



Decision Document

Environmental Protection Act 1986, Part V

Proponent: **BHP Billiton Iron Ore Pty Ltd**

Licence: **L7851/2002/6**

Registered office: Level 1, City Square Brookfield Place
125 -137 St Georges Terrace
PERTH WA 6000

ACN: 008 700 981

Premises address: Mining Area C Project
Mining Tenement ML281SA
NEWMAN WA 6753

Issue date: Thursday, 13 November 2014

Commencement date: Monday, 17 November 2014

Expiry date: Tuesday, 16 November 2027

Decision

Based on the assessment detailed in this document the Department of Environment Regulation (DER), has decided to issue an amended Licence. DER considers that in reaching this decision, it has taken into account all relevant considerations and that the Licence and its conditions will ensure that an appropriate level of environmental protection is provided.

Decision Document prepared by: Haley Brunel
Licensing Officer

Decision Document authorised by: Alana Kidd
Manager Licensing (Resource Industries)



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1 Purpose of this Document

This decision document explains how DER has assessed and determined the application and provides a record of DER's decision-making process and how relevant factors have been taken into account. Stakeholders should note that this document is limited to DER's assessment and decision making under Part V of the *Environmental Protection Act 1986*. Other approvals may be required for the proposal, and it is the proponent's responsibility to ensure they have all relevant approvals for their Premises.

2 Administrative summary

Administrative details		
Application type	Works Approval <input type="checkbox"/> New Licence <input type="checkbox"/> Licence amendment <input checked="" type="checkbox"/> Works Approval amendment <input type="checkbox"/>	
Activities that cause the premises to become prescribed premises	Category number(s)	Assessed design capacity
	5	65,000,000 tonnes per annum
	6	27,541,000 tonnes per annum
	54	480 cubic metres per day
	63	5,000 tonnes per annum
	73	3,500 cubic metres in aggregate
	85B	0.9125 gigalitres per annum
89	3,000 tonnes per annum	
Application verified	Date: N/A	
Application fee paid	Date: N/A	
Works Approval has been complied with	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input checked="" type="checkbox"/>	
Compliance Certificate received	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input checked="" type="checkbox"/>	
Commercial-in-confidence claim	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	
Commercial-in-confidence claim outcome	N/A	



Is the proposal a Major Resource Project?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	
Was the proposal referred to the Environmental Protection Authority (EPA) under Part IV of the <i>Environmental Protection Act 1986</i> ?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	Referral decision No: 1108 Managed under Part V <input type="checkbox"/> Assessed under Part IV <input checked="" type="checkbox"/>
Is the proposal subject to Ministerial Conditions?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	Ministerial statement No: 491 EPA Report No: 913
Does the proposal involve a discharge of waste into a designated area (as defined in section 57 of the <i>Environmental Protection Act 1986</i>)?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	Department of Water consulted Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Is the Premises within an Environmental Protection Policy (EPP) Area Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> If Yes include details of which EPP(s) here.		
Is the Premises subject to any EPP requirements? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> If Yes, include details here, eg Site is subject to SO ₂ requirements of Kwinana EPP.		

3 Executive summary of proposal and assessment

BHP Billiton Iron Ore Pty Ltd (BHPBIO) operates Mining Area C (MAC) to produce iron ore for export via Port Hedland. MAC is located in the Pilbara region of Western Australia, within mining tenement ML281SA. The nearest township is Newman, which is approximately 120 kilometres (km) south-west of MAC. Rio Tinto Iron Ore's Hope Downs operation, Weeli Wolli Springs and the Coondewanna Flats are located 10km east, 20km east and 20km south-west respectively of the MAC operation.

Conventional open cut mining methods are used at MAC to extract ore for processing through a two stage crushing and screening system to produce lump and fines products. Following blending into stockpiles, the ore is loaded onto trains and railed to Port Hedland for export.

BHPBIO has applied to amend the MAC operating licence L7851/2002/6. Under this amendment, BHPBIO is seeking approval to construct and operate three infiltration ponds to dispose of excess mine dewater; and increase the rate of mine dewater discharge from 5.8 gigalitres per annum to 27.54 gigalitres per annum. BHPBIO is also seeking approval for the construction and operation of a Water Treatment Plant (WTP) to produce potable water for the site's accommodation villages. Reject water from the WTP will be disposed of to a 7.4 hectare (ha) irrigation area.

At the time of this amendment, existing sedimentation basins used as a disposal option for excess mine dewater are also being included in the Licence as specified emission points to land.

During this amendment, DER has assessed the emissions and discharges associated with construction and operation of the Packsaddle Infiltration Ponds and Water Treatment Plant; and the operation of the existing sediment ponds. The inclusion of new conditions and changes to existing conditions have been justified in Section 4.



4 Decision table

All applications are assessed in line with the *Environmental Protection Act 1986*, the *Environmental Protection Regulations 1987* and DER's Operational Procedure on Assessing Emissions and Discharges from Prescribed Premises. Where other references have been used in making the decision they are detailed in the decision document.

DECISION TABLE			
Works Approval / Licence section	Condition number W = Works Approval L = Licence	Justification (including risk description & decision methodology where relevant)	Reference documents
General conditions	Definitions	In accordance with recent administrative changes implemented within the Department, the definition of CEO has been updated; and definitions for 'Compliance Report' and 'Department' included in the Licence to reflect changes to the reporting requirements for annual compliance reports.	General provisions of the <i>Environmental Protection Act 1986</i>
	Conditions 1.1.5, 1.1.6 and 1.1.7 (removed)	<p>Guidance Statement <i>Setting conditions</i> (DER, October 2015) states that conditions imposed on Licences must be valid, enforceable and/or risk based. Noting the requirements of this Guidance Statement, conditions 1.1.5, 1.1.6 and 1.1.7 have been removed from the Licence, explained further below.</p> <p>Previous condition 1.1.5 specified: "Nothing in the Licence shall be taken to authorise any emission that is not mentioned in the Licence, where the emission amounts to:</p> <ul style="list-style-type: none">(a) pollution;(b) unreasonable emission;(c) discharge of waste in circumstances likely to cause pollution; or(d) being contrary to any written law."<p>This condition is not valid, enforceable or risk based as it is an explanatory statement that attempts to provide clarification of the operation of the Licence; and has therefore been removed from the Licence.</p><p>Previous condition 1.1.6 specified:</p>	Guidance Statement <i>Setting Conditions</i> (DER, October 2015)



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		<p><i>"The Licensee shall operate and maintain all pollution control and monitoring equipment to the manufacturer's specifications or any relevant and effective internal management system."</i></p> <p>This condition is not enforceable as it is not clear or certain in that the pollution control equipment and monitoring equipment required to be operated and maintained is not specified. The requirements to achieve compliance are not clear.</p> <p>Previous condition 1.1.7 specified: <i>"The Licensee shall immediately recover, or remove and dispose of spills of environmentally hazardous materials outside an engineered containment system."</i></p> <p>This condition is not valid as it inconsistently regulates activities below prescribed category thresholds. DER has assessed the risk associated with spills of environmentally hazardous materials to determine if specific regulatory controls are required on the Licence.</p> <p><u>Emission description</u> <i>Emission:</i> Spills of environmentally hazardous materials, including hydrocarbons, detergents and glues/paints, outside of engineered containment systems.</p> <p><i>Impact:</i> Soil contamination, impacts to groundwater and surface water quality, ecosystem disruption, depending on nature and volume of material released to the environment.</p> <p><i>Controls:</i> Operational personnel at MAC are trained in spill management and spill kits are located at various points around the premises. These</p>	



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		<p>management measures were observed and confirmed during the DER compliance inspection undertaken on 7 May 2015.</p> <p>Prior to the commencement of mining, groundwater at MAC was approximately 75 metres below ground level. Creek systems in the project area are ephemeral, flowing after rainfall events. Groundwater at this depth and ephemeral creek systems are unlikely to be impacted by spills of environmentally hazardous materials outside of containment areas, if attended to quickly, in accordance with site procedures.</p> <p>It is also the responsibility of the Licensee to ensure compliance with other legislative requirements, including Australian Standard 1940-2004 – The storage and handling of flammable and combustible liquids, which specifies that clean up action needs to be initiated immediately following a leak or spill.</p> <p><u>Risk Assessment</u> <i>Consequence:</i> Minor <i>Likelihood:</i> Rare <i>Risk rating:</i> Low</p> <p><u>Regulatory Controls:</u> The risk associated with spills outside of engineered containment systems is low, therefore no further regulatory controls are being applied to the Licence at this time.</p> <p>The general provisions of the <i>Environmental Protection Act 1986</i> with respect to the causing of pollution and environmental harm apply, as does subsidiary legislation including the <i>Environmental Protection (Unauthorised Discharges) Regulations 2004</i>.</p> <p>The site will also be subject to DER compliance inspections, during which</p>	



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		<p>procedures and measures to manage spills and leaks will be inspected.</p> <p><u>Residual Risk:</u> <i>Consequence:</i> Minor <i>Likelihood:</i> Rare <i>Risk rating:</i> Low</p>	
Premises operation	L1.2.2	<p>The Licensee has indicated that the existing putrescible landfill is nearly at capacity and is seeking to include a new putrescible landfill location on the Licence. There is to be no increase to the design capacity of 3,000 tonnes of waste per annual period, and the relevant waste acceptance specifications and process limits on the Licence will remain unchanged.</p> <p>The land system, soil type and aquifer for the existing and proposed landfill locations are the same. However, depth to groundwater is approximately 80 metres at the new location, as opposed to 100 m at the existing landfill site. The depth to groundwater at the new location is still sufficient and impacts from leachate accessing groundwater are unlikely. The risk profile for the new landfill is unchanged; therefore no further regulatory controls are required to be applied to the Licence. The maps in Schedule 1 have been updated to show the location of the new putrescible landfill.</p>	<p>Application supporting documentation</p> <p><i>Landfill Waste Classification and Waste Definitions 1996</i></p> <p>Guidance Statement <i>Licensing and works approval process</i> (DER, September 2015)</p> <p><i>Environmental Protection (Unauthorised Discharges) Regulations 2004</i></p> <p>General provisions of the <i>Environmental Protection Act 1986</i></p>
	L1.2.4	<p>The waste acceptance specifications in Table 1.2.1 have been updated to allow the outflow from the Biomax WWTPs to be measured. Inflow to the Packsaddle WWTP pond system will continue to be measured to determine effluent inputs to this facility.</p>	
	L1.2.12 and L1.2.13	<p>The tyre disposal requirements specified in Table 1.2.2 have been amended to remove duplication with Part 6 of the <i>Environmental Protection Regulations 1987</i>.</p>	



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Works Approval / Licence section	Condition number W = Works Approval L= Licence	Justification (including risk description & decision methodology where relevant)	Reference documents
		<p>Construction and Operation - Packsaddle Infiltration Ponds and Mining Area C WTP DER's assessment and decision making with respect to the construction and operation of the Packsaddle Infiltration Ponds; and the Mining Area C WTP and irrigation area is detailed in Appendix A.</p> <p>Condition 1.2.12 and 1.2.13 has been included in the Licence and requires the construction of the Packsaddle Infiltration Ponds and Mining Area C Water Treatment Plant in accordance with the supporting documentation submitted with the Licence amendment application. Condition 1.2.14 and 1.2.15 allows the operation of these facilities in accordance with the conditions of the Licence following submission of compliance documentation for construction of the works.</p>	
Emissions to land including monitoring	L2.3.1 and L3.3.1	<p>Operation – Packsaddle Infiltration Ponds The Licensee is proposing to operate three infiltration ponds to dispose of excess mine dewater through Managed Aquifer Recharge. DER's assessment and decision making with respect to this emission is detailed in Appendix A (Premises operation).</p> <p>Operation – Western and Central Sediment Basins The Licensee currently disposes of excess mine dewater to the Western and Central Sediment Basins, which are being included on the Licence as emission points to land.</p> <p>DER's assessment and decision making with respect to the operation of these infiltration basins is detailed in Appendix B.</p>	<p>General provisions of the <i>Environmental Protection Act 1986</i></p> <p><i>Environmental Protection (Unauthorised Discharges) Regulations 2004</i></p> <p>Guidance Statement <i>Licensing and works approval process</i> (DER, September 2015)</p>
Fugitive emissions	N/A	Construction and operation <u>Emission Description</u>	General provisions of the <i>Environmental Protection</i>



DECISION TABLE			
Works Approval / Licence section	Condition number W = Works Approval L = Licence	Justification (including risk description & decision methodology where relevant)	Reference documents
		<p><i>Emission:</i> Fugitive dust and noise emissions from site preparation works, including earthworks and vehicle movement, for the Packsaddle Infiltration Ponds and Mining Area C WTP and irrigation area. There is not expected to be any significant dust or noise emissions during operation of these facilities.</p> <p><i>Impact:</i> Dust emissions can be harmful to human health and the environment. Elevated total suspended particulates can impact ambient environmental quality resulting in amenity impacts and can smother vegetation. Particulate matter that is less than 10 (PM₁₀) or 2.5 (PM_{2.5}) micrometres in diameter can be drawn deep into the lungs causing human health impacts.</p> <p>Noise emissions can be a nuisance to nearby residents.</p> <p><i>Controls:</i> The closest receptor to the Mining Area C WTP construction site is the Mulla Mulla Camp, located approximately 1.5 km to the south east. The closest receptor to the Packsaddle Infiltration Ponds construction site is Packsaddle camp, located approximately 1 km east of the closest infiltration basin.</p> <p>During construction there is expected to be a minor increase in dust and noise. Due to the distance of the construction sites to the nearest on-site sensitive receptors and temporary nature of construction works, impacts will be negligible.</p> <p><u>Risk Assessment</u> <i>Consequence:</i> Insignificant <i>Likelihood:</i> Possible <i>Risk Rating:</i> Low</p> <p><u>Regulatory Controls:</u> The general provisions of the <i>Environmental Protection Act 1986</i> apply. Noise</p>	<p><i>Act 1986</i></p> <p><i>Environmental Protection (Noise) Regulations 1997</i></p> <p>Mining Area C Environmental Management Plan (Revision 5, September 2012)</p>



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Works Approval / Licence section	Condition number W = Works Approval L= Licence	Justification (including risk description & decision methodology where relevant)	Reference documents
		<p>emissions are subject to the provisions of the <i>Environmental Protection (Noise) Regulations 1997</i>.</p> <p>The Mining Area C Life of Mine Environmental Management Plan (EMP), required under Ministerial Statement (MS) 491, includes provisions relating to the management of dust. Specifically the watering of haul roads, construction areas and unsealed roads, minimising land disturbance where practicable, maintenance of dust suppression equipment and control systems, and informing employees of the importance of minimising ambient dust levels.</p> <p>No further regulatory controls are required to be applied to the Licence as the risk associated with fugitive noise and dust emissions from construction activities and the operation of the facilities has been assessed as low.</p> <p><u>Residual Risk</u> <i>Consequence:</i> Insignificant <i>Likelihood:</i> Possible <i>Risk Rating:</i> Low</p>	
Ambient quality monitoring	L3.5.1 to L3.5.3	Conditions 3.5.1, 3.5.2 and 3.5.3 have been updated to include monitoring requirements to determine impacts to groundwater and vegetation as a result of the operation of the Packsaddle Infiltration Ponds, which is discussed further in Appendix A.	Application supporting documentation.
Information	L4.2.1 and L4.3.1	<p>Condition 4.2.1 has been updated to include reporting requirements for the monitoring results associated with the discharge of mine dewater to the Packsaddle Infiltration Ponds and Western and Central Sedimentation Basins.</p> <p>The notification requirements specified in condition 4.3.1 have been updated to require the submission of compliance documentation following completion of construction of the Packsaddle Infiltration Ponds and Mining Area C WTP. A</p>	



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Works Approval / Licence section	Condition number W = Works Approval L= Licence	Justification (including risk description & decision methodology where relevant)	Reference documents
		commissioning plan for the Mining Area C WTP is also required under condition 4.3.1. The requirement to submit a commissioning report following the completion of commissioning has been included in the non-annual reporting requirements of the Licence, specified under condition 4.2.2	
Licence duration	N/A	The existing expiry date aligns with the expiry of Mining Tenement ML281SA.	Guidance Statement, Licence duration (DER, November 2014)



5 Advertisement and consultation table

Date	Event	Comments received/Notes	How comments were taken into consideration
9 May 2016	Application referred to Department of Water and Department of Parks and Wildlife	Department of Parks and Wildlife provided comments regarding potential impacts to Mulga Woodlands, the proposed groundwater and vegetation monitoring program and Priority flora identified in the indicative infiltration zone.	Comments noted.
20 June 2016	Proponent sent a copy of draft instrument (prior to 21 day consultation period)	LICENCE Licence expiry date Request that the expiry date remain unchanged, as it currently aligns with the expiry of Mining Tenement ML281SA. Condition 1.2.12 and Table 1.2.6 - remove reference to Works Approval application form to avoid confusion and correction to condition referenced in note. Condition 3.5.1 and 3.5.2 – Correct the limits referenced in Table 3.5.1 and 3.5.2. DECISION DOCUMENT <ul style="list-style-type: none">• Comment regarding dust and that it is not a key factory for Mining Area C and therefore it is managed	Change implemented. In accordance with recent administrative changes implemented within the department, the reference to Applications form has been removed from the Licence and replaced with specific construction requirements for the infrastructure subject to approval under the amendment. Updated in line with comments. Comment noted



Date	Event	Comments received/Notes	How comments were taken into consideration
		under Part V via existing standard operating procedures.	
21 July 2016	21 day consultation period correspondence sent to Licensee, including draft amended Licence highlighting changes and draft decision document	<p>LICENCE Licence expiry date Request to retain existing expiry date in order to align with the expiry of Mining Tenement ML281SA (ie. 4 August 2028).</p> <p>Table 1.2.1 – amend waste acceptance specifications for the WWTP's which discharge treated effluent to irrigation areas to require recording of outflow volume as opposed to inflow volume.</p> <p>Table 1.2.6 – amend the construction requirement table to remove specific infrastructure specifications. This will allow for minor modifications without the requirement to apply for a separate Licence amendment.</p> <p>Table 3.2.1 and Table 3.3.1 – change 'chlorine' to 'chloride'.</p> <p>Table 3.3.1 – as opposed to having a flow meter at each infiltration pond, allow flow to be measured from one meter at the trunk line prior to discharge to the infiltration/sediment basins. With respect to</p>	<p>Change implemented.</p> <p>Change implemented. Volume of treated wastewater from Biomax systems is to be recorded at the outflow to the irrigation areas, and inflow for the Packsaddle WWTP which is a pond treatment system.</p> <p>Change not implemented, however condition has been updated to allow for design variations provided they are:</p> <ul style="list-style-type: none"> - minor in nature and do not materially change or affect the infrastructure; or - where change improves the functionality of the infrastructure and does not increase risks to public health, public amenity or the environment; and is in accordance with all other conditions of the Licence. <p>Change implemented.</p> <p>Change implemented to allow flow to be measured from one meter at the trunk line prior to discharge to the infiltration/sediment basins.</p>



Date	Event	Comments received/Notes	How comments were taken into consideration
		<p>the proposed Packsaddle Infiltration Ponds, the Licensee has indicated that the 'high level alarm' system implemented on each pond will ensure water is distributed appropriately.</p> <p>Table 3.5.1 – monitoring bore MB1 has been constructed. Replace reference to MB1 with bore reference HPSA1633.</p>	Change implemented.



6 Risk Assessment

Note: This matrix is taken from the DER Corporate Policy Statement No. 07 - Operational Risk Management

Table 1: Emissions Risk Matrix

Likelihood	Consequence				
	Insignificant	Minor	Moderate	Major	Severe
Almost Certain	Moderate	High	High	Extreme	Extreme
Likely	Moderate	Moderate	High	High	Extreme
Possible	Low	Moderate	Moderate	High	Extreme
Unlikely	Low	Moderate	Moderate	Moderate	High
Rare	Low	Low	Moderate	Moderate	High



Appendix A – Premises Operation

Packsaddle Infiltration Ponds – Construction and Operation

Dewatering volumes at Mining Area C are projected to increase significantly over the FY2017-2021 period, with peak volumes estimated to reach up to 32 megalitres per day (ML/day) in FY2017 and more than 70 ML/day in FY2021. Site water demand over the same period is projected to remain relatively constant, at around 10 to 14 ML/day, which will result in estimated surplus water volumes of 22 ML/day in FY2017, increasing to 60 ML/day in FY2021.

In response to the increasing surplus mine dewater volumes, BHPBIO is proposing to develop and operate a number of distinct surplus water disposal options at Mining Area C to provide operational flexibility and enable the transition away from surplus water injection at A Deposit to allow below water table mining at that location.

The first surplus water disposal option proposed for development is a Managed Aquifer Recharge (MAR) scheme, comprising a series of three infiltration ponds (Packsaddle Infiltration Ponds) each with the capacity to dispose of up to 10ML/day of surplus mine dewater with a total scheme capacity of 30 ML/day. This is based on:

- Nominal pond dimensions of 80 metres (m) wide by 500 m long by 0.5 m deep; and
- Long term, conservative, infiltration rate of 250 millimetres per day (mm/day).

Each infiltration basin will comprise four individual basins, with three basins in use at any one time and the fourth acting as standby to enable maintenance (removal of algal/weed growth and sediment). The ponds will be fenced to restrict livestock access. Figure 1 depicts the indicative location of the infiltration ponds relative to the existing Mining Area C operations.

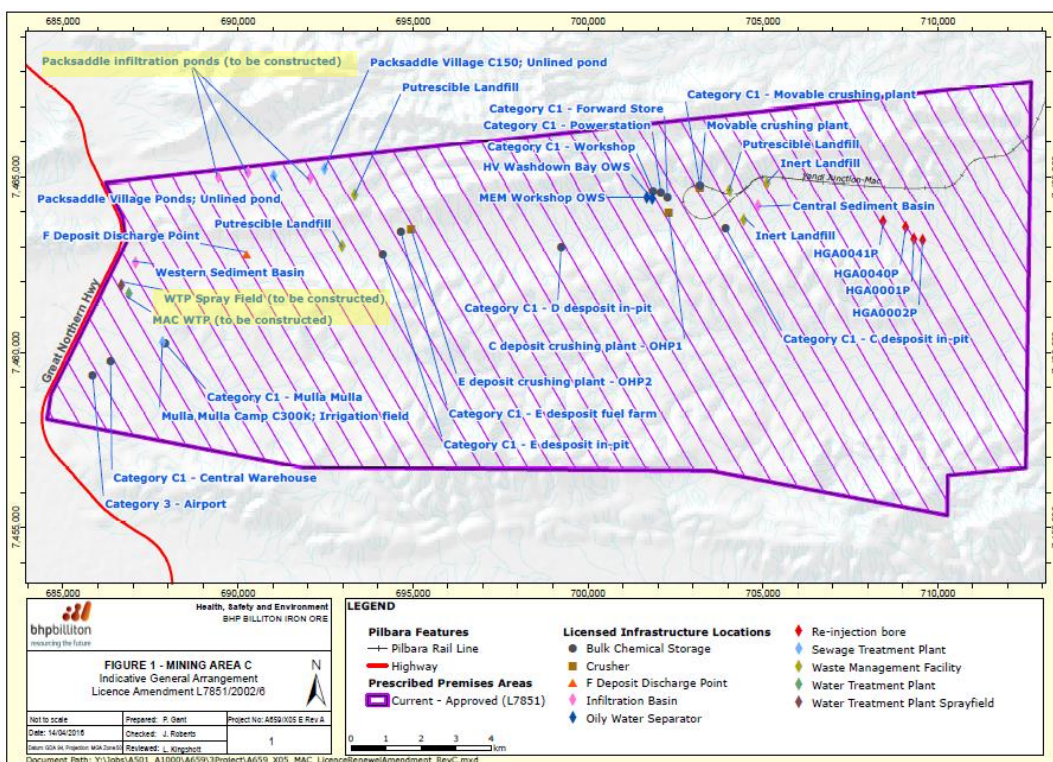


Figure 1. Location of proposed Packsaddle Infiltration Ponds and Mining Area C WTP and irrigation area (highlighted yellow)



The ponds will be located within the Hamersley Range – Fractured Rock aquifer unit. The geological sequence beneath the infiltration ponds comprises 20 to 50 m of tertiary detrital and alluvial material, derived from erosion of the Brockman Iron Formation (BIF) ridges on either side of the valley, which is underlain by mineralised, weathered and fractured BIF and Shale of the BIF.

Groundwater elevations within the valley are relatively constant. Depth to groundwater is approximately 96 m in the area of the proposed infiltration ponds and 75 m beneath the Mulga woodland to the west. The groundwater table is situated within the fractured bedrock aquifer and the tertiary detritals are unsaturated.

No Threatened Flora species listed under the *Environment Protection and Biodiversity Conservation Act 1999* or the *Wildlife Conservation Act 1950* have been identified within the indicative infiltration zone.

Two species listed as Priority flora by the Department of Parks and Wildlife have been recorded within the indicative infiltration zone.

The project will require up to 12 hectares (ha) of native vegetation to be cleared for the infiltration ponds and will involve some disturbance of vegetation along the approximately 7 km long pipeline route. All clearing will be undertaken in accordance with MS 491. The Licensee has indicated that clearing will be minimised and cleared areas that are no longer required will be revegetated.

Normal operation

Emission Description

Emission: Discharge of up to 30 ML/day of mine dewater from the Mining Area C Marra Mamba deposits into the three Packsaddle Infiltration Ponds. Water discharged will seep into the subsurface through the relatively thick unsaturated zone and continue to saturate it before it reaches the groundwater table.

Impact: Infiltration of mine dewater causing a rise in the groundwater level (mounding) beneath the Packsaddle Valley, potentially impacting on Mulga woodland located at the western end of the valley, should levels rise to less than 5 metres below ground level (mbgl) as soils become waterlogged.

Preliminary infiltration trials have been conducted in the indicative infiltration ponds zone and have proven the alluvial and detrital material to be highly permeable, exceeding 500 mm/day. Figure 2 depicts the location of the infiltration ponds and extent of the Mulga woodland potentially impacted by groundwater mounding.

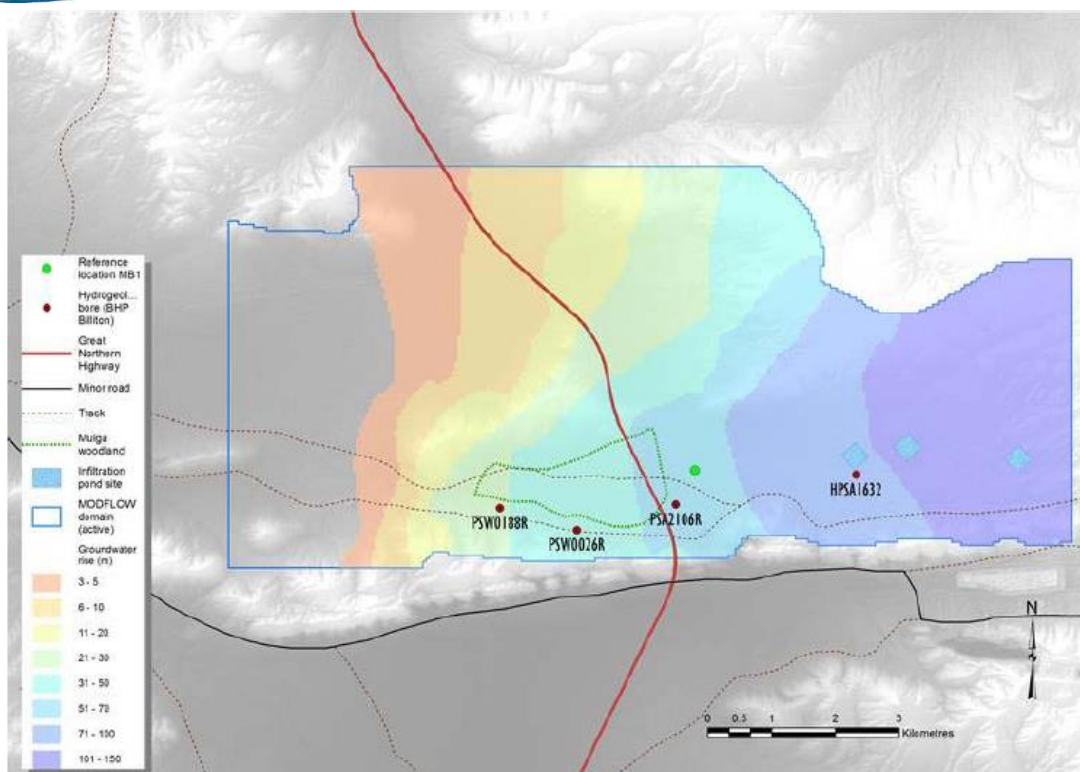


Figure 2. Location of Packsaddle Infiltration Ponds and Mulga woodland

To assist in quantifying the likely response of groundwater levels within Packsaddle Valley, and hence the likelihood of impacts to the Mulga woodland, a simple 3D numerical groundwater model was used. The model was run for a period of ten years with an initial infiltration rate of 30 ML/day (nominally 10 ML/day at each of the indicative pond locations). As the hydraulic properties of the alluvium/detrital deposits are uncertain, two scenarios were run with the hydraulic conductivity and storage settings for these deposits at the low (Case A) and high (Case B) end of what is expected (Figure 3).

Modelled Aquifer Unit	Modelled Aquifer Properties					
	Kh (m/d)		Kv (m/d)		Sy	
	Case A	Case B	Case A	Case B	Case A	Case B
Alluvium / Detritals	2.5	25	0.25	2.5	5%	10%
Weathered Bedrock	1.0		0.1		1%	
Unweathered Bedrock	0.01		0.01		0.1%	

Figure 3. Hydrogeological units of the Aquifer Model

Key findings from the modelling, presented in the MAC Discharge Disposal Study (MWH, 23 May 2016) are:

- Operation of the infiltration ponds leads to an increase in groundwater levels directly beneath them which propagates westwards;
- At monitoring bore , groundwater levels start to rise in response to operation of the ponds after less than a year, and continue rising throughout the modelled period;
- Wide-scale development of the groundwater mound occurs in about two years and by ten years most of the valley detritals will experience some mounding;



- The modelled low case indicates that groundwater levels rise to a maximum of 16 mbgl, which would not be expected to impact the Mulga woodland;
- The modelled high case indicates that groundwater levels rise to within 5 m of surface after approximately 7 years and almost to the surface at the Mulga woodland after 10 years. This shows the potential for the Mulga woodland to be impacted if large volumes of water are discharged to the infiltration ponds over an extended period.

The MAC Discharge Disposal Study report indicates that an infiltration rate of 30 ML/day is feasible, although this may reduce over time as the detritals underlying the ponds become fully saturated.

Deterioration of groundwater quality and potential impacts to ecosystems receiving groundwater in the area may also occur as a result of the infiltration of mine dewater.

Controls:

A large network of monitoring bores has been installed within Packsaddle Valley and along the adjacent Packsaddle Range (within the P1W and P1E deposits). These bores will be monitored throughout the operation of the infiltration ponds to determine how the valley aquifer system responds to the influx of water. The frequency of data collection will be greatest during the initial years of operation of the ponds, and will reduce as the response of the aquifer system to infiltration is understood. This data collected will be reviewed on an ongoing basis and any trends which show a likely impact on the environment or future mining activities will trigger mitigating action, most likely involving a reduction of water discharge to the ponds before an impact occurs. A water level trigger and limit will be implemented for HPSA1633, as described further below.

Groundwater levels

The groundwater modelling undertaken indicated that groundwater levels at HPSA1633 responded gradually to the cessation of operation of the ponds in both modelled cases. The Licensee has indicated that potential impacts to the Mulga woodland could be effectively managed by monitoring groundwater levels between the ponds and the Mulga woodland, and adjusting the rate of water discharge to the ponds as required.

In order to prevent impacts to the Mulga woodland, the Licensee has indicated that groundwater levels will be monitored on a monthly basis at monitoring bore HPSA1633. Changes in groundwater levels at HPSA1633 will trigger management actions to prevent impacts to the Mulga woodland.

In the event that groundwater levels at HPSA1633 reach the trigger level of 13 mbgl (corresponds to 10 mbgl at the Mulga woodland), the volume of water discharged to the infiltration ponds will need to be reduced to prevent further increases in groundwater levels at HPSA1633 and the Licensee will notify DER of the trigger exceedance. In the event that the groundwater level limit of 8 mbgl is exceeded at HPSA1633 (corresponds to 5 mbgl at the Mulga woodland), discharge will cease until such a time as groundwater levels recede past 13 mbgl at HPSA1633. The Licensee has indicated that during such events surplus water will be disposed of via one or more of the existing surplus water management options, being the Western and Central Sedimentation Basins and the A deposit MAR. The Licensee is also investigating two new MAR schemes at Juna Downs and Camp Hill which will be subject to separate approval. It is currently anticipated that the Juna Downs MAR borefield will commence operation during FY18 and Camp Hill will follow in FY2020.

Ground water quality

Groundwater quality is generally fresh. A groundwater sample taken from the centre of the Packsaddle Valley returned a concentration of 434 mg/L of total dissolved solids (TDS). This is comparable to samples taken from the Mining Area C dewatering borefield which range from 254 mg/L to 408 mg/L TDS, as reported in the Mining Area C FY2015 Annual Aquifer Review.



As the quality of surplus water from mine dewatering is very similar to the quality of groundwater within Packsaddle Valley, impacts to the quality of the groundwater resource are not expected as a result of this discharge.

If monitoring data show that changes to the groundwater table are greater than predicted by the model, the Licensee has indicated that the groundwater model may be re-calibrated an additional scenarios run to predict the capacity of the surplus management scheme and refine the assessment of potential environmental impacts.

Risk Assessment

Consequence: Moderate

Likelihood: Unlikely

Risk Rating: Moderate

Regulatory Controls:

The Packsaddle Infiltration Ponds have been specified as emission points to land under condition 2.3.1 of the Licence. Under condition 3.3.1 the Licensee is required to monitor the volume and quality of water discharged to the infiltration ponds. Monitoring results will be reported to DER annually for assessment.

In order to prevent impacts to the Mulga woodland as a result of groundwater mounding caused by operation of the infiltration ponds, groundwater levels at HPSA1633 will be monitored on a monthly basis and a limit for groundwater level has been specified under Conditions 3.5.1.

Under condition 4.3.1 the Licensee will be required to notify DER in the event of a limit exceedance.

In March 2014, MS491 was amended to remove the water usage and dewatering requirements from the Key Characteristics Table; which now states, "*dewatering and discharge can be managed under other legislation*". The Licensee has advised and it is noted that the drawdown extent at MAC is being realised at an earlier date than initially planned, however does not represent a material change in the groundwater drawdown footprint and the associated impacts presented in the EMP required under MS 491.

The disposal of surplus mine dewater forms a part of the adaptive management approach adopted under MS 491, acknowledging that:

- dewatering rate is dependent upon the rate of below water table mining, the mining sequence and the deposit being mined at any one time; and
- the indicative mine schedule could change and as a result the maximum dewatering rates and period of dewatering may vary accordingly.

Residual Risk

Consequence: Moderate

Likelihood: Rare

Risk Rating: Low

Emergency situations

Emission: Overtopping of infiltration ponds, discharging mine dewater to land.

Impact: Infiltration of potentially sediment laden water to land, impacting on vegetation. Infiltration of water, impacting groundwater quality and levels in the receiving aquifer.

Controls: The Licensee manages the infiltration ponds such that overtopping does not occur, except during high rainfall events. Upstream watercourses will be directed around the ponds; therefore the



only rainfall entering the ponds will be that which is incident on the ponds or the surrounding bunds. Spillways have not been incorporated into the design.

The lowest pond in each infiltration basin will be equipped with a 'high water level' alarm, which will trigger operational personnel to attend the ponds and resolve the issue. There is significant redundant capacity designed into the ponds, primarily to enable maintenance activities without affecting scheme capacity, and this will further reduce the likelihood of the ponds overtopping.

In the event that ponds overflow, excess mine dewater will be directed to one or more of the existing surplus water management options, being the Western and Central Sedimentation Basins and the A deposit MAR. Inundation of vegetation near the ponds would be short term in nature and occur only while the ponds are overtopping. Such an event would be managed so that the duration of the overtopping event does not result in inundation that results in a loss of vegetation.

The quality of groundwater within the source and receiving aquifer are the same, therefore groundwater quality is unlikely to be affected as a result of overtopping of the ponds.

An operational freeboard of 300mm will be maintained. Initially inspections will be undertaken daily to confirm performance of the ponds. Currently, it is anticipated that inspections will be reduced to weekly on a long-term basis.

Risk Assessment

Consequence: Insignificant

Likelihood: Unlikely

Risk Rating: Low

Regulatory Controls:

The risk associated with the overflow of mine dewater from the ponds has been assessed as low. No regulatory controls are required to be applied to the Licence. Section 49 of the *Environmental Protection Act 1986* applies and discharges may also be subject to the *Environmental Protection (Unauthorised Discharges) Regulations 2004*.

Residual Risk

Consequence: Insignificant

Likelihood: Unlikely

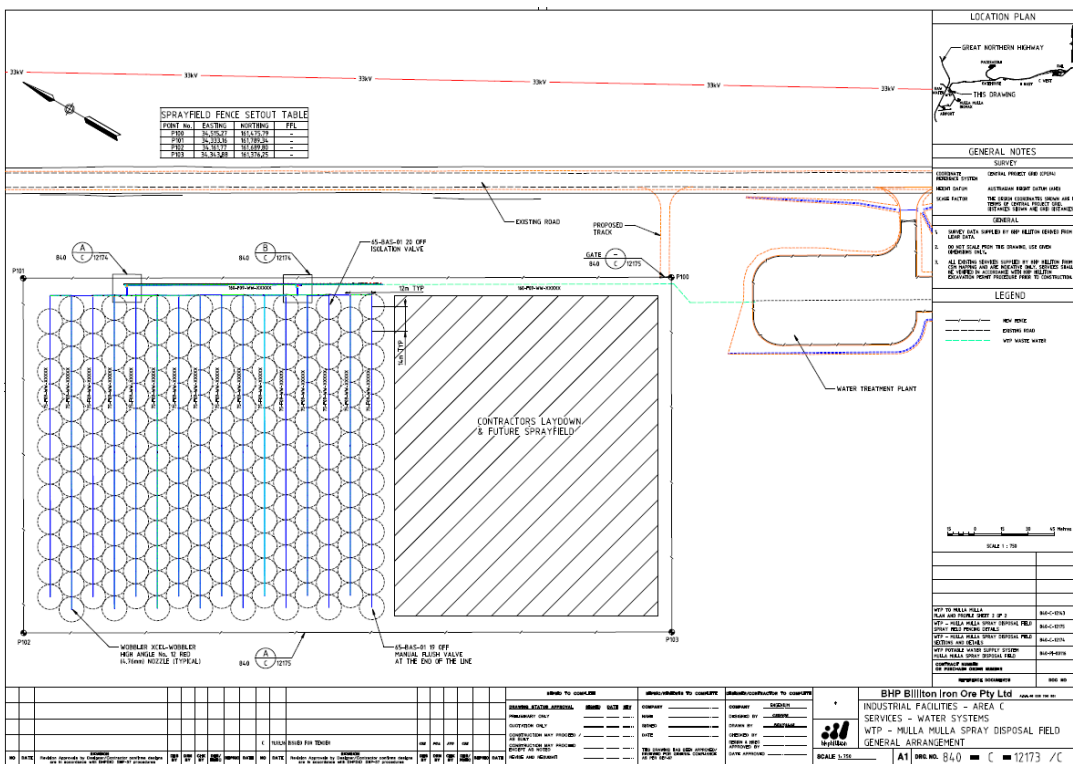
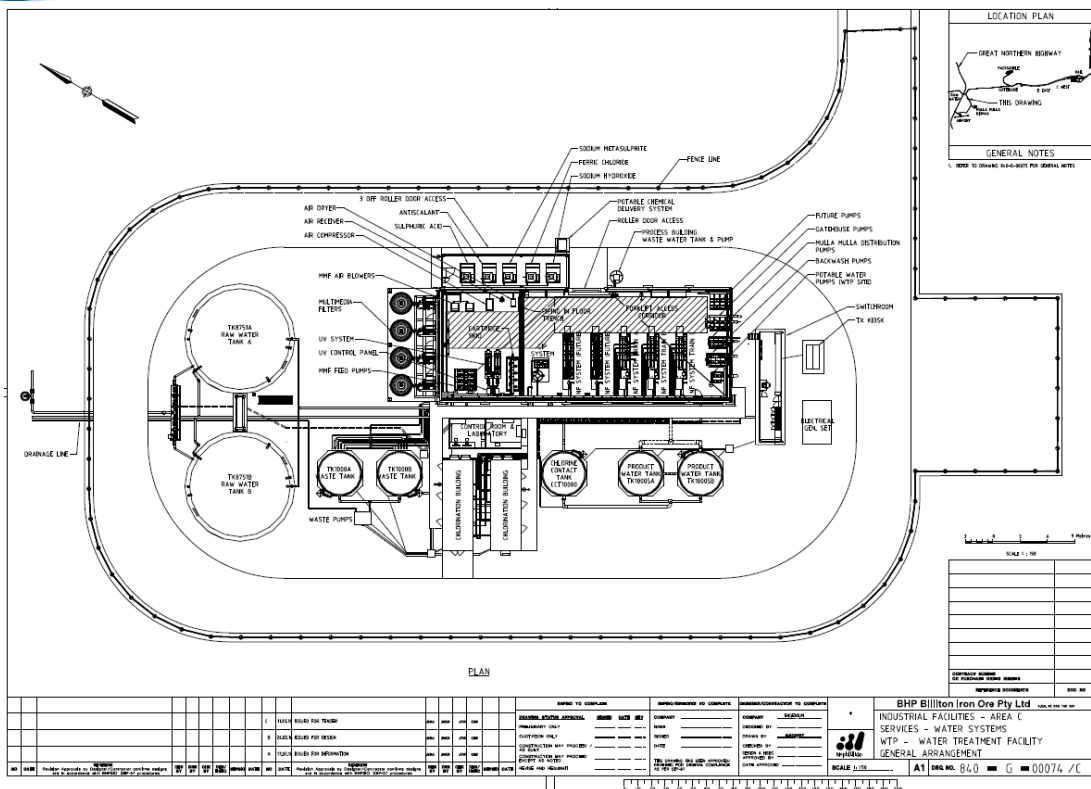
Risk Rating: Low

Mining Area C WTP – Construction, Commissioning and Operation

BHPBIO is proposing to construct a new nano-filtration WTP at Mining Area C to supply potable water to the Packsaddle and Mulla Mulla Camps. The project will be undertaken in two stages:

- Stage 1: Construction of a 0.584 giga-litre per annum (GL/a) (average of 1.6 MG/day) WTP; and
- Stage 2: Expansion of the Stage 1 facility to a 0.9125 GL/a (average of 2.5 ML/day WTP).

The WTP will operate by using a high pressure nano-filtration pump which pushes the pre-treated feedwater through a dual train nano-filtration membrane system, with 87% passing through as permeate (potable water) and 13% rejected as brine. The proposed locations of the WTP and irrigation area are shown in Figure 1 (above). The general layout of the WTP and irrigation areas are depicted in Figures 4 and 5, below.





Permeate is mixed with some of the filtered feed water to achieve reject water with a targeted average TDS of 1,500 mg/L, which will be disposed of at an adjacent 7.4 ha spray field. Following completion of Stage 2 the WTP will produce up to 228.5 ML/a (626 kL/day) of reject water.

The project will require the clearing of approximately 1 ha of native vegetation for the WTP and will involve some disturbance of vegetation within the 7.4 ha spray field. All clearing will be undertaken in accordance with the approved Native Vegetation Clearing Permit (NVCP) CPS 4337/1.

Commissioning and Normal operation

Emission Description

Emission: Discharge of up to 626 kL/day of reject water, with a TDS concentration of approximately 1,500 mg/L, to a 7.4 ha spray field.

Impact: Impacts to native vegetation as a result of irrigation of reject water, impacts to groundwater quality and levels due to infiltration of reject water, impacts to surface water quality resulting from runoff of water from the irrigation area.

Controls:

The Licensee will monitor the volume and quality of the reject water and has proposed a limit of 1,800 mg/L TDS.

In the event that the TDS of the reject water exceeds 1,500 mg/L but is less than the 1,800 mg/L limit, the following actions will be undertaken:

- TDS will be measured daily for one week to determine if there is an increasing trend;
- If the TDS continues to exceed 1,500 mg/L but does not show an increasing trend monitoring will continue on a weekly basis for one month; and
- If the TDS continues to exceed 1,500 mg/L but still does not show an increasing trend monitoring will return to a quarterly basis.

In the event that the TDS of the reject water exceeds 1,500 mg/L, is less than the 1,800 mg/L limit, but shows an increasing trend the following actions will be undertaken:

- The reject water will be monitored on a weekly basis;
- An investigation into potential causes of the high TDS will be undertaken; and
- The appropriate actions identified in the investigation will be implemented.

In the event that the TDS of the reject water exceeds the limit of 1,800 mg/L the following actions will be undertaken:

- Reject water will be blended (with either raw or treated water) to ensure that water discharged to the spray field has a TDS below 1,800 mg/L; and
- An investigation into the cause of the exceedance will be undertaken and appropriate actions taken to correct the problem.

The Licensee has undertaken a similar project at the Mooka Camp, which operates under Part V of the EP Act Licence L8679/2012/1. A TDS discharge limit of 1,876 mg/L was specified under the Mooka Camp operating Licence and vegetation monitoring was conducted six monthly to identify if there has been any degradation in vegetation quality as a result of the TDS in discharge water. The Licensee has reviewed the past 2.5 years of monitoring data and determined that there has been no detrimental effect on the vegetation of the Mooka Camp spray field.

The proposed discharge from the proposed Mining Area C WTP is unlikely to impact on the vegetation of the spray field as:

- There has been no adverse impact on vegetation as a result of the TDS of the irrigated water at the Mooka spray field (licence limit of 1,876 mg/L);



- The proposed Mining Area C spray field has the same floristic community (Triodia Open Hummock Grassland) as the existing Mooka spray field;
- The proposed Mining Area C spray field has the same soil type as the existing Mooka spray field; and
- The target TDS of the reject water from the Mining Area C will be an average of 1,500 mg/L TDS, with a limit of 1,800 mg/L which is less than that of the Mooka irrigation field.

There are no surface water features in or adjacent to the proposed WTP and sprayfield. The nearest drainage line lies more than one kilometre to the south of the proposed irrigation field. Depth to groundwater is 80 m and is used mainly for mining and mine dewatering from the iron ore mines.

Mean daily evaporation recorded at the closest meteorological site (Wittenoom located 90 km away) is 8.6 mm/day, which equates to 3.1 m per year. Negligible impacts to groundwater and surface water are expected, due to the distance between the sprayfield and these receptors, and the regions high evaporation rates.

It is also noted that no Threatened Flora species listed under the *Environment Protection and Biodiversity Conservation Act 1999*, the *Wildlife Conservation Act 1950* or species listed as Priority flora by the Department of Parks and Wildlife have been identified within the area.

The Licensee has indicated that a Commissioning Plan for the WTP is currently being developed, however it is unlikely to be finalised until after construction has commenced. The final commissioning plan will detail the monitoring frequency and limits of the discharges associated with the WTP and the contingencies to be undertaken should the water quality be unacceptable for irrigation.

Risk Assessment

Consequence: Minor

Likelihood: Unlikely

Risk Rating: Moderate

Regulatory Controls:

Condition 2.3.1 specifies the discharge of reject water to the sprayfield as a Licensed emission point. A limit for TDS concentration in water discharged to the irrigation is specified under condition 2.3.2. In the event that the limit is exceeded, discharge will need to cease and DER notified. Monitoring requirements for volume discharged and water quality are specified under condition 3.3.1.

The requirement to submit a commissioning plan to DER has been included under condition 4.3.1.

Residual Risk

Consequence: Minor

Likelihood: Rare

Risk Rating: Low



Appendix B – Emissions to land including monitoring

Normal operation

Emission: Discharge of 2.08 gigalitres per year (GL/year) of excess mine dewater to the Western Sediment Basin and 8.67 GL/year of excess mine dewater to the Central Sediment Basin. Water is directed to the sedimentation basins either through the existing stormwater management drainage system or through water pipelines.

Impact: Infiltration of water through the soil profile, impacting on groundwater quality and levels in the receiving aquifer, potential impacts to ecosystems receiving groundwater in the area.

Depth to groundwater is approximately 80 m at the Western Sediment Basin and 106 m at the Central Sediment Basin.

Controls: The quality of groundwater within the source and receiving aquifers are the same, therefore impacts to groundwater quality are not expected to occur as a result of the infiltration of mine dewater.

Infiltration rates are low due to clay-rich detritals, groundwater levels are deep and the basement aquifer (dolomite) is highly permeable and will conduct water away. Groundwater mounding impacting on vegetation in the disturbed mining areas is unlikely.

Groundwater levels are monitored regularly throughout MAC and towards the Coodewanna Flats to the west, and so any changes in groundwater levels which could affect vegetation would be identified. However, no specific groundwater monitoring at these basins is undertaken or planned by the Licensee.

Discharge water will also be lost to evaporation.

Risk Assessment

Consequence: Minor

Likelihood: Possible

Risk Rating: Moderate

Regulatory Controls:

Condition 2.3.1 has been amended to include the Western and Central Sediment Basins as specified emission points to land. Under Condition 3.3.1 the Licensee will be required to monitor the volume of surplus mine dewater discharged to the basins and undertake quarterly monitoring to analyse water quality. The Licensee will be required to report the monitoring results annually to DER for review, including a comparison against previous monitoring results to identify any trends.

Residual Risk

Consequence: Minor

Likelihood: Possible

Risk Rating: Moderate

Emergency situations

Emission: Overtopping of sediment basins, discharging mine dewater to land.

Impact: Infiltration of potentially sediment laden water to land, impacting on vegetation. Infiltration of water, impacting groundwater quality and levels in the receiving aquifer.

Controls: The Licensee manages the sediment basins such that overtopping does not occur, except during high rainfall events. In the event that the basins overtop the vegetation downstream is unlikely



to be impacted as the overtopping events are likely to be short term and the vegetation occurs on a floodplain which is used to periodic inundation.

The quality of groundwater within the source and receiving aquifer are the same, therefore groundwater quality is unlikely to be effected as a result of overtopping of the ponds.

An operational freeboard of 300 mm is maintained on the Western Sediment Basin and the spillway has been designed to accommodation flows over a 100 year Annual Recurrence Interval (ARI).

The Central Sediment Basin lies along a highly disturbed unnamed non-perennial drainage line which flows easterly from the centre of MAC before leaving the side at the Eastern boundary of MAC. Prior to leaving MAC this unnamed non-perennial drainage line passes through the Eastern Sediment Basin to ensure that no sediment is discharged from the site. The Eastern Sediment Basin has been constructed to capture sediment flowing to the east from the mining operation, and has been constructed with a spillway which accommodates flows over the 5 year ARI.

Risk Assessment

Consequence: Insignificant

Likelihood: Unlikely

Risk Rating: Low

Regulatory Controls:

The risk associated with the overflow of mine dewater from the basins has been assessed as low. No regulatory controls are required to be applied to the Licence. Section 49 of the *Environmental Protection Act 1986* applies and discharges may also be subject to the *Environmental Protection (Unauthorised Discharges) Regulations 2004*.

Residual Risk

Consequence: Insignificant

Likelihood: Unlikely

Risk Rating: Low