements of Clause 10.2 of the Environmental Impact Assessment (Part IV Division 1) Administrative Procedures 2012 (Administrative Procedures) for environmental assessment prescribed under the EP Act.

The EPA issued an Environmental Scoping Document (ESD) for the Proposal on 31 December 2014. The ESD provides an outline of the preliminary key environmental factors, a description of the scope of the assessment of the Proposal and an indicative timeline for the assessment process. The PER document was subsequently prepared, which described the Proposal and its likely effects on the environment. The PER document was released for public comment on 2 November 2015 for a period of six weeks, ending on 14 December 2015.

The Proposal was also referred to the Commonwealth Department of the Environment (DoE) under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) on 26 September 2014. The DoE determined on 25 October 2014 that the Proposal was 'not a controlled action' (Decision notice 2014-7343) and therefore does not require assessment and approval under the EPBC Act.

1.3 PURPOSE AND STRUCTURE OF THIS DOCUMENT

Four submissions were received during the formal public comment period for the PER. This document provides responses from the Proponent to a summary of issues raised in the submissions made on the PER. The summary of issues was collated by the Office of the Environmental Protection Authority (OEPA) and provided to the Proponent in accordance with the requirements of Clause 10.2.6 of the Administrative Procedures. The responses presented in this document have been prepared in accordance with Clause10.2.6 of the Administrative Procedures.

This document also describes additional key studies completed for the Proposal and additional consultation undertaken since the PER was finalised in advance of its public review period in November 2015, and provides a checklist comparing relevant aspects of the Proposal against EPA policies. It is structured as follows:

- Background, EPA assessment process, purpose of the document and recent changes to the Proposal (Section 1).
- Proponent responses to issues raised in the public submissions (Section 2). Figures prepared in response to submissions received on the PER are provided in **Appendix A** of this document.
- Additional studies undertaken for the Proposal since the finalisation of the PER (Section 3). Key studies are provided in **Appendix B** (the CD attached to this document).
- Additional consultation undertaken since the finalisation of the PER and the ongoing consultation program (Section 4). Details of consultation undertaken, topics raised and outcomes (and Proponent response where relevant) are provided in **Appendix C** of this document.
- Checklist comparing relevant aspects of the Proposal against EPA policies (**Appendix D**).

1.4 CHANGES TO THE PROPOSAL SINCE THE RELEASE OF THE PER DOCUMENT

During the Proposal feasibility study, detailed engineering designs identified the need for a 10 m wide light vehicle access road along the western margin of the proposed flood protection levee. The access road is required to allow access for construction, rock armouring and ongoing maintenance of the levee (including safety and structural inspections), as well as to provide access to Weeli Wolli Creek for hydrological, riparian and aquatic fauna monitoring purposes. The proposed access road will also allow access for deconstruction of the levee upon closure. An additional 5.5 ha of clearing within the broader floodplain will be required to facilitate construction of the access road, bringing the total clearing within the mapped creekline vegetation units to approximately 57 ha. The total proposed clearing within creekline vegetation will remain within the estimated 69 ha of disturbance as described in Section 14.3.1 of the PER document, as this estimate allowed for some flexibility to accommodate changes to engineering designs, such as the proposed access road.

2 Response to submissions

The OEPA provided a submission on the Proposal and received submissions from the Department of Parks and Wildlife (Parks and Wildlife), Department of Mines and Petroleum (DMP), Department of Water (DoW) and Department of Aboriginal Affairs (DAA) during the public review period.

Detailed responses to the summary of public submissions prepared by the OEPA are provided in **Table 1**. Figures accompanying the responses are provided in **Appendix A**. Related supporting documents not previously provided in the PER are provided in **Appendix B** (the CD attached to this document), while the consultation undertaken by the Proponent since the finalisation of the PER in advance of its public review period is summarised in **Appendix C**.

Table 1: Response to submissions

Issue no.	Submitter	Submission and/or issue	Proponent response
Flora and vegetation			
1	Parks and Wildlife	Please note that as of 3 November 2015 the publication of the Wildlife Conservation (Rare Flora) Notice 2015 in the Government Gazette, *L. catapycnon* is no longer declared as rare flora.	Noted. Populations of *Lepidium catapycnon* will be avoided until the species' conservation status has been re-evaluated under the EPBC Act.
2	DoW	Please note that the channel iron deposit (CID) doesn't align with the riparian vegetation and cannot be relied upon to infer drawdown in the riparian zone. Provide further estimation and discussion of impacts to riparian zone whilst taking this into consideration.	While there are limited historical water level data available for the riparian zone outside the CID, the DoW stated in its submission on the Proposal that, whilst limited, available bore data suggests that the pre-mining depth to groundwater near the confluence of Marillana and Weeli Wolli creeks was approximately 6-8 m. This approximate depth seems realistic and is supported by the general lack of baseline *Melaleuca argentea* co-dominated communities along this portion of the creek, as well as the absence of evidence from historical vegetation data (Integrated Environmental Services 1981) of obligate phreatophytes (strictly groundwater dependent) forming a component of the vegetation occurring near the Proposal Area. The depth to groundwater is likely to have been variable along the length of Weeli Wolli Creek, which is predicted to be within the potential zone of influence from the Proposal. Baseline groundwater elevation modelling for the section of Weeli Wolli Creek adjacent to the Proposal Area predicted a groundwater table 20-50 m below ground for the majority of the creek and 12-20 m below ground for the remainder of the floodplain. With respect to riparian vegetation and the components at risk of impact from drawdown; the degree to which drawdown is likely to propagate away from the CID and into surrounding lithologies (and ultimately influence the riparian alluvials) is such that obligate phreatophytes are the key component considered at elevated risk of direct impact from drawdown. Analysis of historical information has shown that records of the obligate phreatophyte *M. argentea* near the Proposal appear to be recent, with individuals of this species

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			likely to have established following the commencement of surplus water discharge from upstream of the Proposal (URS 2015; Rio Tinto 2015). Piezometers have recently been installed in the creekline adjacent to existing Digital Canopy Photography (DCP) tree health monitoring sites to further understand direct ecohydrological responses with current water levels, particularly focussed on the alluvial aquifer. Impacts to the riparian zone are discussed further in the Proponent response to Issue No. 3, No. 4 and No.5.
3	DoW	Considering the riparian vegetation is likely to have adapted to the current groundwater levels, please provide a discussion detailing the potential impacts to vegetation health through groundwater decline rate exceeding rooting growth rates.	It is considered that the potential impacts to vegetation health due to rapid drawdown would be varied depending on the vegetation type/species, its position in the riparian zone, and the hydrological regime in its vicinity. The dewatering activities associated with the Proposal are considered likely to produce losses of individual trees within the Weeli Wolli Creek riparian zone. It is expected that the potential for loss is greatest in areas currently with greatest access to soil moisture, such as within and adjacent to the low-flow channel. However, the majority of these areas would be maintained during the Proposal from surplus water discharge within the creek. Beyond this Proposal, it is expected that the relevant stretch of creek will revert to a system similar to its ephemeral pre-mining state without active restoration through natural process driven by climatic events (e.g. cyclones) and resultant flood events, which provide optimum conditions for the establishment and survival of new propagules. Landscape-scale ecosystem processes such as nutrient cycling, flooding, fire and recruitment will remain unaffected by the Proposal. In order to explain the potential impacts on riparian vegetation in relation to rapid drawdown in more detail, there are two key zones to consider (**Figure A1**; **Appendix A**): 1. The incised-channel/low-flow zone and adjacent banks, where it is predicted that continued discharge will maintain a certain width/depth of adequate alluvial soil pore moisture regardless of the movements of the groundwater table (zone where all relevant groundwater dependent species will occur). 2. The floodplain zone, which includes the upper banks, secondary channels and

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			broader floodplain (where *M. argentea* does not occur, but *Eucalyptus camaldulensis* will occur). **In relation to (1) the incised-channel/low-flow zone and adjacent banks**: During groundwater abstraction and subsequent drawdown, depth to groundwater is considered inconsequential given the ongoing approved surplus water discharge expected to be maintained within the Proposal Area. This discharge is predicted to augment alluvial sediment moisture levels, and as a result, adequate soil-pore moisture in the fringing areas should remain to support the ongoing persistence of riparian vegetation. Alluvial saturation zones, and associated soil pore water in the adjacent capillary fringes may change and become more spatially variable; however, in the upper sediments where moisture presence is most important, adequate soil pore water will likely be maintained, and therefore riparian vegetation should not be subject to unusually high degrees of water stress from groundwater drawdown. A good example for comparison is the development of below water table open cut mine pits adjacent to riparian vegetation communities in the existing Yandi operations. Plate 4 of the PER document and Plate 3 of Rio Tinto (2016a) provide a visual indication from October 2015 of the proximity of riparian vegetation located in the incised channel zone of Marillana Creek adjacent (approximately 50 m) to the existing JSW pit wall. Populations of *M. argentea* (including mature baseline populations), along with vegetation comprising this species as a structural component continue to exist in this area without an observable impact from drawdown associated with the existing mining operations. With the water table beyond the reach of such highly soil water dependant populations, their persistence is inferred as being supported by the saturated alluvials and adjacent pore water of the capillary fringe provided by the perennial surface water regime. **In relation to (2) the floodplain zone**: The majority of this zone occurs outside the area of expected influence from surplus water discharge. There may be some potential for impact from a rapid decline in the groundwater table as a result of drawdown in this zone. The ongoing surplus water discharge since 2007 from Hope

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			Downs 1 (HD1) (as well as the reinjection scheme within the Proposal Area) may have elevated groundwater levels to a point where the root architecture/resource allocation, canopy architecture and standing biomass of riparian tree species in this zone have been influenced accordingly. Such changes may have led to some degree of reliance on access to the groundwater resource and as a result, the ability of certain species/individuals to reallocate resources in response to rapid rates of water table decline may be reduced. In some cases, these changes have the potential to result in increased mortality within certain species and zones of the floodplain habitat. While access to the broader groundwater table in the floodplain zone by key riparian tree species (i.e. *Eucalyptus victrix* and *E. camaldulensis*) has the potential to be diminished as a result of the Proposal, the regular natural surface water flow events on the floodplain are expected to remain. In combination with the likely influence of the artificial base load of surplus water discharge on floodplain inundation frequency, such inputs are likely to be sufficient to maintain the ongoing viability of these key riparian tree species in this zone. These species (those broadly characterised as facultative phreatophytes), have evolved in arid environments, and are known to possess adaptations to survive in conditions of highly variable soil moisture availability. *Eucalyptus camaldulensis* occurs sporadically in this zone and tends to occur either close to the incised channel zone, or in lower micro-topographies and preferential flow zones of key secondary channels, which are most likely to be influenced by the smaller, more regular peak flow events. A full analysis of the influence of groundwater drawdown in the riparian zones, with local case studies is provided in Rio Tinto (2016a), which is included in **Appendix B** of this document. The location of the riparian zones and the dominant riparian tree species are mapped in **Figure A1** in **Appendix A** of this document. In addition, a new Rio Tinto ecohydrological study has commenced (in collaboration with the University of Western Australia) that is expected to further refine the understanding of the relationship between surface water and groundwater

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			interactions and the ecohydrological setting of Weeli Wolli Creek (Rio Tinto 2016b).
4	DoW	On page 167 of the PER the following statement is provided - "*Only a small percentage of these communities are likely to occur within the impact zone (beyond the banks adjacent to the low-flow channel)*". It is recommended that the risk assessment should be updated to include areas where current average depth to groundwater is up to 10m or 15m for occurrences of *Eucalyptus victrix* and the risks to the entire riparian vegetation zone from drawdown in excess of 5m (predicted minimum).	The risk assessment undertaken by URS (2015), which was included in Appendix 3 of the PER document, included consideration of the risk to both the incised channel and the floodplain. This included areas where elevated groundwater levels may have led to some increased reliance on access to groundwater. The risk assessment determined that, beyond the incised channel zone (excluding one community possessing co-dominant populations of *E. camaldulensis*); the Proposal poses a low risk to the vegetation of the floodplain zone (such communities comprising a dominant tree stratum of *E. victrix*). The risk (low to high) of declining water availability within the riparian zone was presented in Figure 56 of the PER document. This has been further refined based on additional integration of the surface water modelling with the riparian vegetation mapping (RTIO 2016a) and is provided as **Figure A2** in **Appendix A** of this document.
5	DoW	Please note and comment on the potential impacts to the following tree species: • *Melaleuca argentea* - generally occur where the average drawdown to groundwater is <4m. Based on Pilbara wide datasets (Loomes 2010; Stratagen 2006; Maunsell 2003) *Melaleuca argentea* are unlikely to occur beyond a drawdown to groundwater of 8m and only large, mature trees are likely to survive long term where drawdown to groundwater is >6m - in the absence of surface water.	Baseline groundwater elevation modelling for the section of Weeli Wolli Creek adjacent to the Proposal Area predicted a groundwater table 20-50 m below ground for the majority of the creek and 12-20 m below ground for the remainder. Because *M. argentea* is likely to occur only in areas where the depth to groundwater is less than 6 m, potential baseline populations of this species along this section of Weeli Wolli Creek were previously likely to be broadly dependent on consistent soil moisture and localised perched aquifers rather than groundwater proximity. Present day populations of this species are broadly interpreted to have proliferated in this area because of ongoing surplus water discharge since 2006. In the Proposal Area, there are only a few locations where a portion of current populations of *M. argentea* was conservatively interpreted to have been potentially present prior to 2006 (Rio Tinto 2016a). These locations are shown in **Figure A3** in **Appendix A** of this document. The existing environmental management of the Yandi Operations is

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			achieved by implementation of a number of management plans and commitments required by, or related to, Ministerial Statement No. 914 or EPBC Decision 2011/5815. Existing environmental monitoring and management in place under the plans required by MS914 currently already cover the Revised Proposal Development Envelope and beyond which will also address the potential impacts of the Proposal.
		• *Eucalyptus camaldulensis* - generally occur where average drawdown to groundwater is <5m and are unlikely to occur beyond a drawdown to groundwater of 10m.	*Eucalyptus camaldulensis* currently appears in many cases to co-occur with *E. victrix* in areas where the average depth to groundwater is greater than 10 m. This was investigated through analysis of all water monitoring bores on the Rio Tinto database inside or within 150 m of the boundary of vegetation units mapped as containing *E. camaldulensis* as a dominant or co-dominant species. Of these selected bores from the database, a total of 238 had an initial bore water elevation (elevation at the time of drilling) recorded at time of installation. Of these, approximately 40% possessed an initial water elevation greater than 15 m below ground level (bgl), with 50% possessing an initial water elevation of greater than 10 m bgl. These data suggest *E. camaldulensis* is capable of occurring in areas where the groundwater table is greater than 10-15 m below ground. In these areas, *E. camaldulensis* is likely to be sustained by conditions other than depth to groundwater, such as finer scale differences in surface water regime, substrate characters, ground surface elevations, and hydrogeological variability. These conditions may combine to maintain either more consistent soil pore water availability, a broader (vertically) capillary fringe, or a sufficiently moist unsaturated zone (vadose soil water resource) in close proximity to the roots of resident *E. camaldulensis*. This may suggest the interaction of the unsaturated zone with both the water table and periodic surface water inputs is sufficient to ensure survival of *E. camaldulensis* even if the groundwater table is generally out of reach of tree roots. From such investigations, and after consideration of the focus of studies conducted by Loomes (2010), it is considered that this study is potentially more relevant to large rivers of the Pilbara (with typically shallow water tables) and less applicable to drier creek systems of the Hamersley Ranges (the location of the Proposal). In general,

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			creek systems of the Hamersley Ranges dissect more topographically-variable terrain and would typically possess consistently deeper groundwater tables than the De Gray, Yule, Robe and Fortescue rivers, which were the focus of Loomes (2010). These river systems generally dissect the flatter Chichester/Roebourne sub-regions. In addition, the typical topographical and geomorphological constraints within Hamersley Range creek systems, combined with narrower course alluvial zones and closely fringing fine-grained floodplains, are likely to increase the residence times for pore water sourced from intermittent surface water influx. As an example of the shallow nature of groundwater tables within systems studied by Loomes (2010), it is also noted that Antao and Bainbridge (2010) presented vegetation mapping for the Lower Robe River with a 400-700 m wide floodplain zone mapped as containing scattered *E. camaldulensis,* indicating consistent groundwater availability within the floodplain. Considering the typical distribution of such species in Hamersley Range creek systems, this appears to demonstrate the results of Loomes (2010) are likely to be most relevant to *E. camaldulensis* occurring in major Pilbara rivers where the depth to groundwater is typically shallow. Further information is provided in Rio Tinto (2016a), which is included in **Appendix B** of this document.
		• *Eucalyptus victrix* - deep rooting depths may allow groundwater use where drawdown to groundwater is up to 15m, however depending on antecedent condition are typically less susceptible to groundwater drawdown.	Communities where *E. victrix* is the dominant eucalypt species are well represented and widespread within the Pilbara bioregion. *Eucalyptus victrix* has been shown to access groundwater in areas where the depth to groundwater is low (O'Grady et al. 2009), but, in non-riparian habitats, has also been observed to exploit shallow soil pore water to meet is transpiration needs (Grigg et al. 2008). In addition, *E. victrix* is generally considered to be an example of an adaptive facultative phreatophyte, being relatively drought tolerant, but susceptible to decline when groundwater becomes limiting (Muir Environmental 1995). The potential for this species to be considered a vadophyte in certain catchment conditions is explored in Rio Tinto (2016a). Where the Proposal is adjacent to Weeli Wolli Creek, the decline in the health and stature of this species (typically beyond the incised channel zone) is a potential impact. However, the frequency and magnitude of surface water inputs and floodplain

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			inundations characteristic of this area, combined with management approaches, are considered sufficient to ensure the ongoing viability of local riparian populations. Work by Pfautsch et al., (2014) in Weeli Wolli Creek concluded that that water use by *E. victrix* is highly plastic and opportunistic. Such conclusions, along with observations surrounding the wide range of groundwater conditions in which this species occurs, demonstrate that this species is inherently well adapted to high variations of water availability. Furthermore, it is not unreasonable to consider that this species is able to utilise a vadophytic water use strategy under certain catchment conditions given the range of water use strategies which facultative phreatophytes are accepted to utilise.
6	OEPA	Please identify the likely areas of impacts to riparian vegetation with maps, under the proposed drawdown schedule. Note the likely rate of drawdown that would not impact on vegetation in the riparian zone, including detailed provisions for monitoring, drawdown triggers and management of vegetation health.	Figure 56 in the PER document identified the risk of declining water availability within the riparian zone, based on 2019 drawdown predictions. An approximate 2.8 km section of vegetation is at high risk of decline due to reduced water availability, with an additional 3 km section of vegetation at medium–high risk, and a further 5 km section at medium risk. The risk of declining water availability within the riparian zone has been further refined based on additional integration of the surface water modelling with the refined riparian vegetation mapping. This is provided as **Figure A2** in **Appendix A** of this document. Table 21 in the PER document provided information on the possible responses of riparian tree species to drawdown in the low-flow channel and incised channel. Significant (potentially fatal) impacts to *M. argentea* (obligate phreatophyte) are not predicted until drawdown rates reach 10-15 m in the incised channel only, with some potential for *E. camaldulensis* fatalities once the water table is lowered by 15-20 m in the incised channel. However, previous observations suggest that at the scale of the incised channel zone, such groundwater elevation changes are unlikely to be realised due to the overlying maintenance of surface water discharge. The dependence of riparian tree species on groundwater and potential impacts to these species from drawdown are discussed further in the Proponent response to Issue No. 4 and No. 5, along with Rio Tinto (2016a), which is included in **Appendix B** of this document.

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			Management actions/triggers were provided in the Surface Water Discharge and Vegetation and Groundwater Dependant Ecosystems Monitoring and Management Plan included in Appendix 4 of the PER document. The management measures presented in the Plan will be updated in response to the ecohydrological study (Rio Tinto 2016b) findings.
Subterranean fauna			
7	DoW	The PER limits discussion to stygofaunal communities within the project area. The cumulative impacts of dewatering to stygofaunal habitat and species survival cannot be assessed. Please provide a map showing anticipated dewatered areas (regional) and the habitat extent for species that may be threatened. A discussion outlining the management of risks to stygofauna including a map showing refuge areas for stygofauna with limited distribution should also be provided.	Data from surveys of the Proposal Area (Biota Environmental Sciences [Biota] 2014) and Development Envelope (Biota 2015) suggest that the risk of any stygofauna species' distribution being limited to the Proposal Area is low. Geological, hydrological and biological data indicate that stygofauna habitats and populations are effectively connected at minimum at the local catchment scale within Marillana and Weeli Wolli Creeks (refer to Section 2.2.3 of Biota 2016). Of the 26 stygofauna taxa recorded from the Proposal Area and determined to species level, only two are currently known from only the Proposal Area. These two taxa are considered unlikely to be restricted to the Proposal Area given that the remaining taxa have distributions that extend to the wider catchment scale or further afield in the Pilbara bioregion (Biota 2014). Further, the majority of the 88 taxa known from the Development Envelope have also been recorded more widely across the Marillana-Weeli Wolli catchment and in some cases elsewhere in Australia or globally (Biota 2015). As stated in Section 16.4.1 of the PER, there are sections of both Marillana Creek and Weeli Wolli Creek that will remain unaffected by the dewatering associated with the Proposal and unaffected by that arising from other existing operations such as Hope Downs 1 and BHP's Yandi Operations. These areas, which effectively represent habitat refugia for the stygal community that occurs within the local catchments, were depicted in Figure 76 of the PER document. This figure indicated substantial areas of stygofauna habitat in Weeli Wolli Creek, particularly in the reach between the Proposal Area and Hope Downs 1, would remain unaffected by

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			dewatering and would effectively represent refugia. Areas of the upper reach of Marillana Creek will be similarly unaffected by the Proposal. In addition to the Proposal and the Proponent's greater Yandi Operations, the three other operations that may influence stygofauna habitat in the area are BHP Billiton's Yandi and Mining Area C operations, and Rio Tinto's Hope Downs 1 operation; these three operations are also depicted in Figure 76 of the PER document. The extent of dewatering influence from these operations is not quantified to the same degree of detail to be able to be mapped; however, localised reductions in groundwater habitats will occur in the areas immediately adjacent the operations. All of these operations currently discharge groundwater into the superficial floodplain aquifers of Marillana and Weeli Wolli creeks and will continue to do so during the implementation of the Proposal. Discharge of dewatered groundwater into Marillana and Weeli Wolli creeks has to date effectively expanded the spatial and vertical extent of stygofauna habitat in the area, as continuous recharge of surface water maintains higher water table levels in the floodplain aquifer than occurred under baseline (pre-mining) conditions (URS 2015). Ongoing discharge from these operations is expected to continue to result in surface water flow in at least the low flow channel of Weeli Wolli Creek during implementation of the Proposal (URS 2015). This is expected to mitigate to some extent the impacts to stygofauna arising from the dewatering required for the Proposal. Superficial stygofauna habitat in areas downstream of Hope Downs 1 and the Proposal Area in particular are likely to remain saturated as a result of this ongoing discharge and may act as refugia during the implementation of the Proposal. To enable an assessment of the potential loss of habitat following cessation of mining, the Proponent has quantified the area and mapped the extent of the CID and alluvium/colluvium/calcrete habitat in the Development Envelope and in a wider catchment encompassing BHP's Yandi Operations (refer to **Figure A4** provided in **Appendix A** of this document). This has considered the direct loss of habitat based on the extent of mine pits only (dewatering information was not available for most

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			operations) associated with the Proponent's existing approved Yandi Operations, the Proposal, Hope Downs 1 and BHP's Yandi and MAC Operations. The approximate extent of stygofauna habitat in the local catchment shown in **Figure A4** is 117,213 ha, which represents the baseline case for this assessment (prior to the commencement of development). Existing and approved pits account for the removal of 4,230 ha (3.6%) of the stygofauna habitat in this local catchment; the Proposal accounts for an additional impact of 605 ha (0.5%). An estimated 112,378 ha (95.9%) of stygofauna habitat within the local catchment depicted in **Figure A4** would remain unaffected by mine pits. Additional localised reductions in stygofauna habitat will also occur in the areas immediately adjacent to the other existing operations in the catchment; however, those operations also discharge groundwater into the superficial floodplain aquifers of Marillana and Weeli Wolli Creeks, saturating some habitat areas that would otherwise be seasonally dry or potentially dewatered.
8	DoW	The proponent needs to clearly demonstrate the continuity of the presumed habitat with site specific data e.g. the Weeli Wolli Formation sits between much of the alluvial and CID habitat – this formation is not considered to be stygofauna habitat and may represent a barrier to migration between available habitats. This could be a risk analysis, given the model is not suited to making quantitative predictions.	The submission suggests the Weeli Wolli Formation is located between much of the alluvial and CID habitat in the Proposal Area and could therefore represent a barrier to stygofauna movement. However, the CID is actually imbedded in the underlying Weeli Wolli Formation, and the Weeli Wolli Formation does not occur between the CID and the superficial alluvium (refer to Figure 25 in the PER document). The CID aquifer is hydrologically connected to the overlying superficial floodplain aquifer for the entire length of the Proposal Area (Rio Tinto 2010a), with no known indication of physical barriers to potential stygofauna movement between the two groundwater systems.
9	DoW	Stygofauna monitoring and impact management has not been addressed in the current conditions. DoW requests the opportunity to comment on the revised "*Vegetation and Groundwater Dependent Ecosystem Monitoring and Management Plan*", Condition No. 6-3.	As part of the approval for the existing Yandi Operations, under MS 914, an Environmental Values Statement (EVS) was required to be developed for Weeli Wolli Creek, as per condition 6-1 and 6-2. The existing EVS is summarised in Section 6.1 of the PER document and it acknowledges stygofauna as an identified environmental value in the Marillana-Weeli Wolli Creek catchment. As such, management for stygofauna is addressed in the existing Yandicoogina Vegetation and Groundwater

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			Dependent Ecosystems Monitoring and Management Plan, which is included in the Yandicoogina Monitoring and Management Plan (MMP). The Yandicoogina Vegetation and Groundwater Dependent Ecosystems Monitoring and Management Plan was developed in 2012 in consultation with both Parks and Wildlife and the DoW. As part of the development of the plan, a draft was provided to Parks and Wildlife and the DoW for review and a site visit was undertaken with representatives from the DoW. Feedback on the draft plan was received by both Parks and Wildlife and the DoW; this feedback was incorporated into the final plan prior to submission and acceptance by the OEPA. The management plan utilises habitat parameter triggers for stygofauna including in relation to groundwater levels (water availability) and water quality. Stygofauna species sampling is used as a correlative parameter. Stygofauna sampling at Yandicoogina occurred on a biannual basis from 2005 until 2013 and has to date resulted in no discernible trends in the overall ecological community. The existing approved MMP is currently being updated to ensure it is consistent with the EPA (2015) guidelines for management plans (EAG17). As part of this update, the management actions and triggers for stygofauna will be subject to minor refinement to ensure the parameters are clearly defined and measurable.
Hydrological processes			
10	DoW	The Fortescue Marsh has not been included within the model domain, and therefore has not been considered as part of the impact assessment. Provide justification as to why the Marsh has been excluded. Provide a discussion as to why a requirement for ongoing monitoring to demonstrate that discharge water is not reaching the marsh is not required. Or alternatively, provide a discussion relating to the impacts of any discharge reaching the marsh	The Proponent's Groundwater Operating Strategy includes ongoing monitoring via an extensive network of piezometers covering the existing Yandi Operations, the Proposal and Fortescue Marsh, along with wetting front monitoring. Locations of ongoing monitoring sites are provided in **Figure A5** in **Appendix A** of this document. The conceptual understanding of the Fortescue Marsh indicates there is substantial groundwater storage beneath the Marsh, which suggests potential impacts to the Marsh from the Proposal will not be significant. Hydrogeological assessments have shown that water entering the Marsh either infiltrates or evaporates rapidly due to the large surface area of the Marsh. Flow into the Marsh is predominantly from surface

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		boundary (as defined by the EPA's published guidance) are considered insignificant.	water and this is demonstrated by the groundwater model report provided in the PER and supported by infiltration tests in the field. An additional report has been prepared to clarify the interaction with the Fortescue Marsh is provided in **Appendix B** (Rio Tinto, 2016c). The groundwater model provided in the PER covered an area of 25.5 km by 30 km. The model was constructed and designed to predict the dewatering requirements of the Proposal and the extent of groundwater drawdown during operations. The inclusion of Fortescue Marsh and alluvial fans associated with major tributaries discharging into Fortescue Marsh would have increased the model domain to at least 50 km by 100 km. This would have in turn resulted in a model grid size of 100 m, which would have increased the uncertainty associated with model predictions to a point where the model accuracy would be considered highly compromised. Inclusion of the Fortescue Marsh in the model domain would have meant that dewatering and extent of drawdown and small-scale processes in the Marsh could not have been determined with confidence. This is particularly important because of the very low gradient (approximately 0.0001 in the Marsh), shallow alluvium (approximately 70 m) and large extent of the Marsh (approximately 40 km by 100 km). In order to overcome the problems posed by the potential inclusion of the Fortescue Marsh in the model domain, the Proponent has referenced several specific and detailed studies that address the potential effect of the proposed dewatering on the water balance of the Marsh. The results of these studies (Dogramaci et al. 2012, Skrzypek et al. 2013, Dogramaci and Skrzypek 2015, Dogramaci et al. 2015; Rio Tinto, 2016c [**Appendix B]**) demonstrate that: 1. The Fortescue Marsh water balance is dominated by flooding rather than groundwater lateral flow. 2. The cumulative discharge from the Hope Downs 1 (Rio Tinto), Yandicoogina (Rio Tinto) and Yandi (BHP Billiton) mine operations are negligible compared to the volume of Fortescue Marsh storage and flood water delivered to the Marsh. *3.* Groundwater quality in the palaeochannel beneath the Marsh has not changed

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			as a result of the cumulative discharge from the Hope Downs 1 (Rio Tinto), Yandicoogina (Rio Tinto) and Yandi (BHP Billiton) mine operations.
11	DoW	Simulated drawdown maps appear to indicate some impacts to groundwater levels at the northern boundary of the model. Considering this, provide a discussion to confirm that no impacts to Fortescue Marsh will occur.	Discharge from D09 has been included in the model, which contributes to the sharp boundary change in the northern part of the model domain near the confluence of Marillana Creek and Weeli Wolli Creek. Simulated drawdown at the northern boundary of the model is less than 1 m (**Figure A6**; **Appendix A** of this document). On this basis, the potential for impact to Fortescue Marsh, located approximately 30 km from the northern boundary of the model, is considered negligible. Refer also to the Proponent response to Issue No. 10, which discusses the problems posed by potential inclusion of the Fortescue Marsh in the model domain, along with the key results of studies (Dogramaci et al. 2012, Skrzypek et al. 2013, Dogramaci and Skrzypek 2015, Dogramaci et al. 2015, Rio Tinto 2016c [**Appendix B**]) undertaken to address the potential effect of the proposed dewatering on the water balance of the Marsh.
12	DoW	The groundwater model is suitable for a general prediction of groundwater drawdown, but is not sufficient to make precise estimates of drawdown depth and extent. Please consider, incorporate or comment on the following points on the model: • the model geometry is poorly described;	The groundwater model was developed in accordance with the Australian groundwater modelling guidelines (Barnett et al. 2012) and was peer-reviewed by an independent consultant (Hydrogeologic 2015) in relation to adherence to the guidelines. In addition to the groundwater model, the Proponent has studied the different scale groundwater processes in the area using conceptual hydrogeology, numerical and analytical models and tracer techniques using hydrochemistry and isotope of water molecules (e.g. Bourke et al. 2015 and Dogramaci et al. 2015). Section 7 of Rio Tinto (2014a), which was provided in Appendix 3 of the PER document, describes the groundwater model setup in detail, including the model geometry.
		• determination of direct rainfall recharge estimates is inadequately described;	Section 7 of Rio Tinto (2014a), which was provided in Appendix 3 of the PER document, describes infiltration rates as a percentage of the monthly rainfall. This is

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			standard practice in groundwater modelling. Recharge zones are shown on Figure 28 in Rio Tinto (2014a).
		• monthly rainfall recharge figures are not presented;	Monthly rainfall data from January 1998 to December 2013 are provided in Figure 3 in Rio Tinto (2014a). Refer also to Proponent response to Issue No. 12 in relation to 'determination of direct rainfall recharge estimates is inadequately described'.
		• limited transient calibration discussion;	The calibration period for the groundwater model was from January 1998 to December 2014; a period of 17 years. Figure 34 to 40 in Rio Tinto (2014a), which was provided in Appendix 3 of the PER document, describe in graphical form the model calibration. Figure 33 in Rio Tinto (2014a) shows the location of the calibration bores. The model calibration was considered acceptable for such a complex hydrogeological system. The model will be recalibrated annually as hydraulic stresses from mining increase; as hydraulic stresses in the system increase, so will understanding of the system itself.
		• limited regarding the apparent dewatering impact at the northern boundary;	Refer to Proponent response to Issue No. 11.
		• limited discussion on the sensitivity analysis and subsequent uncertainty analysis; and	A discussion of the sensitivity analysis conducted for the groundwater model is provided in Section 10 of Rio Tinto (2014a), which was provided in Appendix 3 of the PER document. The sensitivity analysis was conducted by perturbing two hydrostratigraphic unit parameters: hydraulic conductivity and specific yield. Hydraulic conductivity was perturbed by 20% on either side of the calibrated value and specific yield by 50% on either side of the calibrated value. The results indicated that the model is not sensitive to hydraulic conductivity of the alluvial at the water supply bores, eastern clay conglomerate/weathered channel deposit, or Upper Vitreous Goethite (Figure 44 in Rio Tinto [2014a]), nor to the specific yield of Limonite Goethite Clay in the Billiards and Junction South West areas (Figure 45 in Rio Tinto [2014a]). These results indicate that hydraulic conductivity and specific yield can vary without significant distortion of the calibration. Because of their potential to significantly contribute to uncertainty in the model, a

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			sensitivity analysis was conducted for these unit parameters. The analysis involved predictive simulations to provide an upper bound of dewatering requirements and is discussed in Section 12 of Rio Tinto (2014a). Based on the sensitivity analysis of the calibrated model, hydraulic conductivity of the Upper Vitreous Goethite was increased to the upper bound value of 5 m/day and specific yield of the Limonite Goethite Clay was increased to an upper bound value of 0.2. This resulted in negligible difference in dewatering rates or volumes and indicates that the dewatering predictions are not sensitive to these unit parameters.
		• groundwater quality has not been incorporated into the groundwater model.	Dogramaci et al. (2015) demonstrated that groundwater quality in the CID, which flows northward toward the Fortescue Marsh, has been unaffected by the exiting Yandi Operations and is unlikely to change as a result of the Proposal. Incorporation of water quality into the groundwater model for the Proposal would have resulted in a solute transport model, which would be unsuitable for determination of the impact of dewatering on groundwater quality.
13	DoW	Predicated dewatering rates presented in the URS (2015) report differ from those presented in the RTIO (2014b) numerical groundwater modelling report. Please clarify predicted dewatering rates.	Predicted dewatering rates for the greater Yandi Operations (including the Proposal) range from 75 GL/year to 83 GL/year. The 8 GL/year difference between these predictions allows for ongoing optimisation of the mine schedule and associated changes to dewatering requirements. Irrespective of changes to the mine schedule, a conservative 'worst case' scenario of 83 GL/year has been used. This allows for numerous potential mine optimisation scenarios. The environmental impact assessment presented in the PER document used the worst scenario value of 83 GL/year.
14	DoW	The groundwater model has been based on a constant discharge rate coming from the BHP Yandi mine, and used to determine dewatering estimates for the expansion proposal. Further discussion should be provided to address the cumulative groundwater drawdown across projects, and potential drawdown	The purpose of the groundwater model was to estimate the maximum potential volume of mine dewatering required for the Proposal. As such, the model used the maximum discharge from BHP Billiton's Yandi operation (based on the BHP dewatering Licence) and Rio Tinto's Hope Downs 1 operation, along with the Proponent's greater Yandi Operations (including the Proposal). The drawdown contours generated for the Proposal have therefore considered the cumulative effect

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		within the Weeli Wolli Creek alluvials.	of these mine operations. It is considered unlikely that groundwater drawdown from BHP Billiton's Yandi operation or Rio Tinto's Hope Downs 1 operation would propagate to the Weeli Wolli Creek alluvials.
15	DoW	Provide details relating to the potential for through-flow of excess discharge water, and how this will remain within the 17km wetting front. An argument and justification should be provided relating to the saturation of the alluvials not extending further downstream of Weeli Wolli Creek than would be visible from surface expression (i.e. the "wetting front").	As stated in the PER document, surplus water will be discharged and constrained to a well-defined low-flow channel, with the modelled wetting front within the existing approved footprint of 17 km beyond the Marillana – Weeli Wolli Creek confluence. Whilst some sub-surface flow may occur, infiltration tests downstream of the current wetting front have confirmed high rates of vertical infiltration and unsaturated soil conditions, which supports observations that there has been no significant change in water levels downstream since discharge commenced. In addition, the creek channel morphology becomes a more defined incised channel and associated vegetation becomes more sparsely distributed with limited vegetation in the incised channel. Vegetation in these downstream reaches is largely constrained to the banks and therefore less likely to be affected by inundation from surface discharge (refer to **Figure A7** and **Plates A1-A5** provided in **Appendix A** of this document). Rio Tinto (2014b), which was included in Appendix 3 of the PER document, conducted an assessment to investigate the response of the wetting front to continual discharge from DO9 of 46 GL/year, 58 GL/year and 84 GL/year. These volumes respectively represent the minimum, average and maximum rates of discharge predicted from DO9 from 2017 to 2032. The predicted footprint of the wetting front under each discharge scenario was determined based on the assumption that steady state conditions were established. The assessment estimated the footprint of the wetting front would extend 10.7 km from the confluence of Marillana and Weeli Wolli creeks under a scenario of 46 GL/year, 12.3 km under a scenario of 58 GL/year and 15.5 km under a scenario of 84 GL/year.

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16	DoW	Cumulative impacts have been discussed, however no actual projects have been incorporated into the PER impact assessment, citing a lack of detailed data. Given BHP's Yandi project borders the current RTIO Yandicoogina project, it should be considered as part of the groundwater model and dewatering/discharge assessment, and several scenarios should be considered to evaluate the potential for cumulative impacts.	The purpose of the groundwater model was to estimate the maximum potential volume of mine dewatering required for the Proposal. As such, the model used the maximum licensed discharge from BHP Billiton's Yandi operation (based on the dewatering licence for that operation) and Rio Tinto's Hope Downs 1 operation, along with the Proponent's greater Yandi Operations (including the Proposal). The drawdown contours generated for the Proposal have therefore considered the cumulative effect of these mine operations.
17	DoW	The proponent has analysed annual discharge amounts from various projects but does not appear to have commented on the potential cumulative impact. This lack of consideration for cumulative impacts should be discussed.	The discharge extent modelling conducted for the Proposal (Rio Tinto 2014b) considered the cumulative impact of discharge from the Proposal, discharge from the Proponent's existing Yandicoogina Operations and discharge of recirculated water from Hamersley HMS's Hope Downs 1 operation. As stated in Rio Tinto (2014b), discharge from Hope Downs 1 will be re-circulated through the CID and back to the surface when dewatering for the Proposal begins, resulting in all potential discharge from Hope Downs 1 being abstracted by dewatering for the Proposal. The abstracted water is proposed to be pumped to DO9 (the location at which water from the Proponent's existing Yandicoogina Operations is currently discharged into Marillana Creek; refer to Figure 29 in the PER document) and, from there, released into Marillana Creek and subsequently into Weeli Wolli Creek downstream of the confluence. As stated in the PER, up to 70% of the water discharged from BHP's Marillana Creek (Yandi) operation is re-abstracted and discharged by the Proponent's existing Yandicoogina Operations. Therefore, the discharge extent modelling conducted for the Proposal (Rio Tinto 2014b) has also considered the majority of cumulative impacts associated with BHP's Marillana Creek (Yandi) operation. Refer also to the Proponent response to Issue No. 16.
18	DoW	Given the expected interaction of dewatering	Potential impacts in relation to Weeli Wolli Creek are addressed in Section 13

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		(drawdowns) and discharge (surface inundation), the resulting net impact on Weeli Wolli Creek from known mining operations should be discussed from three perspectives: changed water regime, risks to stygofauna populations, impacts of riverine vegetation.	(changed water regime), Section 16 (risks to stygofauna populations) and Section 14 (impacts to riparian vegetation) of the PER document. Refer also to the Proponent responses to Issue No. 2, 3, 4, 5 and 6 (impacts to riparian vegetation), No. 7 and 8 (risks to stygofauna populations) and No. 10, 11, 12, 13, 14, 15, 16, 17 and 19 (changed water regime).
19	OEPA	The OEPA notes that the flood levee and creek crossing may result in permanent changes to the Weeli Wolli creek system. Please provide scaled diagrams (vertical and horizontal) superimposed on satellite imagery showing how the levee will look like during operation and following closure. Please also comment on how this may impact hydrological processes in addition to water levels and velocities (such as scouring) within Weeli Wolli Creek, and how the levee may result in impacts (direct and indirect) to flora and vegetation on the western and eastern side of the levee.	Scaled diagrams of the proposed flood levee during operations are provided as **Figure A8** to **Figure A12** in **Appendix A** of this document. The levee is proposed to be used as backfill in the pit upon closure and will not remain following cessation of mining operations and decommissioning. A typical levee cross section was provided in Figure 5 of the PER document. As depicted in the figure, the western bank of the levee (adjacent to Weeli Wolli Creek) will be lined with geotextile fabric to prevent erosion of the levee surface. The figure also depicts rock armouring above the geotextile fabric, which will further reduce the potential for erosion and scour. During operations, vegetation to the west of the levee (between the levee and Weeli Wolli Creek) may experience additional inundation and velocity of flow during high flow/flooding events. This may result in minor and temporary impacts on components of the riparian vegetation. Vegetation to the east of the levee (between the levee and the proposed mine pit and/or infrastructure) may experience reduced inundation and velocity of flow during high flow/flooding events, as the levee will provide a barrier to floodwaters from Weeli Wolli Creek. This may result in some loss of condition of this vegetation over time. Following cessation of mining, the levee will be removed and the levee site rehabilitated, allowing vegetation on both sides of the levee site to recover.
Inland waters environmental quality			
20	DoW	It should be noted that given the high level of uncertainty with the pit lake modelling, DoW is unable	Mean and peak salinity of pit lake water was modelled using probability analysis to account for the uncertainty associated with individual scenarios. The analysis

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		to offer confident discussion regarding the probable mean and peak salinity of pit water predictions and whether pit water is likely to report significantly to CID at the pit boundary and impact groundwater quality downstream.	provided model outputs with an associated probability of pit lake salinity and water level reaching a certain level, rather than an associated uncertainty. To calculate the water and salt balance of the open pit, lateral flow flux was calculated using a numerical groundwater model. The lateral flow of water from the pit downgradient depends on the difference in gradient between the groundwater level and pit water level. In situations where the pit acts as a groundwater sink, pit water would not report to the CID at the pit boundary and would not affect groundwater quality downgradient. In situations where the pit water level is higher than the groundwater level, seepage would occur and the quality of seepage would depend on both climatic and hydrogeological parameters.
21	DoW	Please note that the following reference is not supplied with the PER, so is likely unavailable to other (public) reviewers – Dogramaci S, Firmani G, Headley P, Skrzypek G and Grierson P 2015, *Evaluating recharge to an ephemeral dryland stream using a hydraulic model and water, chloride and isotope mass balance*. Journal of Hydrology v521. Pp. 520-532.	Relevant information from the Dogramaci et al. (2015) journal article was included in Section 3 of the PER document. The article is freely available at: https://www.researchgate.net/publication/270345046_Evaluating_recharge_to_an_ephemeral_dryland_stream_using_a_hydraulic_model_and_water_isotope-chlorine_mass_balance.
Rehabilitation and decommissioning			
22	DoW	It is noted that the pit lakes are modelled as groundwater sinks. Evapo-concentration of contaminants over time is likely due to the nature of the chemical reactions between pit walls and pit water, therefore continuous refinement and update of closure modelling is recommended. It should also be noted that the DoW will provide ongoing support and advice to Hamersley as the project progresses and closure approaches. Ongoing studies will include characterisation of pit walls and pit water chemistry,	Continuous refinement and update of closure modelling is proposed as part of the ongoing requirement to update the closure plan and to account for mine planning updates and optimisation. The Proponent acknowledges and welcomes the ongoing support and advice the DoW will provide as the project progresses and closure approaches. Commensurate with the acid and metalliferous drainage (AMD) risk of the Proposal deposits, samples from the existing Yandi Operations, including tailings samples, have been tested for acid-base accounting (ABA) and geochemical characterisation. All samples were classified as either non-acid forming (NAF) or Uncertain-NAF (UC-

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		and this should be assessed at each review against the DMP/EPA guidance on mine closure.	NAF) due to their low sulphur content. The samples were enriched (when compared to the average crustal abundance) in arsenic, gold, boron, bismuth, antimony, selenium, thallium and mercury; however, static leach testing indicated these elements were not readily leached. A multi-step leach regime was implemented to determine the distribution of elements among mineral hosts. The regime used different leachates with successive strength to target different mineral components of the samples. The bulk of the elements were not leached until the final steps, which indicates they are strongly bound and unlikely to be leached under the geochemical conditions expected to develop in mine voids. Leaching tests of Yandi wastes under saline conditions have been conducted because salinity is expected to increase in the Yandi pit lakes. Leaching was undertaken at two different levels to represent saline groundwater and possible brines that develop in pit voids due to evapo-concentration. Overall, the results of the leaching tests indicated an increase in the leached mass of calcium, magnesium, potassium, strontium, copper, barium, manganese and zinc with an increase in salinity. For all other elements, there appeared to be either a decrease, or no increase in the leached concentration as a function of the differing salinity levels. The Proponent is also conducting an ongoing column test that simulates the dynamics of groundwater evaporating in a pit lake and subsequently infiltrating through waste backfill. Preliminary results indicate that alkaline conditions would develop as a result of evapo-concentration, but are not sustained as water passes through waste material. Reducing conditions have also been observed to develop in the column test; however, no additional leaching of materials was observed as a result of such conditions.
23	OEPA	The OEPA notes that for RTIO to meet the EPAs objective for rehabilitation and decommissioning, they would need to make sure the pit lake does not pose an unacceptable risk to environmental or human health and require ongoing intervention after closure	The Proposal pit lakes are not expected to generate chemicals that pose risks to environmental or human health. The preliminary stochastic water balance model developed for the Proposal indicated pit lake water quality would be strongly influenced by future climate conditions. Modelled over a 1,000-year period, the results suggested salinity would increase. The model suggested a 50% probability

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		of the mine. Due to the difficulty predicting water quality in pit lakes, contingency procedures and commitments need to be developed for the pit lake. Contingency measures should not be ongoing in nature. A conceptual site model for the lake in accordance with appendix H of the mine closure guidelines needs to be developed.	that the average annual salinity over the 1,000-year period modelled would be 3,000 mg/L or less and a 50% probability that pit lake water salinity would still be fresh (<1,000 mg/L) after 75 years. During periods of simulated prolonged drought, when pit lake water levels would drop to their lowest levels, salinity of up to 11,000 mg/L salt was modelled. During simulated wet periods, salinity was modelled to be as low as 200 mg/L. The Proponent agrees that pit lakes should not pose an unacceptable risk to environmental and human health, which is reflected in its closure objectives for the Proposal. The Proponent has undertaken conceptual pit lake modelling in line with Appendix H of the Department of Mines and Petroleum (DMP) and EPA (2015) guidelines for preparing mine closure plans. A closure risk assessment has also been undertaken. Based on current predictions, several risks relevant to pit lakes have been identified (refer to Section 20 of the Rio Tinto [2015b] Closure Plan, which was included in Appendix 4 of the PER document) but none have been assessed as being higher than Class II (equivalent to a moderate risk as per the classification matrix in the DMP and EPA [2015] guidelines). Notwithstanding this, substantial mitigation actions have been proposed to further reduce risks and provide greater certainty of closure outcomes in relation to the proposed pit lakes.
24	DoW	Pit lakes are also of concern where there is a risk of pit lake water entering the creek system (either by seepage or when the lakes overtop after major rainfall and flooding events). This water will have significantly different chemistry to the creek system and carries the risk of vegetation or stygofauna impacts. Discuss the likelihood of this occurring and any management actions that will be implemented.	Based on current closure design and modelling, there is an 80% probability that floodwater from Weeli Wolli Creek will flow into the mine pit void on an annual basis. The inflows would contribute to a reduction in the pit lake salinity and would be expected to deliver nutrients and aquatic fauna/flora to the pit lake. An average of 10% of the floodwater volume from Weeli Wolli Creek could be captured in the Proposal mine pit void with each flood event. The ratio of outflow to Weeli Wolli Creek inflow is very low, which suggests accumulated salinity in the pit lake will be diluted; however, further work is proposed to validate this assumption and to determine appropriate engineered systems to buffer the effects of the rare (three in 200 years) peak flow events. Removal of the Proposal pit lake water through overtopping would be expected to

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			increase the salinity in the Weeli Wolli Creek floodwater to a maximum of 300 mg/L. This water quality is within the natural range observed in pools following flood events and as such is not expected to affect the downstream environment (refer to the Rio Tinto [2015b] closure plan). Continuous monitoring of water levels and water quality in the Proposal pit lake will be implemented to enable timely implementation of appropriate preventive or corrective measures such as passive treatment using wetlands and/or the use of engineered channels. Across the Proponent's greater Yandi Operations, a range of pit lake water quality scenarios are anticipated. Some pit lakes are assumed to be groundwater sinks, such as Oxbow, Junction Central and the Proposal mine pit; others are predicted to develop throughflow conditions, such as Junction South West A (JSW-A) and Junction South West C (JSW-C). For pit lakes assumed to be groundwater sinks, groundwater seepage or lake overtop is unlikely to occur. Salinity in such pit lakes is expected to increase over time; however, the incoming groundwater quality is relatively fresh and therefore pit lake water quality is expected to remain fresh to brackish for several hundred years. Refer also to Proponent response to Issue No. 23. Pit lakes predicted to develop throughflow conditions are expected to contain fresh water as the pit lakes would be fed by the Marillana Creek alluvial aquifer system; thus, no particular management action should be required for these pit lakes.
25	DoW	The proponent should commit to document its predictions for recovery of vegetation when the creek system returns to runoff-driven flow, rather than dewatering-driven flow. Given the questions raised under Flora and Vegetation regarding rooting depths and adaptation to changes, the sudden removal of discharge could shock the riverine vegetation with a	To support the system recovery and adaption back to a natural ephemeral regime, a transitional management approach will be adopted towards the end of cessation of mining operations. The aim of this approach would be to gradually return the creeks to their pre-existing ephemeral regime. A range of options may be used including a reduction in discharge flow rate, periodic discharge, and alignment of discharge reduction with seasonal conditions. Groundwater suppression via abstraction and resultant discharge is likely to continue post operations until the closure landform is

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		rapid transition to a drier environment and no permanent shallow surface water.	completed. Once the discharge of surplus water ceases, or is substantially reduced, water availability in the riparian zone associated with Weeli Wolli Creek would be expected to decline to a net reduction of 3-9% below baseline conditions (URS 2015). The groundwater table would be expected to progressively lower at 2-2.5 m per year; this rate is similar to that observed in monitoring bore hydrographs after episodic recharge events (URS 2015). Based on the Proponent's current understanding and observations during operations at Yandicoogina, riparian vegetation is expected to eventually achieve a new equilibrium without human assistance following cessation of mining activities and discharge of surplus water. The existing environmental management plans implemented at Yandicoogina include measures to respond to impacts relating to the modification of major creek systems or associated riparian vegetation communities, including in relation to potential impacts and mitigation associated with creek discharge.
26	DMP	In relation to rehabilitation and closure it is noted that the creation of permanent pit lakes post-closure may not be compatible with the current adjacent cattle grazing pastoral activities. As such an alternate post-mining land use still needs to be agreed with relevant stakeholders for this area. Consideration should be given to this and it is expect that an agreed post-mining land use be defined within the Mine Closure Plan. Post-mining land use is necessary to provide the basis for developing closure objectives and associated completion criteria.	The closure plan and PER document both acknowledge that the post-mining landform will be incompatible with pastoral land use, and that further consultation is required to confirm the post-mining land use with key stakeholders. Section 17.4 of the PER document states "The mine void and post-closure landforms within the mine void, such as the fringe of the pit lakes, may not be compatible with cattle grazing activities that dominated the area prior to mining". The proponent's vision for mine closure in the Pilbara described in the closure plan, is for the rehabilitated sites to be compatible with the surrounding environment and post-mining land use. The Proposal would aim to be compatible with the adjacent pastoral activity. The proponent acknowledges this will require the development of strategies to mitigate potential impacts from cattle entering the Proposal footprint and to ensure adjacent pastoral land value is not unacceptably impacted. Post-closure land uses will be resolved with key stakeholders prior to closure.

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			Until a final land use is agreed, the closure and rehabilitation strategy for the Proposal Area will ensure the site remains compatible with general Pilbara land uses by creating landforms that are stable for access by humans and native fauna, ensuring water systems support existing riparian vegetation and are compatible with the natural system dynamics, and establishing ecosystems with similar biodiversity and cultural heritage values as surrounding reference sites. The proponent considers that achievement of these goals would be appropriate regardless of the outcomes of final land use discussions. Section 17.4 of the PER also states that "When the site approaches scheduled closure, location specific management plans will be finalised for each closure domain. These plans will detail the physical closure, dismantling and subsequent rehabilitation implementation, in accordance with the closure objectives and legal obligations. Stakeholder engagement and endorsement of the final completion criteria will be facilitated at this time, and the post-closure monitoring program will be finalised in alignment with the agreed completion criteria."
27	DMP	It should be noted that at this stage completion criteria are general in nature. It is expected that completion criteria will be subject to ongoing review and that as the project progresses the completion criteria will contain more measurable and time-bound parameters.	It is acknowledged that measurable and time bound completion criteria are required for site closure, which is dependent on the agreement of the final landform and is subject to ongoing stakeholder consultation and agreement. Completion criteria to measure closure implementation success against agreed closure objectives have been recommended within the Yandicoogina Closure Plan. The completion criteria will be refined based on information developed during implementation of the Proposal, from baseline studies and rehabilitation trials, then finalised with stakeholders as the Proposal approaches closure. When the site approaches scheduled closure, location specific management plans will be finalised for each closure domain. These plans will detail the physical closure, dismantling and subsequent rehabilitation implementation, in accordance with the closure objectives and legal obligations. Stakeholder engagement and endorsement of the final completion criteria will be facilitated at this time, and the post-closure

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			monitoring program will be finalised in alignment with the agreed completion criteria. These monitoring programs are expected to address: • vegetation, erosion and ecological function • invasive species, including weeds and feral animals • terrestrial fauna and stygofauna • surface water and groundwater levels, quality and contaminants • heritage.
Heritage			
28	DAA	Please note that a search of the Register of Places and Objects indicates that there are three Registered Aboriginal sites and two lodged heritage places that are either partially or wholly overlapped by the Project area, as illustrated in Figure ES2 of the PER document. The three Registered sites are DAA 10004 (Cork Tree Well), DAA 20387(Y00/05) and DAA 20388 (Y00/06). The two lodged places are DAA 22163 (YB04-01) and DAA 18423 (Y99-01). It is understood that archaeological and ethnographic surveys have been conducted with Traditional Owner groups across the Project footprint and the majority of the Proposal area and that these surveys have documented artefact scatters, rock shelters and engravings as well as possible burial sites. The Proponent is invited to provide any recent information regarding Aboriginal heritage places in the Project area if it is available. The Proponent is also welcome	Archaeological and ethnographic surveys have been undertaken with Traditional Owner groups across the Proposal footprint and the majority of the Proposal Area. These surveys have documented artefact scatters, rock shelters and engravings, as well as possible burial sites in the broader Development Envelope. The Proposal will not affect these sites. Heritage surveys have been undertaken in and around PBS with particular focus on the DAA sites listed in the submission (Anthropos 2008; Archae-aus 2003, 2011; Day 2005; Department of Aboriginal Sites 1982; Ethnosciences 2015; Gavin Jackson CRM 2014; Rapley 2006). The specific details of these reports are not included in the PER document to maintain confidentiality of heritage places for the Traditional Owners. The Proponent provides to the DAA any recent information regarding Aboriginal heritage places in the Proposal Area if it is available. The Proponent acknowledges and welcomes the offer of seeking further or more detailed advice from DAA if required.

Issue no.	Submitter	Submission and/or issue	Proponent response
		to seek further or more detailed advice from DAA if required.	
29	OEPA	Please provide comment on the level of understanding and acceptance of the Traditional Owner groups to the changes to the creek system during and after closure of the site.	Extensive consultation has been undertaken with the Traditional Owners of the Proposal Area, the Banjima, Nyiyaparli and Yinhawangka people, including presentation of the existing operations and the Proposal and predicted environmental impacts. The Proponent will maintain ongoing consultation with Aboriginal stakeholders over the life of the Proposal, in accordance with processes established for the existing Yandi Operations. The Proposal was first presented to the Traditional Owners at the Yandi Monitoring and Liaison Committee Meeting on 2 December 2013. Closure has been an agenda item at all subsequent meetings and has been regularly discussed. The Proposal has been presented and discussed at Yandi Monitoring and Liaison Committee Meetings on a quarterly basis. Meeting reports from these discussions have been provided to the Traditional Owners. On-site consultation has also been undertaken with elders in March 2014, during which closure was discussed in detail. No negative feedback on the closure strategy or Proposal impacts was received. To aid in the presentation and degree of understanding, consultation DVDs were provided which included animations of: • the natural system • the mine proposal and infrastructure • the altered system, predicted environmental impacts, monitoring and management • proposed closure landform.

3 Additional studies

The following reports provide supplementary technical information to the PER and are referred to in the responses to submissions:

- Supplementary stygofauna review prepared by Biota (2016): Biota undertook a brief technical review to provide supplementary supporting information to address matters raised in Issue No. 7 and No. 8 (**Table 1**) in relation to stygofauna. The review included information on stygofauna habitat and distribution, the relationship between stygofauna records and habitats, and potential cumulative impacts. The full report is provided in **Appendix B**.
- Supplementary riparian vegetation report prepared by Rio Tinto (2016a): The Proponent prepared a report providing detailed information on riparian vegetation in and around the Proposal Area and specifically addressing the matters raised in Issue No. 3, No. 4, No. 5 and No. 6 (**Table 1**). The full report is provided in **Appendix B**.
- 3D visualisation of the levee: To address the matters raised in Issue No. 19 (**Table 1**), the Proponent prepared scaled diagrams of the proposed flood levee during operations. These are provided as **Figure A8** to **Figure A12** in **Appendix A** of this document.
- Installation of new piezometers at Digital Canopy Photography (DCP) tree health monitoring sites in the alluvial aquifer. The Proponent's Groundwater Operating Strategy includes ongoing monitoring via an extensive network of piezometers covering the existing Yandi Operations, the Proposal and Fortescue Marsh, along with wetting front monitoring. Locations of ongoing monitoring sites are provided in **Figure A5** in **Appendix A** of this document. Additional piezometers have been recently installed in the creekline adjacent to existing Digital Canopy Photography (DCP) tree health monitoring sites to further understand ecohydrological responses and current water levels.
- Rio Tinto (Rio Tinto 2016b), in collaboration with the University of Western Australia, is undertaking a study to assess the relationship between surface water-groundwater interactions and the ecohydrological setting of Weeli Wolli Creek. The study, will focus on further understanding the ecohydrologic functioning of the creek system, and will sample and characterise sediments from the unsaturated zone; surface water and groundwater; and vegetation water use over a period of four years at dewatering locations to understand the extent of modern recharge in comparison to lateral flow. Results of this study will inform adaptive environmental management during operations and upon closure.
- Supplementary hydrogeological information prepared by the Proponent (Rio Tinto 2016c). Supplementary information was prepared to summarise the findings within the PER, clarify the hydrogeological setting of the Proposal, and further assess and discuss the interaction between the Proposal and the Fortescue Marsh. The full report is provided in **Appendix B**.

4 Additional and ongoing consultation

Since submission and finalisation of the PER, further consultation has been undertaken with various stakeholders including the Gumula, DoW, OEPA and DAA. Details of this consultation are provided in **Appendix C** of this document. Key topics raised by stakeholders during this consultation included potential impacts to stygofauna and riparian vegetation. The Proponent will continue to meet with stakeholders as required and requested throughout the remainder of the PER assessment process.

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Appendix A Figures

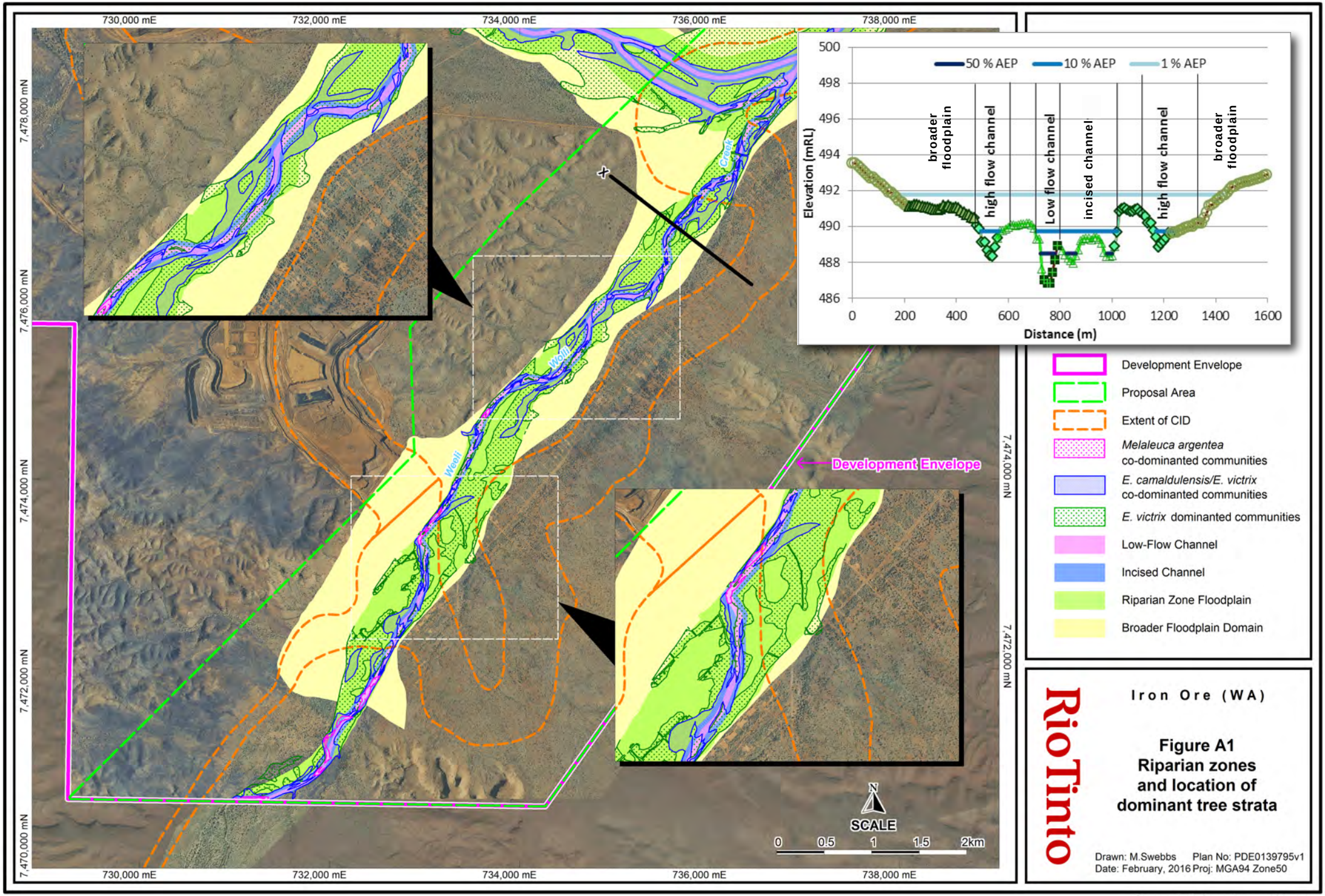
Twelve figures have been provided in this document in response to submissions received on the PER (**Table A1**). Five photographs have also been included (**Table A2**).

Table A1: New figures prepared to address issues raised during the public comment period for the PER document

Figure No.	Description	Relevant Issue No.
A1	Riparian zones and location of dominant tree strata	3
A2	Risk of declining water availability within the riparian zone (amended version of Figure 56 of the PER document)	4, 6
A3	Spatial proximity of baseline *Melaleuca argentea* communities to permanent surface water in the Proposal Area	5
A4	Stygofauna habitat in and around the Development Envelope	7
A5	The location of ongoing monitoring sites (piezometers) as per the Proponent's Groundwater Operating Strategy, covering the existing Yandi Operations, the Proposal, Fortescue Marsh and along the wetting front	10
A6	Modelled groundwater drawdown as a result of the Proposal at the year 2032	11
A7	Overview of the approximate location of photograph locations for Plate A1, Plate A2, Plate A3 and Plate A4 (refer to **Table A2**)	15
A8	Scaled diagram depicting the proposed flood levee during operations: Overview of Sections A-D	19
A9	Scaled diagram depicting the proposed flood levee during operations: Section A	19
A10	Scaled diagram depicting the proposed flood levee during operations: Section B	19
A11	Scaled diagram depicting the proposed flood levee during operations: Section C	19
A12	Scaled diagram depicting the proposed flood levee during operations: Section D	19

Table A2: Photographs provided to address issues raised during the public comment period for the PER document

Plate No.	Description	Relevant Issue No.
A1	Immediately upstream of the confluence of Marillana and Weeli Wolli creeks as shown in Figure A7 (refer to **Table A1**)	15
A2	Approximately 6.5 km downstream of the confluence of Marillana and Weeli Wolli creeks as shown in Figure A7 (refer to **Table A1**)	15
A3	Approximately 9.3 km downstream of the confluence of Marillana and Weeli Wolli creeks as shown in Figure A7 (refer to **Table A1**)	15
A4	Approximately 10.3 km downstream of the confluence of Marillana and Weeli Wolli creeks as shown in Figure A7 (refer to **Table A1**)	15
A5	Approximately 38 km downstream of the confluence of Marillana and Weeli Wolli creeks	15



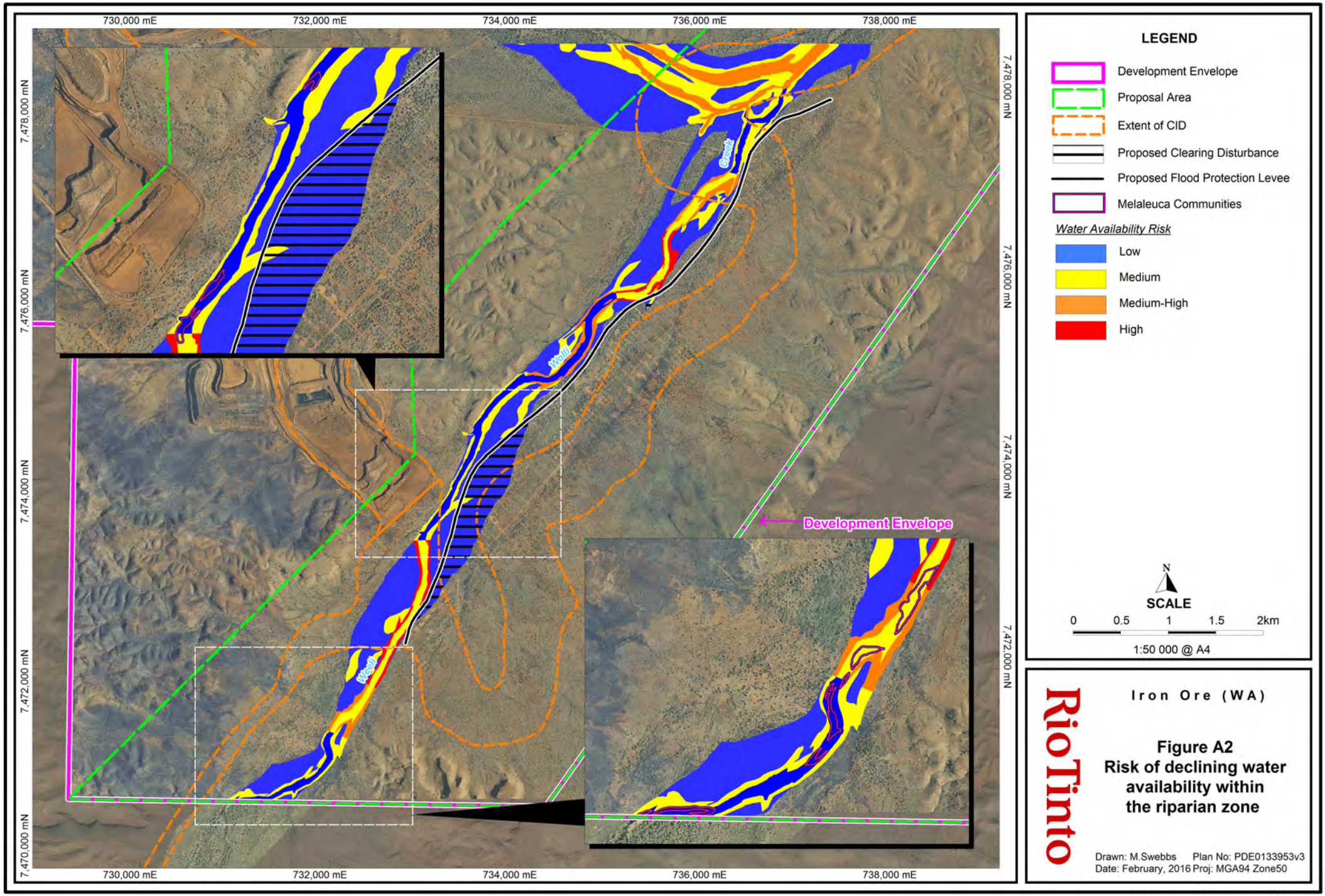
RioTinto

Iron Ore (WA)

Figure A1
Riparian zones and location of dominant tree strata

Drawn: M.Swebbs Plan No: PDE0139795v1
Date: February, 2016 Proj: MGA94 Zone50

Geospatial Information and Mapping



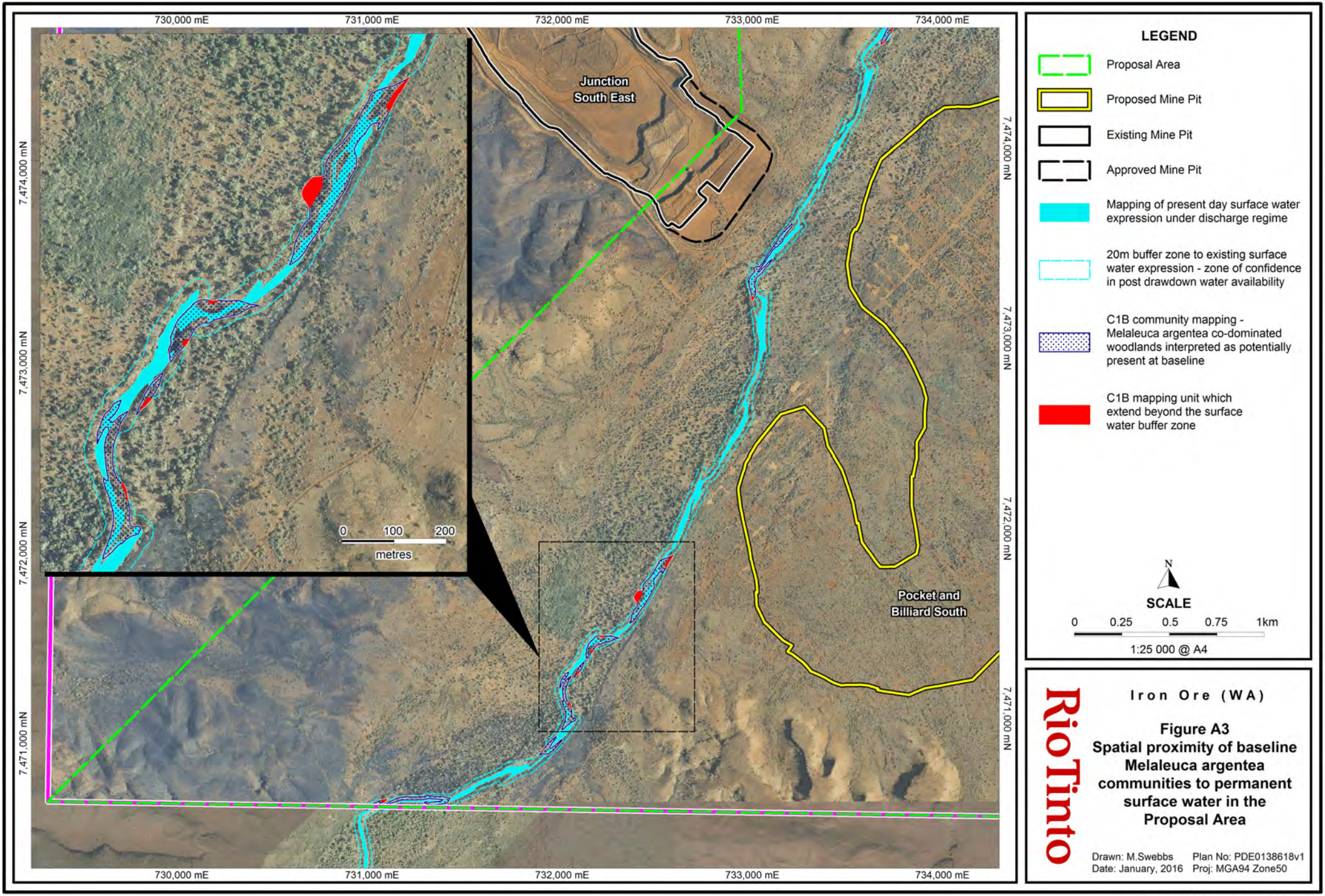
RioTinto

Iron Ore (WA)

Figure A2
Risk of declining water availability within the riparian zone

Drawn: M.Swebbs Plan No: PDE0133953v3
Date: February, 2016 Proj: MGA94 Zone50

Geospatial Information and Mapping



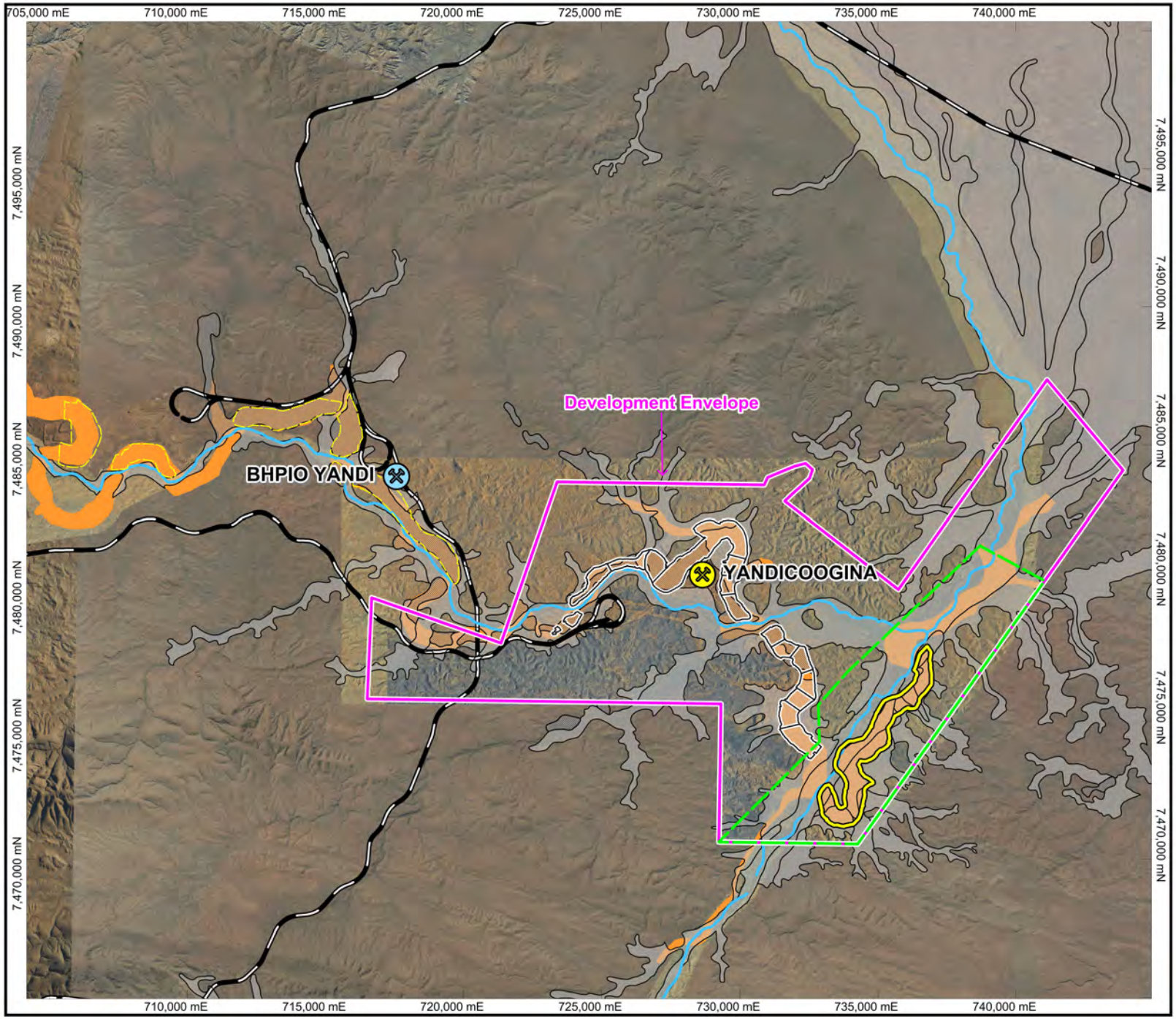
RioTinto

Iron Ore (WA)

Figure A3
Spatial proximity of baseline Melaleuca argentea communities to permanent surface water in the Proposal Area

Drawn: M.Swebbs Plan No: PDE0138618v1
Date: January, 2016 Proj: MGA94 Zone50

Geospatial Information and Mapping



LEGEND

- Development Envelope
- Proposal Area
- Conceptual Mine Pit
- Existing Mine Pit
- Indicative BHP Mine Pit
- Existing Railway
- Major Watercourse

Potential Stygofauna habitat and refuge (by geology unit)

- Alluvium, Colluvium, Calcrete
- Czp - CID
- CID

N

SCALE

0 2 4 6 8 10km

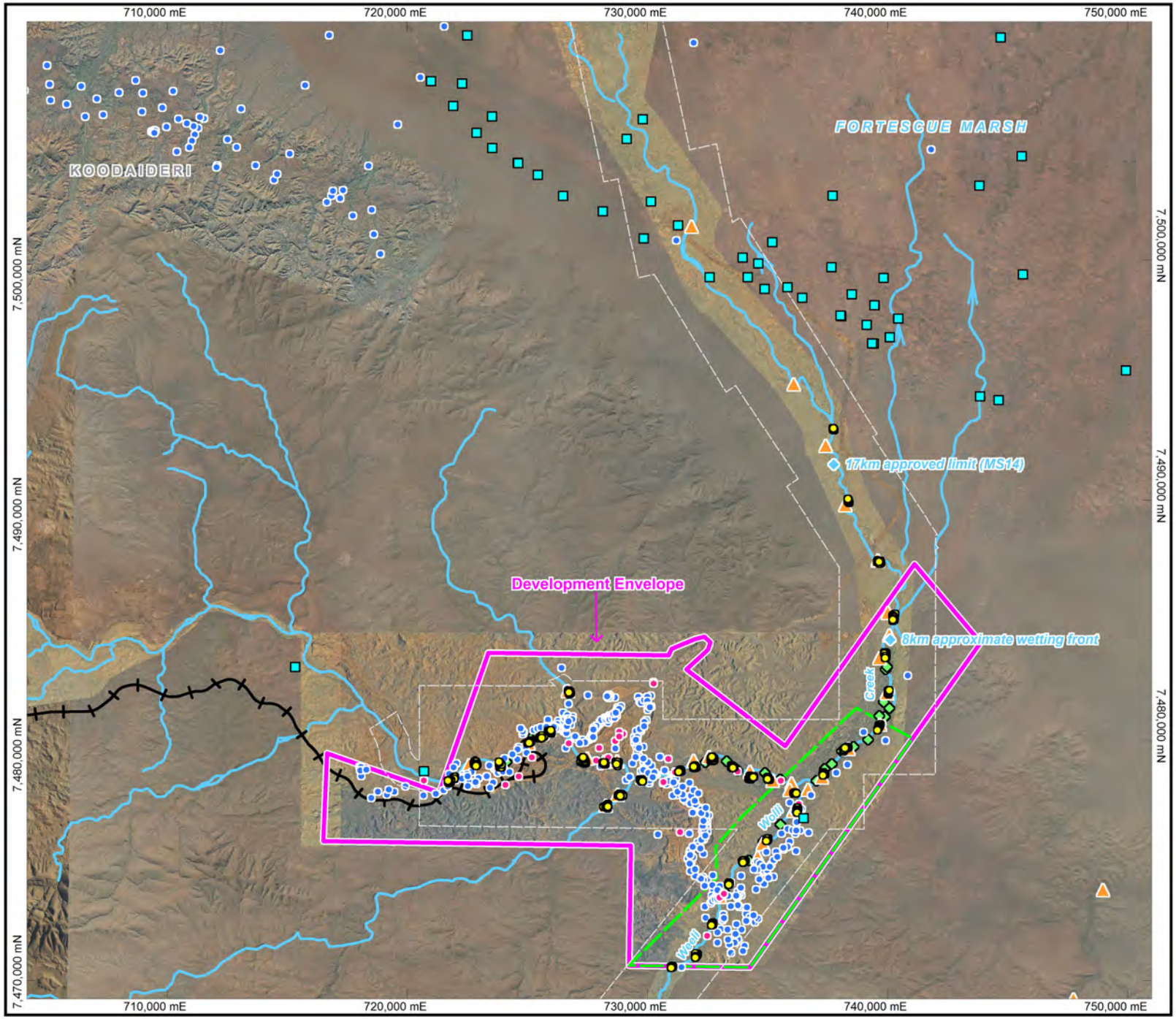
1:200 000@ A4

RioTinto

Iron Ore (WA)

Figure A4
Stygofauna habitat in and around the Development Envelope

Drawn: M.Swebbs Plan No: PDE0136314v3
Date: February, 2016 Proj: MGA94 Zone50



LEGEND

- Development Envelope
- Proposal Area
- Major Watercourse
- Yandicoogina Railway
- Modelled Wetting Footprint Extents

Vegetation Monitoring Sites

- Digital Canopy Photograph Sites
- Vegetation Condition Transects
- Extent of DMSI Imagery

Water Monitoring Sites

- DOW
- Rio Tinto
- Surface Water

Aquatic Fauna Monitoring

- Aquatic Fauna Monitoring Site

N

SCALE

0 2.5 5 7.5 10km

1:230 000 @ A4

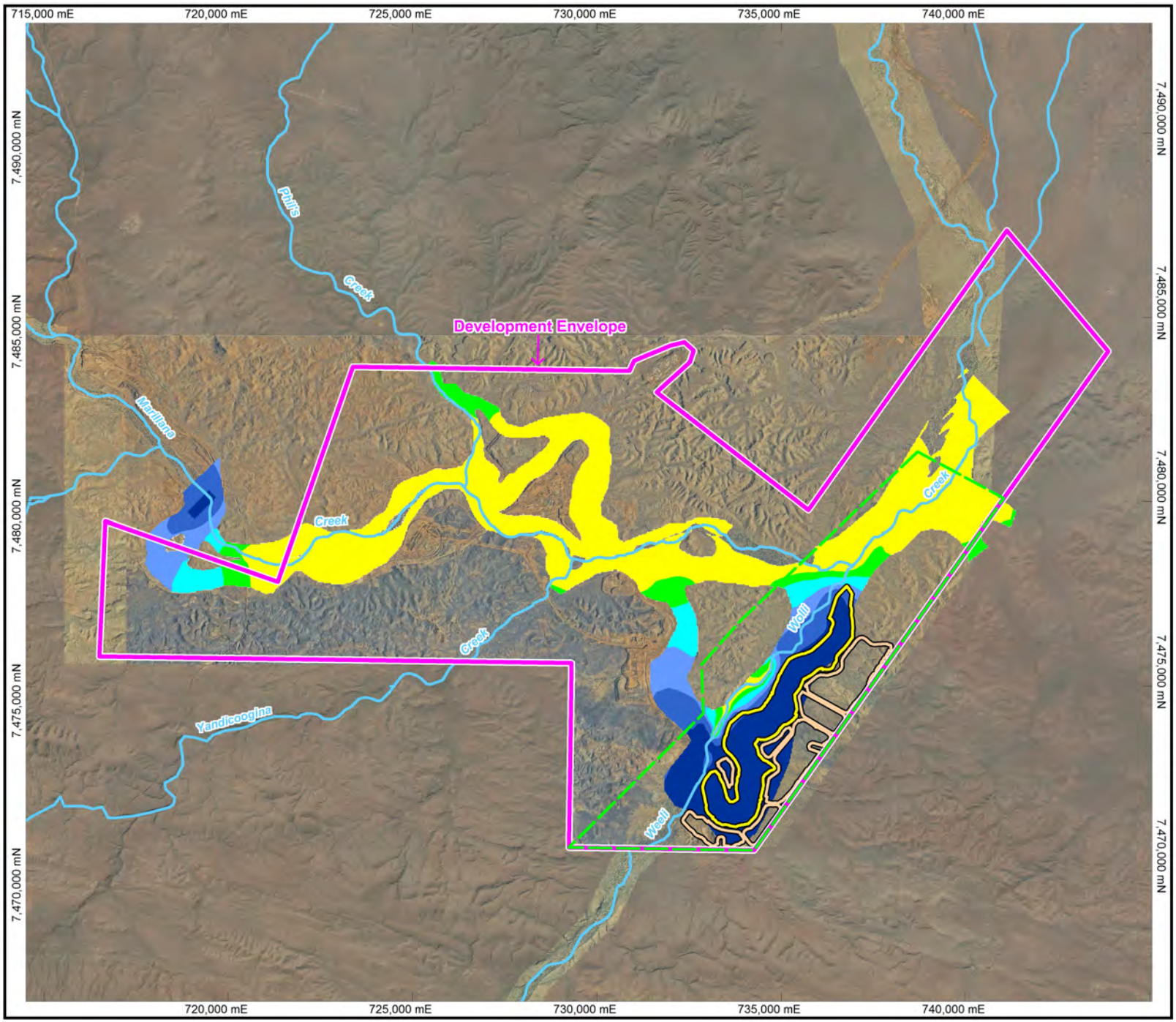
Iron Ore (WA)

Figure A5
The location of ongoing monitoring sites (piezometers) as per the Proponent's Groundwater Operating Strategy, covering the existing Yandi Operations, the Proposal, Fortescue Marsh and along the wetting front

Drawn: M.Swebbs Plan No: PDE0139737v1
Date: February, 2016 Proj: MGA94 Zone50

Rio Tinto

Geospatial Information and Mapping



LEGEND

- Development Envelope
- Proposal Area
- Conceptual Mine Pit
- Conceptual Waste Dump / Stockpile
- Major Watercourse

Drawdown in December 2031

metres

50
30
20
10
5
0

N

SCALE

0 2 4 6km

1:150 000 @ A4

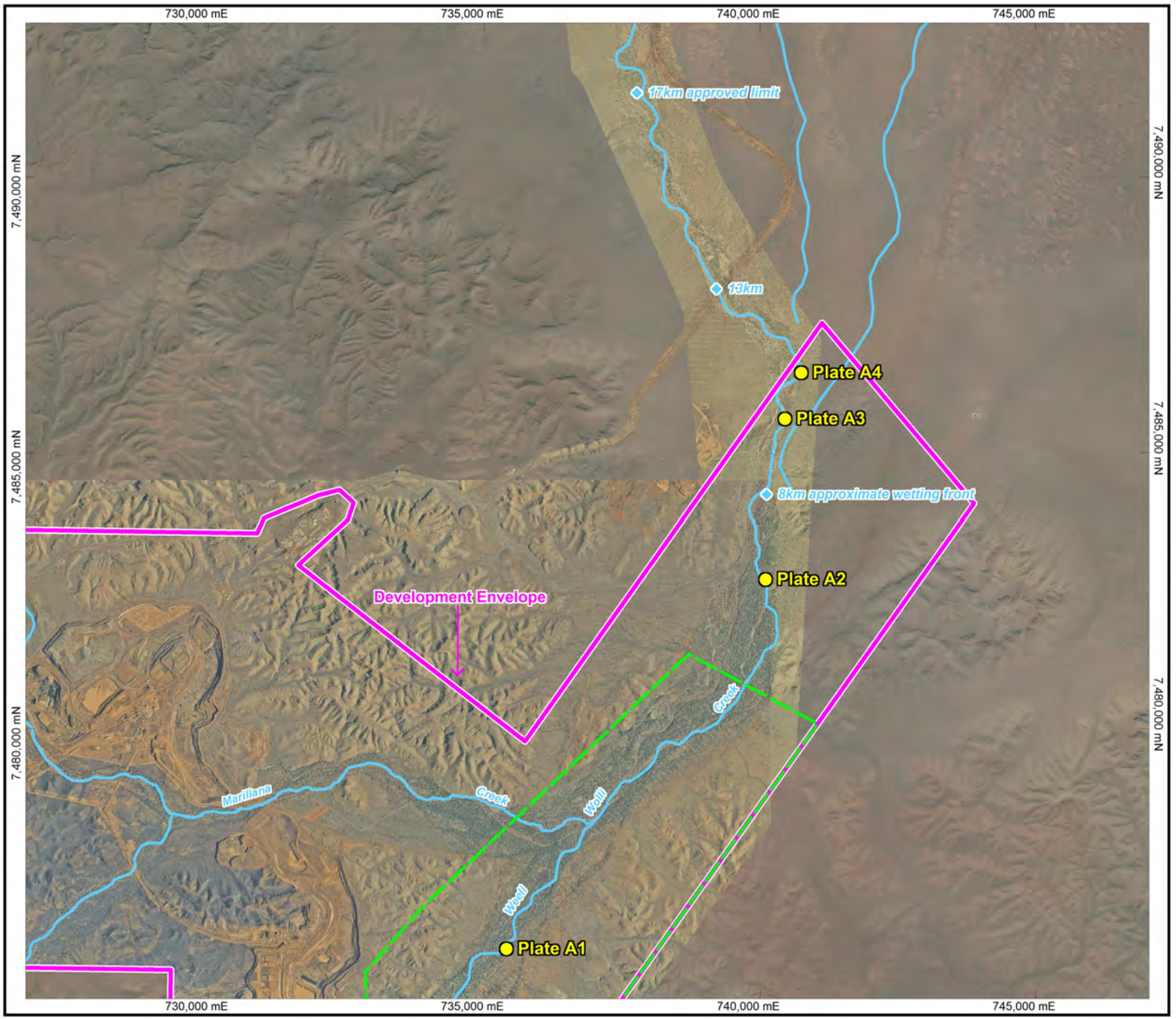
RioTinto

Iron Ore (WA)

Figure A6
Modelled groundwater drawdown as a result of the Proposal at the year 2032

Drawn: B Jackson Plan No: PDE0133872v3
Date: February, 2016 Proj: MGA94 Zone50

Geospatial Information and Mapping



LEGEND

- Development Envelope
- Proposal Area
- Approximate Photograph Location
- Wetting Footprint Extents
- Major Watercourse

N

SCALE

0 1 2 3 4 5km

1:100 000 @ A4

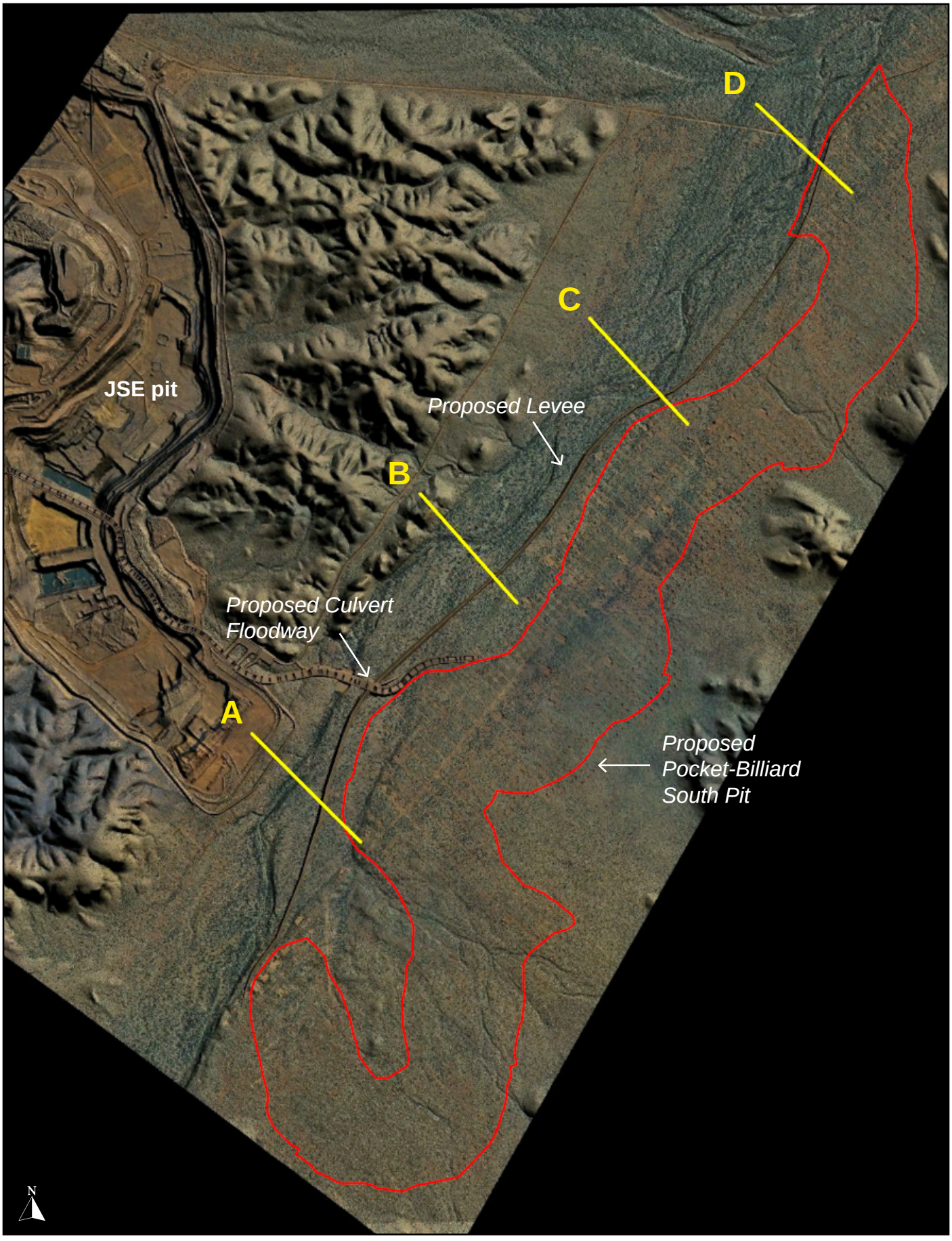
RioTinto

Iron Ore (WA)

Figure A7
Overview of the approximate location of photograph locations for Plate A1, Plate A2, Plate A3 and Plate A4 (refer to Table A2)

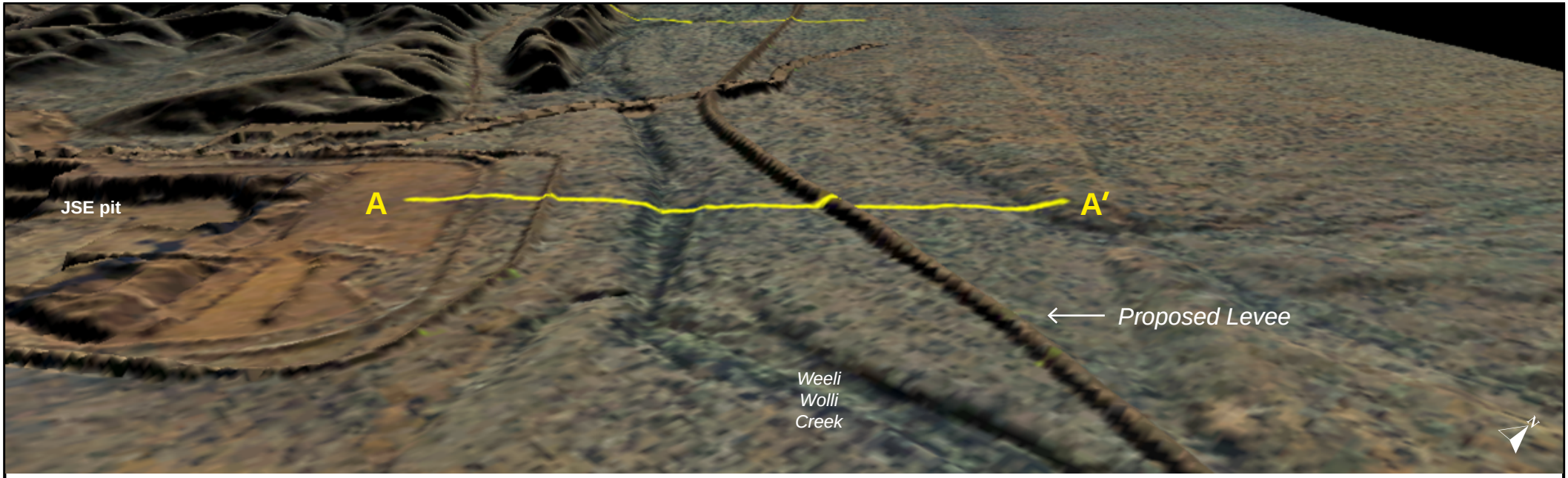
Drawn: M.Swebbs Plan No: PDE0139604v1
Date: February, 2016 Proj: MGA94 Zone50

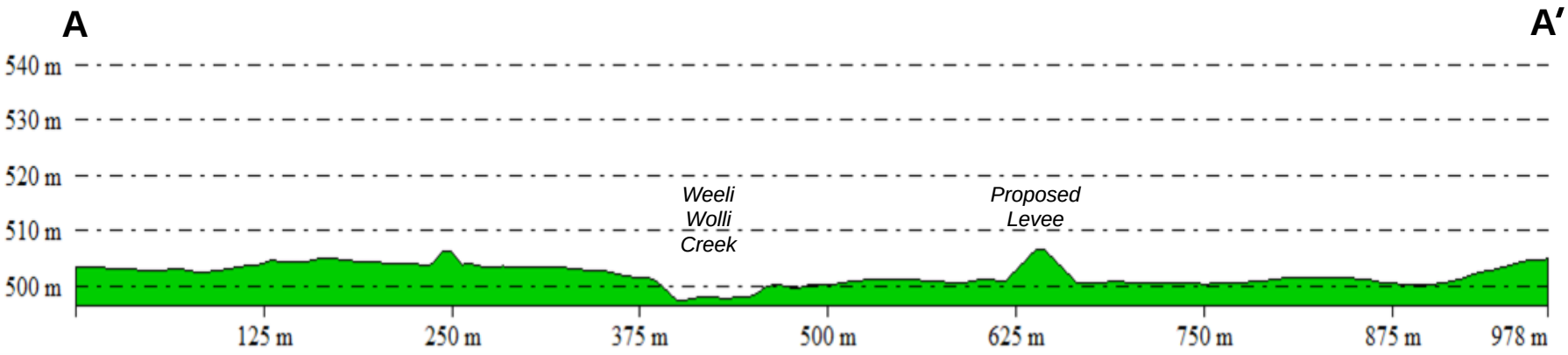
Geospatial Information and Mapping



RioTinto

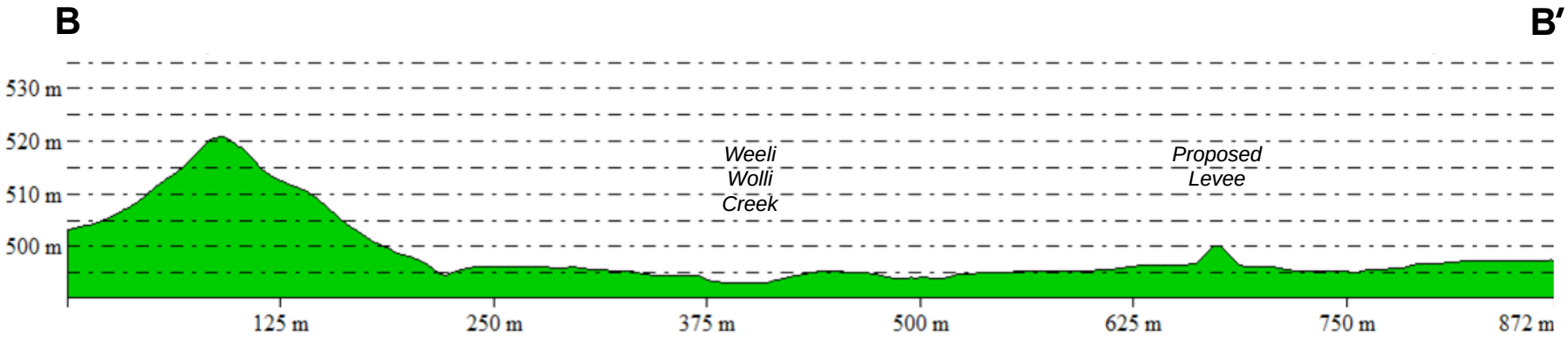
Figure A8 - Scaled diagram depicting the proposed flood levee during operations: Overview of Sections A-D





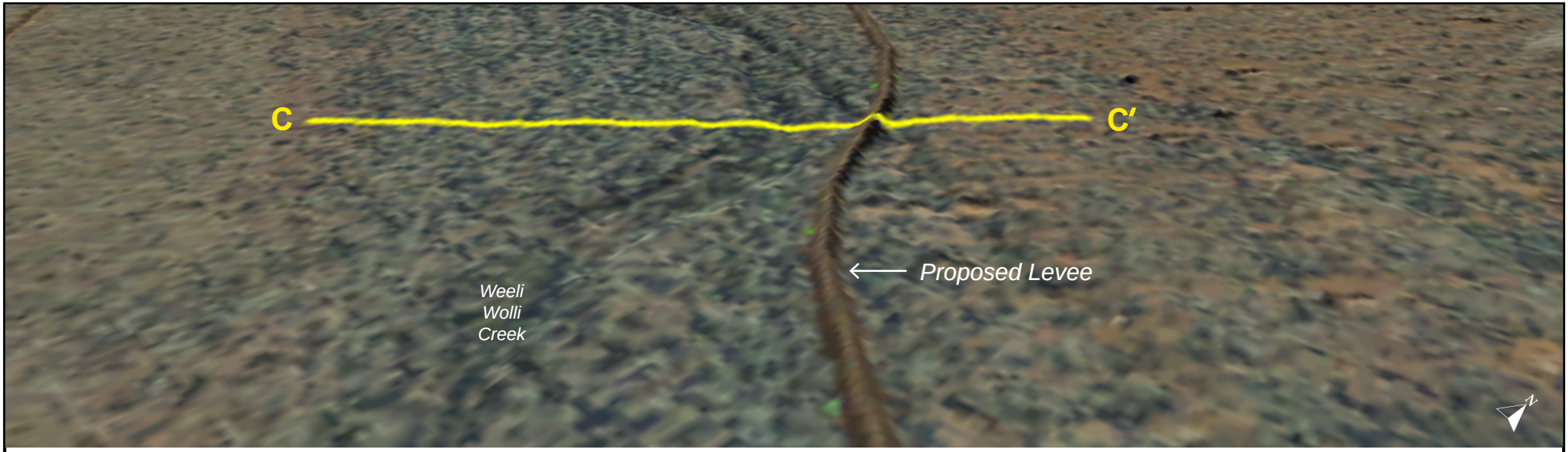
RioTinto

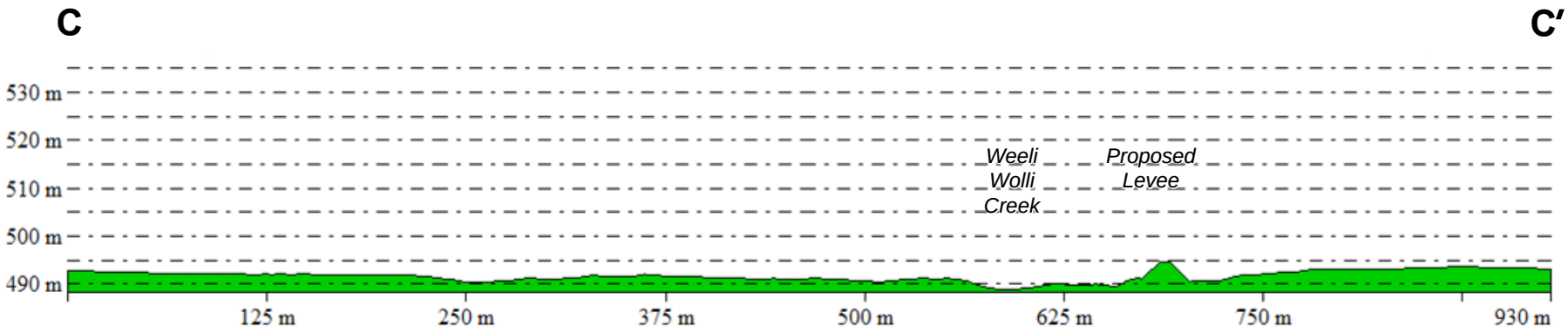
Figure A9 - Scaled diagram depicting the proposed flood levee during operations: Section A



RioTinto

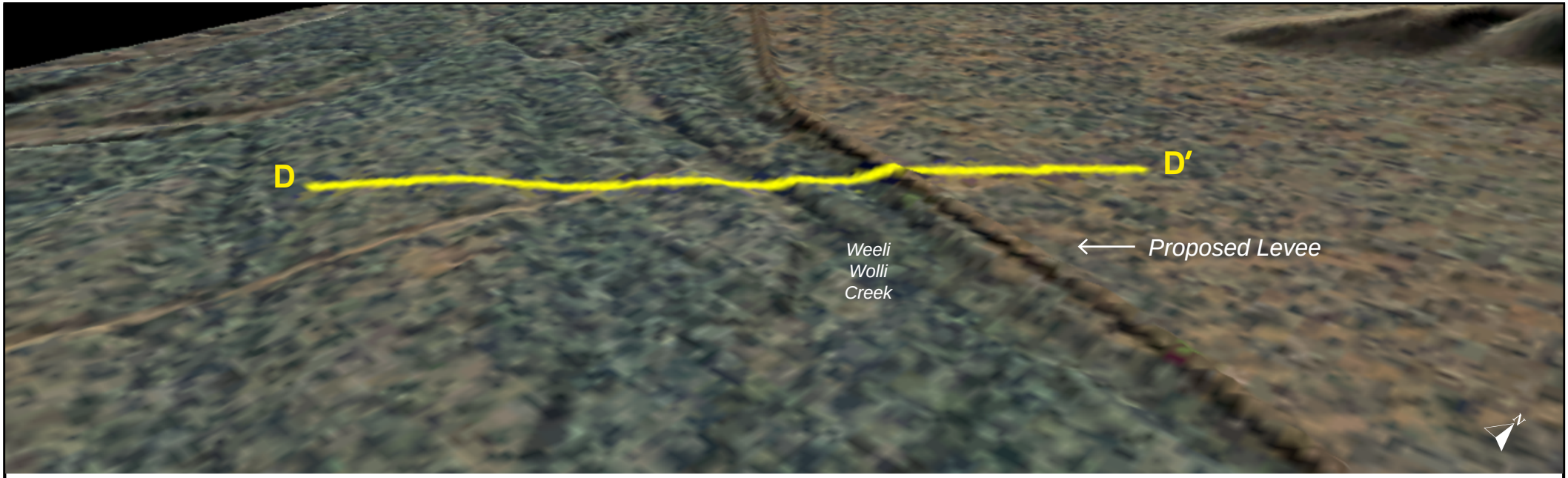
Figure A10 - Scaled diagram depicting the proposed flood levee during operations: Section B

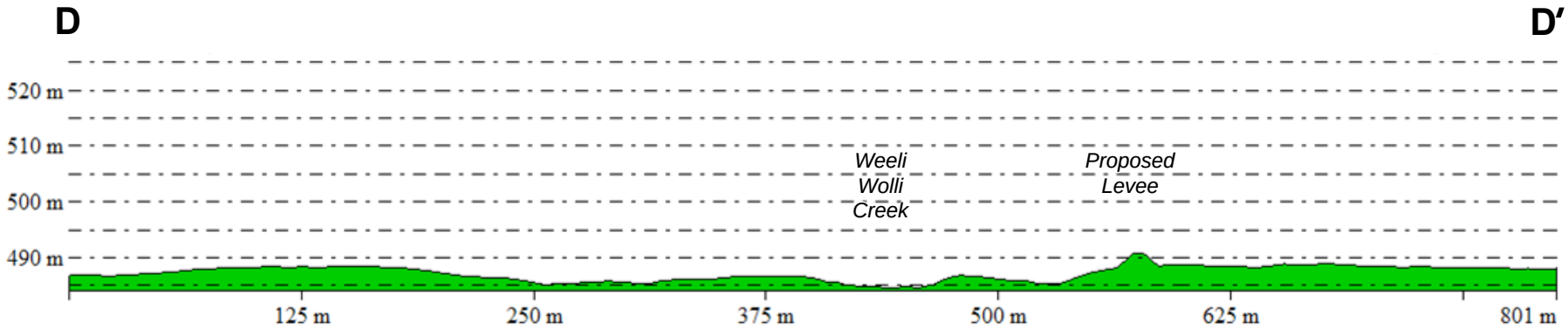




RioTinto

Figure A11 - Scaled diagram depicting the proposed flood levee during operations: Section C





RioTinto

Figure A12 - Scaled diagram depicting the proposed flood levee during operations: Section D

Plate A1: Immediately upstream of the confluence of Marillana and Weeli Wolli creeks as shown in Figure A7

Plate A2: Approximately 6.5 km downstream of the confluence of Marillana and Weeli Wolli creeks as shown in Figure A7

Plate A3: Approximately 9.3 km downstream of the confluence of Marillana and Weeli Wolli creeks as shown in Figure A7

Plate A4: Approximately 10.3 km downstream of the confluence of Marillana and Weeli Wolli creeks as shown in Figure A7

Plate A5: Approximately 38 km downstream of the confluence of Marillana and Weeli Wolli creeks

Appendix B Supporting documents

The following supporting documents are contained on CD inside the back cover of this document:

- Biota Environmental Sciences (Biota) 2016. *Yandi Pocket and Billiards South Supplementary Stygofauna Review*. Unpublished report.
- Rio Tinto 2016a. *Yandicoogina Pocket and Billiards South: Detailed responses to public submissions in relation to flora and vegetation*. Unpublished report.
- Rio Tinto 2016c. *Yandocoogina Pocket and Billiards South: Supplementary Hydrogeological Information*. Unpublished report.

Appendix C Consultation undertaken leading up to and following submission of the PER

Date	Format	Stakeholder	Topics raised	Outcomes (and Proponent response where relevant)
11 November 2015	Presentation	• Gumula • Proponent	Presentation of the Proposal and predicted environmental impacts and proposed management. Timing and discussion of PER process.	Copy of the Draft PER to be provided to Gumula for review. Discussion of monitoring opportunities for Gumula.
16-19 November 2015	On site Heritage Survey	• Gumula • Proponent	An ethnographic survey was conducted with Gumula representatives to discuss changes to the mine layout, hydrological drilling locations, the levee along WW Creek and the overpass (bridge) across WW Creek. Assessments of the nine archaeological sites that cannot be avoided by the Proposal, including Cork Tree Well.	The Proponent will submit an s18 application for the nine sites that cannot be avoided by the Proposal. This is proposed to be submitted to the DAA in July 2016.
4 December 2015	Face to face meeting	• DoW • OEPA • Proponent • Biota Environmental Sciences	DoW general concerns raised regarding changes to stygofauna habitat including: • Consideration of cumulative impacts • Retention of refuge areas • Inundation • Changes to water quality • What habitat is being removed as a result of mining • Areas of the catchment that are not impacted • Stygofauna not a condition under Ministerial Statement No. 914.	As part of the approval for the existing Yandi Operations, an Environmental Values Statement (EVS) was required to be developed for Weeli Wolli Creek. The EVS was developed in consultation with the former Department of Environment and Conservation (DEC) and approved by the CEO of the OEPA on 14 October 2012. It identified a number of high level values, including the identification of stygofauna communities as a local value. The existing MMP for the Proponent's Yandi Operations addresses the EVS and therefore includes management and monitoring measures for stygofauna. Discussion centred on stygofauna monitoring undertaken since 2003. Over 13 phases of sampling have been completed to date, including during the mining and dewatering of Junction Central (1996), Junction South East (2006) and Junction South West (2013). No discernible trends in populations or diversity have been noted to date. Habitat for stygofauna in the Development Envelope is generally concentrated in alluvials and calcretes rather than in the CID. This

Date	Format	Stakeholder	Topics raised	Outcomes (and Proponent response where relevant)
				habitat is extensive in the local region. The completion of a detailed cumulative impact assessment for stygofauna that considers potential habitat outside the Development Envelope is problematic due to tenure restrictions and unavailable and/or unusable data from other proponents in the area. The potential cumulative impacts associated with upstream inputs were taken into consideration in the PER document.
1 February 2016	Face to face meeting	• DoW • OEPA • Proponent • Eco Logical Australia	DoW general concerns raised regarding: • Individual tree species' responses to groundwater drawdown and reliance on groundwater • Physical extent of impact assessment appears to stop at the Development Envelope • The wetting front extent may not reflect base flow • Provision of published papers detailing that there will be no water-related impacts to Fortescue Marsh • Management responses during drought • Discussion on differentiating *Eucalyptus victrix* from *E. camaldulensis* in Pilbara creek systems.	The Proponent presented and discussed additional information on the integration of groundwater and surface water modelling and its alignment of riparian vegetation mapping. This included clarification of the risk-based approach to riparian vegetation communities and consideration of individual species' sensitivities to water availability. Examples of existing riparian areas subject to adjacent groundwater drawdown, including the response of *Eucalyptus camaldulensis* to drawdown near the existing Hope Downs 1 operations and adjacent to the Yandi Operations Junction South East and Junction South West mine pits. This demonstrated that groundwater drawdown in these areas is having no discernible mortality in the creekline. Hydrological papers outlining key research to date on Weeli Wolli Creek and Fortescue Marsh were proposed to be provided. The Proponent provided a discussion of techniques developed by one of its Senior Botanists to differentiate between the eucalypt riparian species in the field and from remote sensing techniques. Proposed management responses during drought, when the system is most likely to be vulnerable to water availability, will be based on soil water measurements, ground water levels and tree health monitoring to inform level of response. Potential responses include maintenance of the current perennial flow in the low flow/incised channel from Hope Downs 1. This is predicted to maintain water availability in the vicinity

Date	Format	Stakeholder	Topics raised	Outcomes (and Proponent response where relevant)
				of the low flow channel where the main riparian woodland is situated and which contains species defined in the EVS. On the floodplain further from the low flow channel, baseline groundwater levels are deeper and the likely reliance on groundwater is considered very low. Hence, any additional management actions in these areas outside the incised channel will focus on temporary supplementation of water where species considered to be of elevated environmental significance (as defined by the EVS) are present and likely to be most vulnerable to a change to both the groundwater and surface water availability.
11 February 2016	Face to face meeting	• DAA	Run through of the main elements of the Proposal including PER process and dates. DAA general queries including: • Sites which be impacted or impact to engraving sites • ethnographic sites subject to impact • S18 process • Gumula understanding of the water being discharged into the creeklines	The Proponent presented the key elements of the Proposal. 3 registered heritage sites will be impacted as a result of implementing the proposal, however no impact to engraving sites. Weeli Wolli creek has elevated ethnographic significance, and the proposal is to maintain the ecological functioning of the creekline. The sites requested for S18 approval will be run in parallel with the Environmental Approvals process. The Proposal has been presented to Gumula on a quarterly basis including specific presentations on the current status of monitoring and the Environmental Impacts predicted as a result of implementing the Proposal. This has also included closure planning. No objections have been raised.

Appendix D EPA policy checklist

Table D1: Checklist against EPA process steps

EIA Process Step	Policies	Is the policy relevant to the proposal? If yes, what are the relevant considerations for the proposal?
Referral	Environmental Assessment Guideline (EAG) No. 16 'Referral of a proposal under s38 of the *Environmental Protection Act 1986*'	The Proposal was referred under Section 38 of the *Environmental Protection Act 1986*', as per EAG No. 16.
Referral	Guidance Statement No. 10 'Level of Assessment for proposals affecting natural areas within the System 6 region and Swan Coastal Plain portion of the System 1 Region'	Not relevant. The Proposal is not in the System 6 region or the Swan Coastal Plain portion of the System 1 region.
Referral, Scoping and Environmental Review	EAG No. 1 'Defining the key characteristics of a proposal'	The Proposal summary and key characteristics are provided in Section 4.1 of the PER document.
Referral, Scoping and Environmental Review	EAG No. 8 'Environmental principles, factors and objectives'	Consideration of environmental principles for the Proposal is provided in Table 44 of the PER document. The following preliminary key environmental factors identified by the EPA and highlighted in the Environmental Scoping Document (ESD) have been addressed in the PER document in the context of relevant EPA objectives: • Hydrological processes and inland waters environmental quality (Section 13 of the PER document) • Flora and vegetation (Section 14 of the PER document) • Terrestrial fauna (Section 15 of the PER document) • Subterranean fauna (Section 16 of the PER document) • Rehabilitation and closure (Section 17 of the PER document) • Offsets (Section 18 of the PER document). The following 'other environmental factors' identified by the EPA and highlighted in the ESD have been

EIA Process Step	Policies	Is the policy relevant to the proposal? If yes, what are the relevant considerations for the proposal?
		addressed in the PER in the context of relevant EPA objectives in Section 19 of the PER document: • Indigenous heritage • Air quality • Amenity.
Referral, Scoping and Environmental Review	EAG No. 9 'Application of a significance framework in the environmental impact assessment process'	The significance framework has been applied through the following: • Further work was identified in the ESD for the preliminary key environmental factors where a significant effect on the environment was considered likely • The PER document focused on the preliminary key environmental factors, which were addressed individually in Sections 13-18 • The PER document demonstrated that all studies identified in the ESD were undertaken and provided the findings of those studies (refer to Appendix 2 of the PER document) • The application of the mitigation hierarchy to each of the key factors was discussed in the respective sections of the PER document.
Scoping and Environmental Review	Environmental Protection Bulletin (EPB) No. 16 'Minor or preliminary works or investigation work'	The Proposal included minor or preliminary works for a number of elements including development of a bypass track for public and Traditional Owner use during the construction and operation phase. The Proposal application demonstrated that the proposed minor or preliminary works met four key criteria under section 41A(3) of the EP Act (and the six steps outlined in EPB No. 16) as follows: 1. It must be work associated with the implementation of the proposal 2. The potential environmental impacts of the work must be less than that which would normally require formal environmental impact assessment 3. The work must not irreversibly lead to substantial implementation of the proposal 4. The work is justified in extent and timing. Separate approvals, permits and licences will be sought from relevant decision-making authorities for the works approved by the EPA. (e.g. a native vegetation clearing permit).
Scoping, Environmental Review and Reporting	EAG No. 6 'Timelines for Environmental Impact Assessment	The EPA applies relevant steps and timeframes for a PER level of assessment in accordance with EAG No. 6.

EIA Process Step	Policies	Is the policy relevant to the proposal? If yes, what are the relevant considerations for the proposal?
	of Proposals'	
Scoping	EAG No. 10 'Scoping a proposal'	The ESD for the Proposal was prepared by the EPA in consultation with the Proponent in accordance with EAG No. 10.
Environmental Review	EAG No. 14 'Preparation of an API – Category A Environmental Review Document'	Not relevant. The Proposal is not being assessed at the API – Category A level of assessment.
Environmental Review	EPB No. 17 'Strategic and derived proposals'	Not relevant. The Proposal is not a strategic or derived proposal.
Environmental Review and Reporting	EAG No. 17 'Preparation of Management Plans under Part IV of the *Environmental Protection Act 1986*'	A number of existing approved management plans are in operation for the existing Yandi Operations contained within the Development Envelope as required by MS914 and have been updated for the PER to include the Proposal. Further updates are proposed to ensure the management plans are consistent with EAG No. 17, however the existing management plan submitted with the PER was developed and submitted prior to the release of EAG No. 17.
Environmental Review and Reporting	EAG No. 11 'Recommending environmental conditions'	Existing Yandi Operations are subject to conditions under Ministerial Statement No. 914. Appendix 6 of the PER document outlined proposed changes to these conditions based on the Revised Proposal. Where opportunities exist, new and revised conditions will be recommended in accordance with EAG No. 11. Monitoring to support outcomes-based conditions is detailed in Section 12.3.1 of the PER document.
Environmental Review and Reporting	EPB No. 11 'Consultation on Conditions Recommended by the EPA'	The Proponent acknowledges the OEPA will seek comment from the Proponent and key decision-making authorities on draft conditions in accordance with EPB No. 11.
All	Guidance Statement No. 33 'Environmental Guidance for Planning and Development'	The main purposes of this guidance statement are to provide information to assist in land use planning and development, and to describe the processes the EPA may apply under the EP Act. Much of the advice and information in this guidance document is relevant to the Proposal. Specific considerations are covered in other policy documents.
All	Guidance Statement No. 55 'Implementing best practice in	This guidance statement is focused primarily on environmental and health impacts from industrial processes. Where these are relevant to the Proposal, best management practices have been outlined

EIA Process Step	Policies	Is the policy relevant to the proposal? If yes, what are the relevant considerations for the proposal?
	proposals submitted to the environment impact assessment process'	in mitigation and key management actions sections of the PER document. Best management practices will also be required in order to meet the objectives of the Closure Plan; these will be determined at a time closer to implementation of the Closure Plan.

Table D2: Checklist against environmental factors

Environmental Sector	Environmental Factor	Policies - Environmental Factor	Is the policy relevant to the proposal? If yes, what are the relevant considerations for the proposal?
Land	Flora and Vegetation	Guidance Statement No. 51 'Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in WA'	Appendix 5 of the PER document detailed where the following considerations were addressed in the PER document: • Level of flora and vegetation survey consistent with that expected in Table 3 of Guidance Statement No. 51 • Description of survey area and methodologies, including reference to timing, duration, survey effort, any survey limitations, and the nomenclature used (WA Herbarium) • Maps and text describing the survey area/plot sites, location of significant species, vegetation mapping, vegetation condition assessment and predicted extent of impact on the vegetation • A comprehensive list of flora species identified and assessment of threatened, priority or other significant flora/ecological communities known or reasonably expected to occur in the area (as defined in Guidance Statement No. 51) • Evaluation of the impact of the Proposal on the species/communities, including reference to the extent of regional clearing of the vegetation complex/type and ecological linkage • Provision of all quadrat data used in reporting as electronic database in raw form, in addition to hardcopy reports.
Land	Flora and Vegetation	Technical Guide – Flora and Vegetation Surveys for Environmental Impact Assessment	This document did not exist at the time surveys were undertaken and has therefore not been considered.
Land	Flora and Vegetation	Position Statement No. 2 'Environmental Protection of Native Vegetation in WA'	Alternatives to the proposal were discussed Section 2 of the PER document. Key mitigation measures were described in Section 14.3 of the PER document. No known species of plant or animal will become extinct as a consequence of the Proposal. No association or community of indigenous plants or animals will cease to exist as a result of the Proposal. No vegetation type will be taken below the 'threshold level' of 30% of the pre-clearing extent of the vegetation type as a result of the Proposal. The on-site and off-site impacts of the Proposal to native vegetation were identified and the Proponent demonstrated that these impacts can be managed in Sections 14.5 and 14.6 of the PER document.

Environmental Sector	Environmental Factor	Policies - Environmental Factor	Is the policy relevant to the proposal? If yes, what are the relevant considerations for the proposal?
Land	Flora and Vegetation	EPB No. 20 'Protection of naturally vegetated areas through planning and development'	Not relevant. This bulletin applies to strategic planning, structure plans, new schemes and scheme amendments, subdivision and development proposals, in urban and peri-urban areas of Western Australia. The Proposal is not located within an urban or peri-urban area.
Land	Flora and Vegetation	EPB No. 21 'Guidance for wind farm developments'	Not relevant. The Proposal does not relate to a wind farm.
Land	Flora and Vegetation	Position Statement No. 3 'Terrestrial Biological Surveys as an Element of Biodiversity Protection'	Avoidance and mitigation measures for terrestrial biodiversity were described in Section 14.3 of the PER document. Predicted outcomes are described in Section 14.6 of the PER document. Field surveys for flora and vegetation were carried out in accordance with EPA Guidance Statement No. 51. Biological surveys were attached to the PER document to be made publicly available.
Land	Terrestrial Fauna	Position Statement No. 3 'Terrestrial Biological Surveys as an Element of Biodiversity Protection'	Avoidance and mitigation measures for terrestrial biodiversity were described in Section 15.5 of the PER document. Predicted outcomes are described in Section 15.8 of the PER document. Field surveys for terrestrial fauna were carried out in accordance with EPA Guidance Statement No. 56. Biological surveys were attached to the PER document to be made publicly available.
Land	Terrestrial Fauna	Guidance Statement No. 20 'Sampling of Short range endemic Invertebrate Fauna for Environmental Impact Assessment in WA'	Appendix 5 of the PER document detailed where the following considerations were addressed in the PER document: • Early initial desktop review and advice received from WA museum on specific target groups for survey • Maps and text describing the survey area, potential short-range endemic habitats and regional context and extent of predicted impact on the habitat • Description of survey methodologies, including reference to timing, duration and survey effort used to sample each of the short-range endemic groups sampled, and any survey limitations • A survey report with assessment of short-range endemic fauna found or reasonably expected to occur in the area, including any Specially Protected and other significant fauna, their known occurrence/habitats locally and their wider status if known, and an evaluation of the risk of the proposal to long-term survival of the species and community.

Environmental Sector	Environmental Factor	Policies - Environmental Factor	Is the policy relevant to the proposal? If yes, what are the relevant considerations for the proposal?
Land	Terrestrial Fauna	Guidance Statement No. 56 'Terrestrial Fauna Surveys for Environmental Impact Assessment in WA'	Appendix 5 of the PER document detailed where the following considerations were addressed in the PER document: • Level of fauna survey consistent with that expected in Table 3 (Appendix 2) of Guidance Statement No. 56 • Description of survey methodologies in the context of the 'Technical Guide on Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment', including reference to timing, duration and survey effort used to sample each of the fauna groups sampled, any survey limitations and the nomenclature used • Maps and text describing the survey area, sampling locations and fauna habitats • A comprehensive list and assessment of fauna known or reasonably expected to occur in the area, including Specially Protected and other significant fauna (as defined in Guidance Statement No. 56), and an evaluation of the impact of the proposal on the species and key habitat/s.
Land	Terrestrial Fauna	Technical Guide on Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment	Consistency with this technical guide was addressed within supporting terrestrial fauna reports, which were attached to the PER document.
Land	Terrestrial Fauna	EPB No. 20 'Protection of naturally vegetated areas through planning and development'	Not relevant. This bulletin applies to strategic planning, structure plans, new schemes and scheme amendments, subdivision and development proposals, in urban and peri-urban areas of Western Australia. The Proposal is not located within an urban or peri-urban area.
Land	Terrestrial Fauna	EPB No. 21 'Guidance for wind farm developments'	Not relevant. The Proposal does not relate to a wind farm.
Land	Subterranean Fauna	EAG No. 12 'Consideration of subterranean fauna in environmental impact	The level of subterranean fauna survey was consistent with that expected in Table 2 of EAG No. 12. The survey design was consistent with the requirements of EAG No. 12. Vouchering and lodgement was undertaken as per EAG No. 12. The results of surveys were clearly presented and the relevant survey report, which was attached to the PER document, included sections outlining the methodology,

Environmental Sector	Environmental Factor	Policies - Environmental Factor	Is the policy relevant to the proposal? If yes, what are the relevant considerations for the proposal?
		assessment in Western Australia'	results and analysis. The survey report considered all the information obtained from the results from the surveys to quantify the likely degree of direct and indirect impacts to subterranean fauna.
Land	Subterranean Fauna	Guidance Statement No. 54a 'Sampling Methods and Survey Considerations for Subterranean Fauna in WA'	Appendix 5 of the PER document detailed where the following considerations were addressed in the PER document: • Early initial desktop review • Inclusion of a subterranean fauna survey report • Maps and text identifying and describing the survey sites/area, the geology/habitat supporting subterranean fauna, and extent of predicted impacts on the habitat • Description of survey methodologies, including reference to timing, duration and survey effort used to sample each of the fauna groups sampled, species identification, and any survey limitations • A comprehensive list and assessment of subterranean fauna recorded or reasonably expected to occur in the area, including any Specially Protected and other significant fauna and their known occurrence/habitats locally and their wider status if known, and an evaluation of the risk of the proposal to long-term survival of the species and community.
Water	Hydrological processes Inland waters environmental quality	Position Statement No. 4 'Environmental Protection of Wetlands'	A small portion of the broader Development Envelope and modelled discharge extent intersects the Poonda Plain Management Area of the Fortescue Marsh. The Fortescue Marsh is not predicted to be affected by the Proposal. This was discussed in Section 13 of the PER document.
Water	Hydrological processes Inland waters environmental quality	EPB No. 22 'Hydraulic fracturing for onshore natural gas from shale and tight rocks'	Not relevant. The Proposal does not include hydraulic fracturing.
Water	Hydrological	Statewide Policy No 5	The Proponent acknowledges this policy will be considered by the DoW in licensing of abstraction for

<table>
<tr><th>Environmental Sector</th><th>Environmental Factor</th><th>Policies - Environmental Factor</th><th>Is the policy relevant to the proposal? If yes, what are the relevant considerations for the proposal?</th></tr>
<tr><td></td><td>processes
Inland waters environmental quality</td><td>‘Environmental water provisions policy for Western Australia’</td><td>the Proposal in order to protect ecological values.</td></tr>
<tr><td>Water</td><td>Hydrological processes
Inland waters environmental quality</td><td>Strategic Policy No. 2.09 ‘Use of mine dewatering surplus’</td><td>Mine dewatering surplus will continue to be discharged to Marillana and Wooli Wolli creeks. The proposed water balance and discharge points were provided in Figure 34 and Figure 35 of the PER document. Alternative options for the use of surplus water over and above the existing approved discharge limits for the Yandi Operation were discussed in Section 13.3.4 of the PER document.</td></tr>
<tr><td>Water</td><td>Hydrological processes
Inland waters environmental quality</td><td>Environmental and water assessments relating to mining and mining related activities in the Fortescue Marsh management area</td><td>A small portion of the Development Envelope and modelled discharge extent intersects Fortescue Marsh Management Area Zone 2b- Poonda Plain. The Fortescue Marsh is not predicted to be affected by the proposal. Further discussion was provided in Section 13 of the PER document.
Although most of the Proposal Area is outside the Management Area, the proposal is consistent with the management objectives for Zone 2b as follows.
<table>
<tr><th>Management Objective</th><th>Response</th></tr>
<tr><td>Maintain the natural flow regime at the boundary between Northern Flank and Marsh zones.</td><td rowspan="3">It is predicted that hydrological impacts to Fortescue Marsh will be avoided. The surface water wetting front associated with additional discharge from the Proposal is predicted to remain within existing approval limits of Ministerial Statement No. 914. Further information was provided in Section 13.3.5 of the PER document.</td></tr>
<tr><td>Maintain the natural flow regime of tributaries entering the Marsh.</td></tr>
<tr><td>Protect the hydrological and ecological integrity of major tributaries entering the Marsh.</td></tr>
</table></td></tr>
</table>

Environmental Sector	Environmental Factor	Policies - Environmental Factor	Is the policy relevant to the proposal? If yes, what are the relevant considerations for the proposal?		
				Protect Priority Ecological Communities.	None of the vegetation communities recorded in the Proposal Area represent Priority Ecological Communities.
				Protect species of conservation significance and their habitat.	Impacts to species of conservation significance were discussed in Section 15.5.1 and Section 14.3.2 of the PER document.
				Protect the Northern Quoll and its habitat.	A targeted Northern Quoll survey was undertaken. Section 15.5.1.1 of the PER document included a discussion on the significance of potential impacts to the Northern Quoll.
				Protect the Bilby and its habitat.	The Bilby is considered unlikely to occur in the Proposal Area.
				Enhance understanding of local subterranean species.	Supporting subterranean fauna surveys have been conducted.
				Enhance understanding of aquatic invertebrates.	Supporting aquatic fauna surveys have been conducted.
Integrating factors	Rehabilitation and closure	Guidelines for Preparing Mine Closure Plans	A Closure Plan for the existing Yandi Operations was approved by the OEPA on 23 January 2015, in accordance with the existing decommissioning and rehabilitation condition (Condition 9) of Ministerial Statement No. 914. This Closure Plan has been updated, consistent with the Guidelines for Preparing Mine Closure Plans, to detail the closure requirements for the Proposal Area. The Yandicoogina Closure Plan (August 2015) was attached to the PER document.		
Integrating factors	Rehabilitation and closure	Guidance Statement No. 6 'Rehabilitation of Terrestrial Ecosystems'	Objectives and completion criteria developed in accordance with Guidance Statement No. 6 were outlined in Section 17 of the PER document.		

Environmental Sector	Environmental Factor	Policies - Environmental Factor	Is the policy relevant to the proposal? If yes, what are the relevant considerations for the proposal?
Integrating factors	Rehabilitation and closure	EPB No. 19 'EPA involvement in mine closure'	The Proponent acknowledges the EPA will assess the mine closure planning proposed in the PER.
Integrating factors	Rehabilitation and closure	EPB No. 22 'Hydraulic fracturing for onshore natural gas from shale and tight rocks'	Not relevant. The Proposal does not include hydraulic fracturing.
Integrating factors	Offsets	EPB No. 1 'Environmental Offsets – Biodiversity'	Potential impacts in relation to offsets identified by the EPA in the ESD were: vegetation, flora, habitat and fauna species of State and National Significance. Mitigation for these factors in accordance with the hierarchy in EPB No. 1 was described in Section 14 (flora and vegetation) and Section 15 (terrestrial fauna) of the PER document. Residual significant impacts and proposed offsets were discussed in Section 18.3 of the PER document.
Integrating factors	Offsets	WA Environmental Offsets Policy and Guidelines	Consistent with the WA Environmental Offsets Guidelines, it is considered that the residual impact of disturbance of vegetation in Good to Excellent condition is significant and will therefore require compensation via an offset. A standard offset approach has been developed by the EPA in regard to this residual impact and it has been applied consistently to projects in the Pilbara. As such, the Proponent is proposing to contribute funding of $1,500 (excluding GST) per hectare of native vegetation, and funding of $3,000 (excluding GST) per hectare of riparian vegetation cleared to a government-established conservation offset fund or an alternative offset arrangement providing an equivalent outcome as determined by the Minister.
All	All	Cumulative environmental impacts of development in the Pilbara region	The Proposal is within the Pilbara region. The PER document and this document provide context for the EPA's advice on the acceptability of the Proposal.
People	Heritage	Guidance Statement No. 41 'Assessment of Aboriginal Heritage'	Section 19.1.1 of the PER document provided details of previous surveys and consultation undertaken in relation to Aboriginal heritage. Mitigation and management in relation to Aboriginal heritage was described in Section 19.1.2 of the PER document. Predicted environmental outcomes were provided in Section 19.1.3 of the PER document.

Environmental Sector	Environmental Factor	Policies - Environmental Factor	Is the policy relevant to the proposal? If yes, what are the relevant considerations for the proposal?
Air	Air Quality	Guidance Statement No. 3 'Separation Distance between Industrial and Sensitive Land Uses'	Not relevant. The Proposal is remote from sensitive receptors, with other mining operations being the nearest premise.
Air	Air Quality	EPB No. 24 'Greenhouse gas emissions and consideration of projected climate change impacts in the EIA process'	The EPA has not required the Proponent to address greenhouse gas emissions or climate change in the PER document. Notwithstanding, the Proponent has committed to: • Measure energy use, calculate greenhouse gas emissions and continually seek opportunities to reduce emissions (refer to Section 23.1 of the PER document) • Improve energy efficiency and contribute to a reduction in greenhouse gas intensity over product life cycles (refer to Section 23.4 of the PER document).
Air	Air Quality	EPB No. 22 'Hydraulic fracturing for onshore natural gas from shale and tight rocks'	Not relevant. The Proposal does not include hydraulic fracturing.
People	Amenity	EAG No. 13 'Consideration of environmental impacts from noise'	Not relevant. The Proposal is remote from sensitive receptors, with other mining operations being the nearest premise.
People	Amenity	Guidance Statement No. 3 'Separation Distance between Industrial and Sensitive Land Uses'	Not relevant. The Proposal is remote from sensitive receptors, with other mining operations being the nearest premise.
People	Amenity	EPB No. 21 'Guidance for wind farm developments'	Not relevant. The Proposal does not relate to a wind farm.

Yandicoogina Iron Ore Project – Revised Proposal

Response to Submissions - Addendum

April 2016

State Assessment Number: Assessment No. 2017

Prepared for Rio Tinto by Eco Logical Australia

DOCUMENT TRACKING

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This document has been prepared by Eco Logical Australia Pty Ltd on behalf of Rio Tinto for the Proponent: Hamersley Iron – Yandi Pty Limited.

Contents

List of tables

1 Introduction

This document provides an addendum to the Yandicoogina Iron Ore Project – Revised Proposal (the Proposal) Response to Submissions document (Eco Logical 2016) submitted to the Office of the Environmental Protection Authority (OEPA) on 29 February 2016. It provides further information and responses to the Department of Water (DoW) additional comments on the Proposal provided in a letter to the OEPA dated 31 March 2016.

This document also describes refinements to the Proposal since the preparation of the Response to Submissions document (Eco Logical 2016).

2 Response to DoW submission

Following submission and review of the Response to Submissions document (Eco Logical 2016), the DoW provided correspondence in a letter dated 31 March 2016 to confirm that a number of matters had been addressed adequately, and provided further comment on some proponent responses where it considered further explanation may be required.

DoW's comments that required further information from the proponent are provided in **Table 1**, with the proponent's responses listed in an adjacent column. These responses should be read in conjunction with the information previously provided in the Response to Submissions document (Eco Logical 2016).

Table 1: Additional information in response to DoW correspondence (31 March 2016)

Issue no.	Submitter	Submission and/or issue	Proponent response
Flora and vegetation			
2	DoW	DoW reiterates that available groundwater data (pre-dewatering) suggests that the groundwater table was approximately 6-8 m below ground level (bgl). This represents a significant difference in terms of impacts to GDE's and expected return to a natural ephemeral regime at mine closure, based on the proponent's baseline groundwater elevation modelling for the section of Weeli Wolli Creek adjacent to the Proposal Area (predicted groundwater table 20-50 m below ground for the majority of the creek and 12-20 m below ground for the remainder of the floodplain).	The Proponent acknowledges that there are limited historical water level data available for the riparian zone, outside the CID, and a record exists for the pre-mining depth to groundwater near the confluence of Marillana and Weeli Wolli creeks of approximately 6-8 m. As previously noted, this approximate depth seems realistic in specific locations, however the depth to groundwater is likely to have always been variable along the length of Weeli Wolli Creek. Of importance in predicting potential impacts is that recent studies (Rio Tinto 2015) indicate that the riparian vegetation along Weeli Wolli Creek (and other ephemeral systems in the Pilbara) is largely supported by pore soil moisture availability that is driven by surface water flows. This is evident in the expansion of the riparian vegetation communities since the commencement of discharge activities in the mid-2000s. It is considered that in many cases, communities historically considered to be groundwater-dependent ecosystems (GDEs) are more likely to be sustained as a result of retention of water in pore soil moisture being held up in the alluvial profile, than dependent on the regional aquifer system. For example, it is likely that areas of *Melaleuca argentea* communities occurring pre-discharge are located in highly localised alluvial systems that are able to retain moisture for long periods of time following surface water flows, but which are often independent of the regional permanent groundwater system. As described in Section 14.3.3.2 of the PER, as groundwater levels below Weeli Wolli Creek are lowered in response to the dewatering, individuals of *M. argentea* outside the low-flow channel and immediate banks (a strip of approximately 10-20 m either side of the 6 m low-flow channel zone) may lose condition and die unless their ecological water requirements are met through rainfall/cyclone events (to supplement the pore water radiating out from the low-flow channel). However, the majority of the *M. argentea* populations interpreted to be present pre-discharge (associated with the

Issue no.	Submitter	Submission and/or issue	Proponent response
			C1B community) are contained within this low flow channel zone and are unlikely to be impacted by dewatering. The *M. argentea* populations which extend outside this zone, and which are therefore most likely to see impact (the C1/C2A and C2/C1 communities), are for the most part, those interpreted as not being present pre-discharge. Consequently, beyond vegetation potentially reverting to more baseline-like structure and composition, and localised impacts, the potential effects of drawdown in the riparian zone is not expected to have a significant impact on the broader health of the riparian vegetation, in particular riparian vegetation that existed prior to discharge activities. As described in the PER, following the cessation of mining activities, the aquifers beneath Weeli Wolli Creek are projected to return to within approximately 10% of their natural (pre-mining) levels, which will enable Weeli Wolli Creek to return to the ephemeral system that existed prior to continuous surplus water discharge from mining activities in the area.
Subterranean fauna			
8	DoW	As noted on page 231, the Weeli Wolli formation has been determined to have low potential for providing suitable stygofauna habitat. Lowering of the water table below the alluvials and into the Weeli Wolli (unsuitable habitat) will cause a degree of ecological isolation to an otherwise contiguous habitat. This has been identified as a potential risk in EAG12, and should have been considered in the PER document. The EPA may consider stating this risk within the assessment report.	As described in Section 16.4.1 of the PER, the groundwater drawdown will reduce the habitat for stygofauna during operations, however there is substantial habitat available within the adjacent alluvium (shallow aquifer) beneath Weeli Wolli Creek and upstream and downstream of both within the CID aquifer and shallow aquifer alluvium. The drawdown is not expected to extend to the Weeli Wolli formation across the entirety of the alluvials (as shown in Figure A6 of Eco Logical 2016), and therefore an ecological pathway will remain in the system during the majority of the operations, even without discharge activities. Discharge of surface water into Weeli Wolli Creek and Marillana Creek is expected to partially offset impacts from dewatering. While the peak dewatering periods may reduce the ability for stygofauna to move through the Proposal Area, restricting the ability for dispersal through the groundwater system towards Fortescue Marsh, the

Issue no.	Submitter	Submission and/or issue	Proponent response
			continuation of upstream discharge from Hope Downs 1 maintaining flow within the low-flow channel combined with natural seasonal flooding events is expected to largely reduce this impact. During the majority of mining and following cessation of mining activities (and recovery of the water table), it is likely that there will be continual habitat connection upstream and downstream of the Proposal, allowing the ongoing dispersal of the stygofauna.
		DoW notes that the existing approved MMP is being updated, and reiterates the request to review and provide comment on any future revisions to the plan.	The Proponent has previously provided the existing Yandicoogina MMP to DoW for review on 30/10/12 and endorsement and will provide any material updates to the MMP to DoW for further review.
Hydrological processes			
12	DoW	DoW considers the model suitable for providing preliminary estimates for dewatering volumes, so that these volumes may be incorporated into the mine planning and to estimating discharge impacts. However, the assessment of potential environmental impacts due to changes in groundwater levels is compromised by the lack of sensitivity analysis on rainfall recharge/extinction depth and streambed hydraulic conductance. DoW accepts that the uncertainty the sensitivity to hydraulic conductivity and storage is adequately described in the modelling report, however as per previous advice, the model is not able to precisely predict the drawdowns which may impact vegetation or stygofauna at specific locations. DoW recommends that the OEPA use the modelled drawdown to form conceptual assessment of impact	A discussion of the sensitivity analysis conducted for the groundwater model is provided in Section 10 of Rio Tinto (2014a; Appendix 3 of PER), and a summary of this analysis in the Response to Submissions document (Eco Logical 2016). The results of the sensitivity analysis indicated that the model is not sensitive to hydraulic conductivity of the alluvial at the water supply bores, eastern clay conglomerate/weathered channel deposit, or Upper Vitreous Goethite (Figure 44 in Rio Tinto [2014a]), nor to the specific yield of Limonite Goethite Clay in the Billiards and Junction South West areas (Figure 45 in Rio Tinto [2014a]). The groundwater model is considered appropriate to predict impacts at the scale of the Proposal Area, and at the level of detail allowed by existing monitoring data. Specifically it is considered appropriate to assess levels of drawdown in the CID. The Proponent accepts that there is a level of uncertainty due to the scale of the modelling in regard to specific areas of desaturation of stygofauna habitat and areas that support the obligate phreatophyte vegetation communities (i.e. those that contain *M. argentea*), as well as the precise rates of hydraulic conductivity in the alluvials. However, it is considered that this fine scale of modelling would be unreliable given the data available and the feasibility of obtaining data at this scale. In order to

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		risk, and uses the modelled drawdown to determine acceptability of the impacts. The zone of acceptable impact can then be used as an adaptive management threshold in the Ministerial Conditions.	address this uncertainty, a risk assessment was undertaken based on the proponent's understanding of groundwater dependency, the variability between riparian species, the available surface water flows, the location in relation to the low flow channel and the distribution of species in the floodplain zone. Notwithstanding, as described in Issue 2 and 8 above, recent studies indicate that the riparian vegetation along Weeli Wolli Creek is largely supported by surface water flows (and pore water availability), and there is adequate available stygofauna habitat adjacent to the drawdown areas to maintain the communities in the area.
15	DoW	The department's concern is over what might be happening to groundwater levels as a result of surface water infiltration into the underlying aquifer. The Fortescue March is not groundwater fed and there is a very low hydraulic gradient across the area, so presumably if an extra 60 GL/annum is infiltrating into the aquifer the hydraulic gradient will change causing groundwater discharge into the shallow aquifers of the Fortescue Marsh – this represents a change to the hydraulic regime. Rio Tinto's response does not satisfy the questions asked including: • What is the modelled/expected impact to groundwater levels downstream of the wetting front as a result of surface water infiltration over the life of the mine; and • What is the potential of this to impact on the hydrological regime of the Marsh. The department recommends a monitoring programme is developed in consultation with the	The net change in discharge, when considering the dewatering of upstream discharge along Weeli Wolli Creek and Marillana Creek, has been calculated conservatively as 30 GL/year that would be added to the current approved discharge volume as a result of implementing the Proposal, of which the total discharge for the Revised Proposal will be up to 78 GL/year. The available information on the storage capacity of the alluvial aquifer downstream of the Proposal (at the mouth of the Weeli Wolli Creek draining into Fortescue Valley) suggest that it is many times larger than that in the vicinity of the Proposal. Specifically, water level monitoring has shown a 2 m rise of groundwater levels in bores located under the downstream ("Billiard North") section of the creek since discharge commenced in 2007. This is compared with up to 10 m rise in the same location as a result of rainfall and flooding. Given the additional discharge of a net 30 GL/year is approximately 38% of the total discharge (of up to 78 GL/year), it is reasonable to assume that the potential rise in groundwater levels is unlikely to materially change the hydraulic gradient from its current state based on the existing knowledgebase of the alluvial fan storage capacity. Analysis of groundwater quality monitoring data further substantiates the high storage capacity downstream of the Proposal Area prior to the boundary of the Fortescue Marsh. There has been a relatively constant concentration of chloride (40 mg/L) since 1998, which responds rapidly to flood events, suggesting the dominance of

Issue no.	Submitter	Submission and/or issue	Proponent response
		DoW, to address the above issues/questions. The EPA may consider making this Ministerial approval condition.	infiltration from flood events. If the entire Billiard North section of the CID aquifer were the natural conduit for through flow, the chloride concentration in groundwater would have been the same as surface water (100 mg/L). This implies the downstream aquifer storage capacity in the Billiard North section is many times larger than the Pocket and Billiards South section, which explains why discharge into Weeli Wolli Creek has little impact on the overall water balance of the aquifer. In addition, the downstream section underlying the CID is fractured and mineralised Brockman Iron Formation, which is characterised by a much higher transmissivity compared to Weeli Wolli Formation and the un-mineralised Brockman Iron Formation underlying the upstream section of Weeli Wolli Creek. This implies that the water recharging the aquifer is insignificant compared with the volume of groundwater storage, and explains why a change in the chloride concentration has not been observed. To provide further reassurance that the Fortescue Marsh is not expected to be significantly impacted, the proponent also provides an analysis of potential impacts if there were to be a level of unexpected perennial surface water flow into the Marsh. The surface water flow into Fortescue Marsh is typically ephemeral, and occurs after episodic rainfall events, usually associated with Tropical Cyclones. Weeli Wolli Creek is a major tributary that conveys flood flow events to the Marsh and during these periods, provides connection with Weeli Wolli Spring and Marillana Creek. Evaporation causes the loss of water from the Marsh and associated accumulation of salts, with the system alternating between fresh, saline and hypersaline conditions (EPA 2013, URS 2015). Should the surface water discharge wetting front in Weeli Wolli Creek extend into the Marsh for a longer duration than normal flooding events (the Poonda Plain management zone 2b), the following impacts could be anticipated to occur: • Artificial recruitment of riparian vegetation as a result of water discharge in isolated sections of the Marsh, similarly to those occurring along the Weeli Wolli

Issue no.	Submitter	Submission and/or issue	Proponent response
			Creek. • Increasing the leaf area index and biomass of vegetation exposed to higher water availability than prior to discharge activities. • Decreasing biomass and waterlogging stress in areas exposed to prolonged soil saturation, resulting in tree health decline or death. • Changes in vegetation structure including an enhanced potential for proliferation of weeds. • Changes to fauna habitats and fauna assemblage, such as more frequent occurrence of some fauna. • Drought stress in vegetation unable to re-adjust to the withdrawal of artificial water supply on cessation of discharge at the conclusion of the Proposal. These potential impacts, if there were to be unexpected perennial surface water flow into the Marsh as a result of the Proposal, are considered to be temporary, minor and would be restricted to a very small proportion of the Marsh. If these impacts were realised, it is considered that it would not significantly impact the environmental values of the Marsh (as identified in EPA 2013), and considered to be minor in relation to the influence on the overall natural hydrological system of the Marsh.
Inland waters environmental quality			
20	DoW	In the instance where the pit lake is a through-flow pit lake, there is likely to be salt water interface between the pit derived water and groundwater down-gradient of the pit. This is insufficient information to provide comment on the geometry of the interface and its impacts to groundwater dependent stygofauna and vegetation. As above, the department recommends future monitoring is conducted as part of Ministerial approval conditions.	The Proponent will liaise with the DoW in relation to knowledge gaps and monitoring requirements to satisfy closure assumptions and planning.

3 Scope refinements to the Proposal

Since the preparation of the PER and Response to Submissions document, a number of refinements to the Proposal have been undertaken. These refinements include additional clearing for a dolerite quarry, changed location and scope of the 33kV power line and additional options for the water discharge outlet. These refinements will not increase the maximum disturbance originally proposed in the PER of 1,800 ha, and are described further below.

3.1 DOLERITE QUARRY

A dolerite quarry is required to provide material for the construction of the flood protection levee. The use of dolerite rock in scour protection for the flood protection levee was identified in the PER (p. 38), however a quarry was not considered as a component of the Proposal at the time of writing the PER due to ongoing investigations for source material (p.42 of the PER).

Possible locations for the quarry have been identified within the Development Envelope, with the primary target being a low-lying hill on the western side of Weeli Wolli Creek, however the specific location(s) will be determined by a geotechnical site investigation. Access to the quarry site shall utilise existing road alignments or access tracks wherever possible.

Clearing of approximately 17 ha of vegetation will be required, with the access approach proposed on the western side. This clearing will not disturb any threatened flora species, and will remain within the originally proposed maximum disturbance of 1,800 ha.

Vegetation will be cleared and topsoil stripped from the quarry footprint, and removed to stockpile in accordance with the site specifications. Overburden (unsuitable, highly weathered rock) will be removed and utilised in the general earthworks, or stockpiled at a prescribed location.

The quarry excavation will be to the shape and levels as determined by the geotechnical investigations. Various blast patterns will likely be utilised to produce the range of rock sizes required, and probably several concurrent work faces will also be required. The quarry will be worked in benches from the top down, predominantly on the western edge (the face that is away from Weeli Wolli Creek). The depth of excavation will terminate above the surrounding ground levels, so as to not leave any depression which would enable water ponding. The final quarry floor will be constructed to be free draining, out of the quarry, to the surrounding ground. The quarry material may continue to be used in the case of a flood event to repair any damage to levees and hence it not proposed to be rehabilitated until closure.

3.2 POWERLINE

The proposed 33 kV powerline connecting the Proposal to the existing Yandi Operations 200 kV powerline was originally located in the north of the Proposal Area, at Grey's Crossing. From a maintainability and constructability point of view the 33 kV power line is now proposed to cross Weeli Wolli Creek above ground at the Weeli Wolli Creek culvert/floodway (located in the south of the Proposal Area near the JSE operations), rather than buried below ground at Grey's Crossing.

This will result in the following:

- Ease and time required to repair an above ground fault versus a below ground fault; and
- Reduced construction clearing footprint.

The power line crossing will be constructed with minimal interference to the riparian vegetation, however a clearing corridor will be required in order to meet both the Shire of East Pilbara and site fire break / bushfire safety requirements.

The clearing required for the power line crossing is within the maximum disturbance of 1,800 ha for the Proposal, and also within the specific 69 ha for riparian vegetation.

3.3 DISCHARGE OUTLET (D09)

As part of the Proposal, approximately 50 GL/y of surplus water is proposed to be discharged from a new discharge outlet. As described in the PER, water was originally proposed to be discharged from a second pipeline and outlet point constructed adjacent to the existing discharge outlet DO9 (required the clearing of approximately 1 ha of riparian vegetation). Detailed engineering studies have identified two potential additional options for the location of the new discharge outlet, which include:

1. Discharging from an outlet point constructed atop the existing D09 outlet; or
2. Discharging from a point further downstream of outlet D09 – investigations are currently being undertaken to determine if this option will still maintain a 17 km wetting footprint limit and supports the overall adaptive management approach.

These other options will remain within the maximum disturbance of 1,800 ha for the Proposal, and also within the specific 69 ha for riparian vegetation.

4 References

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