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**J5 and Bungalbin East Iron Ore Proposal  
Response to Submissions – Appendix L  
Surface Water Management Plan**



## **SURFACE WATER MANAGEMENT PLAN**

# **J5 AND BUNGALBIN EAST IRON ORE PROJECT**

**246-EN-PLN-0004**

**Revised 22 February 2017**

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## 1. SUMMARY

This Surface Water Management Plan (SWMP; Management-based EMP) is submitted in accordance with Item 41(b) of the Environmental Scoping Document (ESD) for the J5 and Bungalbin East Iron Ore Project (the Proposal). Table 1-1 presents the environmental management targets to measure achievement of the environmental objectives to be met through implementation of this SWMP.

**TABLE 1-1: KEY ELEMENTS OF THE EMP**

<b>Title of proposal</b>	J5 and Bungalbin East Iron Ore Project
<b>Proponent</b>	Mineral Resources Limited (MRL)
<b>Ministerial Statement number</b>	N/A (Assessment No. 2031)
<b>Purpose of this Condition EMP</b>	The Surface Water Management Plan is submitted to fulfil the requirements of Item 41(b) of the ESD
<b>EPA's environmental objectives for the key environmental factor/s</b>	<ol style="list-style-type: none"> <li>1. To maintain the hydrological regimes so that existing and potential uses, including ecosystem maintenance, are protected.</li> <li>2. To maintain the quality of surface water, sediment and biota so that the environmental values, both ecological and social, are protected.</li> </ol>
<b>Proposed environmental objectives</b>	As above
<b>Management target/s (measureable, proposal-specific)</b>	<ol style="list-style-type: none"> <li>1. All surface water diversions/drains have been designed, constructed, and maintained to convey the 1:100-yr ARI peak flow rate in a way that maintains continuity of surface water flow through the site.</li> <li>2. All rainfall falling on disturbed land areas is retained within the disturbance footprint, and is infiltrated or directed through a well-maintained appropriately sized sediment trap prior to release of the water into the surrounding environment.</li> <li>3. Haul roads have been designed with floodways, constructed and maintained to convey the 1:100-yr ARI peak flow rate in a way that maintains continuity of surface water flow, and minimises erosion.</li> <li>4. All chemical storage area are self-bunded to capture any spills and have capacity to accommodate a 1:100yr 72hr design storm event</li> </ol>

## Corporate endorsement

I hereby certify that to the best of my knowledge, the Condition EMP provisions within this Surface Water Management Plan are true and correct and address the legal requirements of condition.

Designation: Project Manager    Signed: 

Date: 22 February 2017

## 2. CONTEXT, SCOPE AND RATIONALE

### 2.1 What is the Proposal?

The Proposal is to construct, operate and close two open cut iron ore mines at J5 and Bungalbin East in the Helena-Aurora Range (HAR), about 100 kilometres (km) north of Southern Cross in the Shire of Yilgarn, Western Australia (WA). The Proposal includes three mine pits, three waste dumps, haul roads, and supporting infrastructure.

### 2.2 What Key Environmental Factor/s does this SWMP address?

This SWMP addresses the surface water aspects of the 'Hydrological Processes and Inland Waters Environmental Quality' preliminary key environmental factor.

Hydrological processes and water quality was identified in the ESD as a preliminary key environment factor for the Proposal because the Proposal has the potential to alter hydrological regimes and water quality. Specifically, the following potential impacts to hydrological processes and inland water environmental quality were identified:

- Impacts to natural surface water flows and contamination of surface water as a result of placement, design and operation of the mine and associated infrastructure.
- Alteration of surface water flows may result in changes to natural erosion and deposition patterns which could increase the turbidity of surface water.
- If required, disposal of surplus mine dewater has the potential to impact surface water resources.

### 2.3 Requirements of the ESD

This SWMP is submitted in accordance with ESD Item 41(b), the requirement of which is to or prepare a Management -based Environmental Management Plan (EMP) as part of the identification of management, mitigation and monitoring methods to be implemented for the Proposal to ensure residual impacts on 'Hydrological processes and inland waters environmental quality' are not greater than predicted'.

### 2.4 Rationale and approach in meeting the Environmental Objective

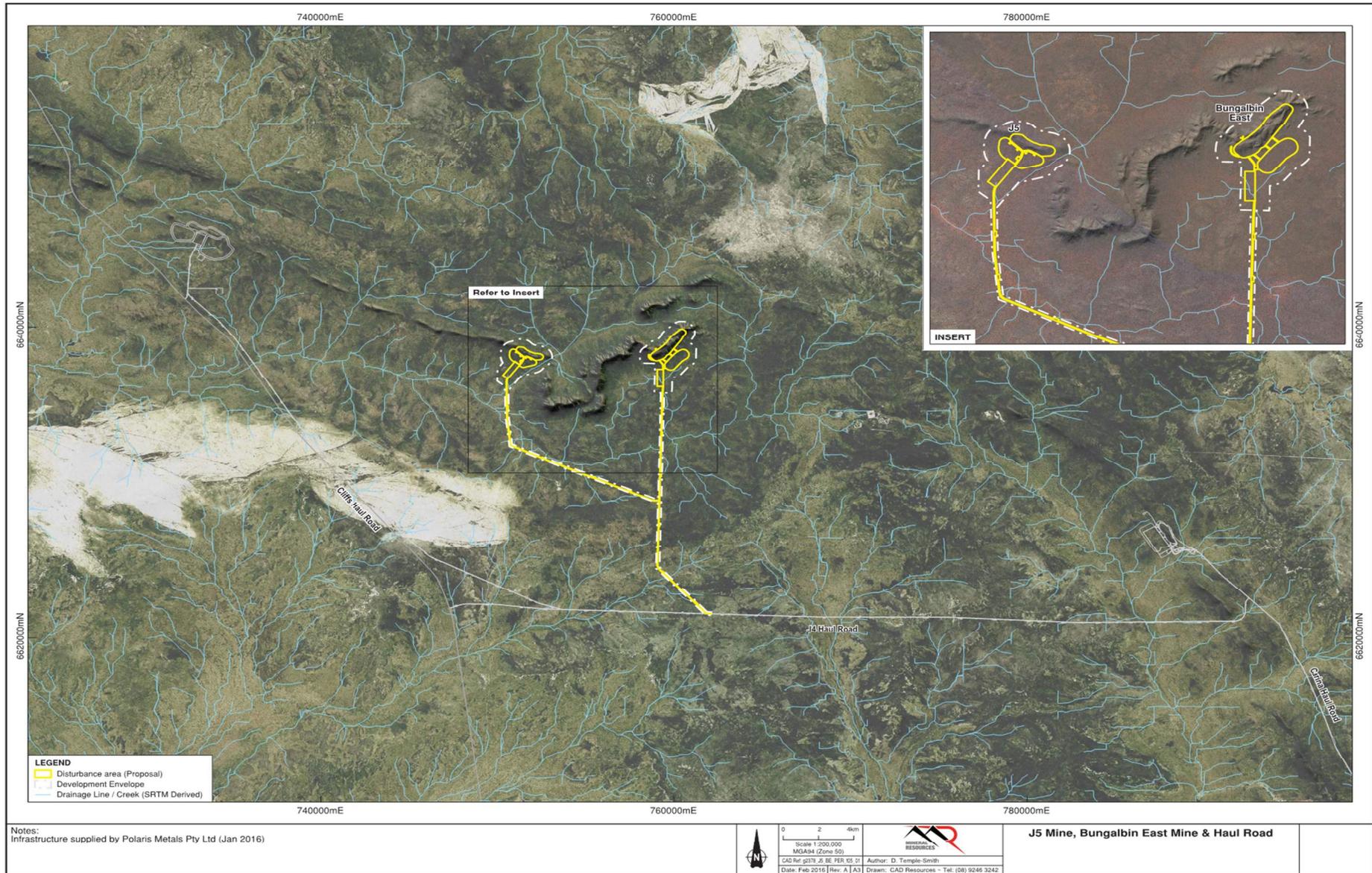
The results of the baseline surveys and the environment risk assessment, outlined further in this section, have been used to inform the management approach for meeting the environmental objectives stated in Table 1-1. The identified management actions, management targets and proposed review and revision of management actions are aligned with the overall management approach.

#### 2.4.1 Results of (baseline surveys/modelling/scientific studies/tests) conducted

The climate of the study area is characterised by an arid temperate climate with a distinctly dry (and hot) summer season and mildly wetter winter months. The environment therefore exists in a water-deficit condition, and thus there are no permanent surface water features and no surface water dependent ecosystems within the Project Area.

Hydrological responses in the region are characterised by highly ephemeral stream, creek and drainage networks with surface water runoff events occurring in response to significant storm events or following the infrequent prolonged periods of rainfall (Golder 2013) (Figure 2-1).

A qualitative environmental risk assessment was undertaken by SWC (2016a) based on the results of regional and local-scale surface water assessments completed by Golder (2013; 2014a, b) and refined by SWC (2016a).



**FIGURE 2-1: SURFACE WATER DRAINAGE SYSTEMS**

The SWC (2016a) assessment identifies the expected level of impact that surface water discharge and modified drainage will have on surface water quality and quantity, potential erosion and sediment transport within and adjacent to the Proposal, taking into account cumulative impacts and a range of climatic scenarios including probable maximum precipitation.

The modelled Probable Maximum Precipitation flood events for J5 and Bungalbin East are shown in Figure 2-2 and Figure 2-3.

The key risks to hydrological processes and inland waters environmental quality are summarised as:

1. modification of surface water flows by site infrastructure
2. degradation of natural water quality as a result of contaminant release
3. degradation of natural water quality as a result of sedimentation
4. degradation of vegetation as a result of increased sedimentation.

#### 2.4.2 Management approach

Management of hydrological processes and inland waters environmental quality will be guided by the following project-specific objectives:

1. Maintain the hydrological regime so that existing and potential uses, including ecosystem maintenance, are protected.
2. Maintain the quality of surface water, sediment and biota so that the environmental values, both ecological and social, are protected.

The management approach to achieve the above management objectives is based on the mitigation hierarchy (avoid, minimise, rehabilitate):

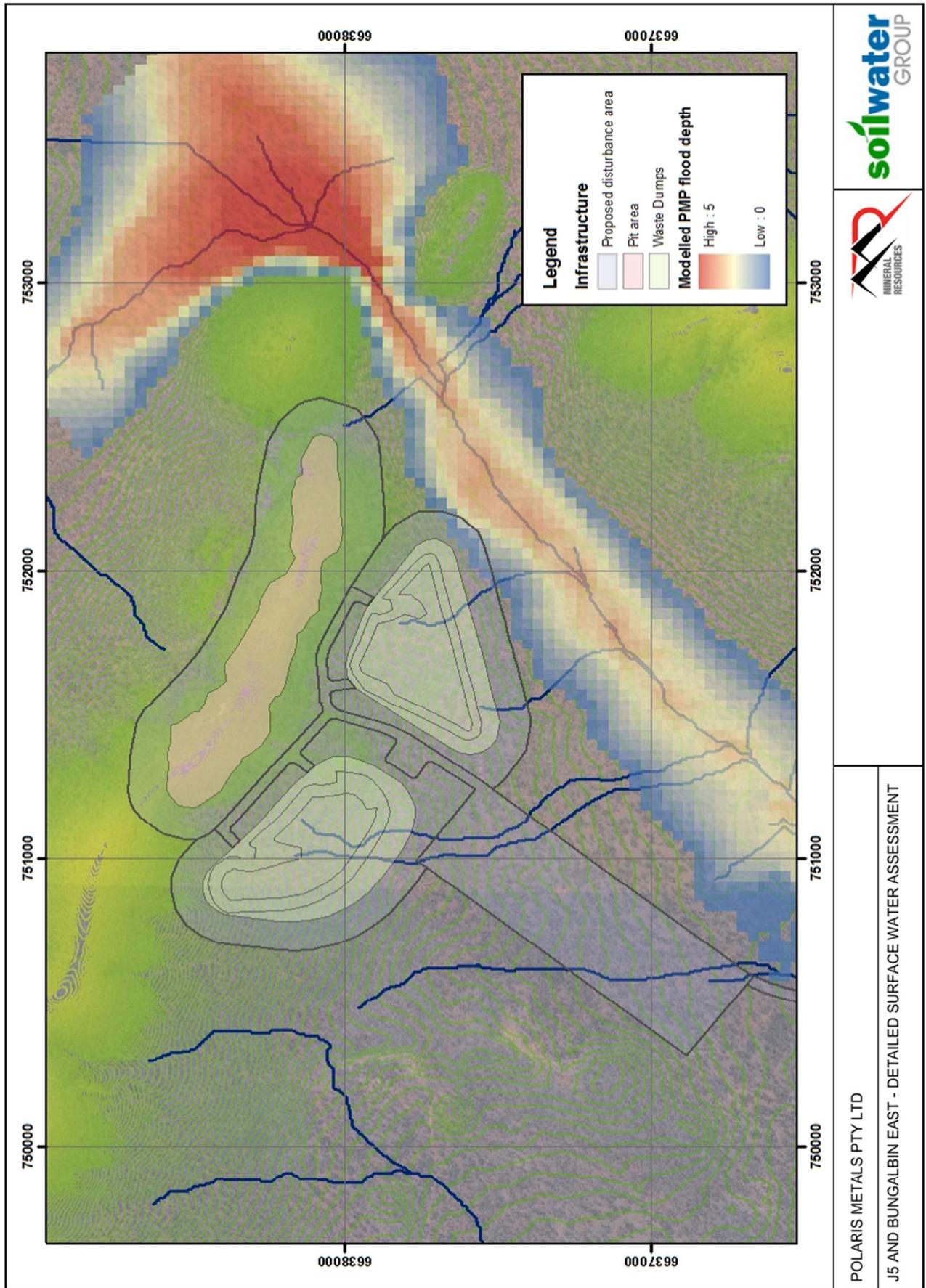
- Avoid interactions with natural surface water flows by specific placement of site infrastructure outside of significant surface water flow pathways and flood-prone areas.
- Minimise impact through diversion of 'clean water' runoff around the active mining areas, wherever practicable, and treatment of runoff from disturbed areas of the site by directing it through sediment traps prior to discharge.
- Rehabilitate and monitor disturbed areas, both within and surrounding the site, prior to site closure.

#### 2.4.3 Rationale for choice of management target/s

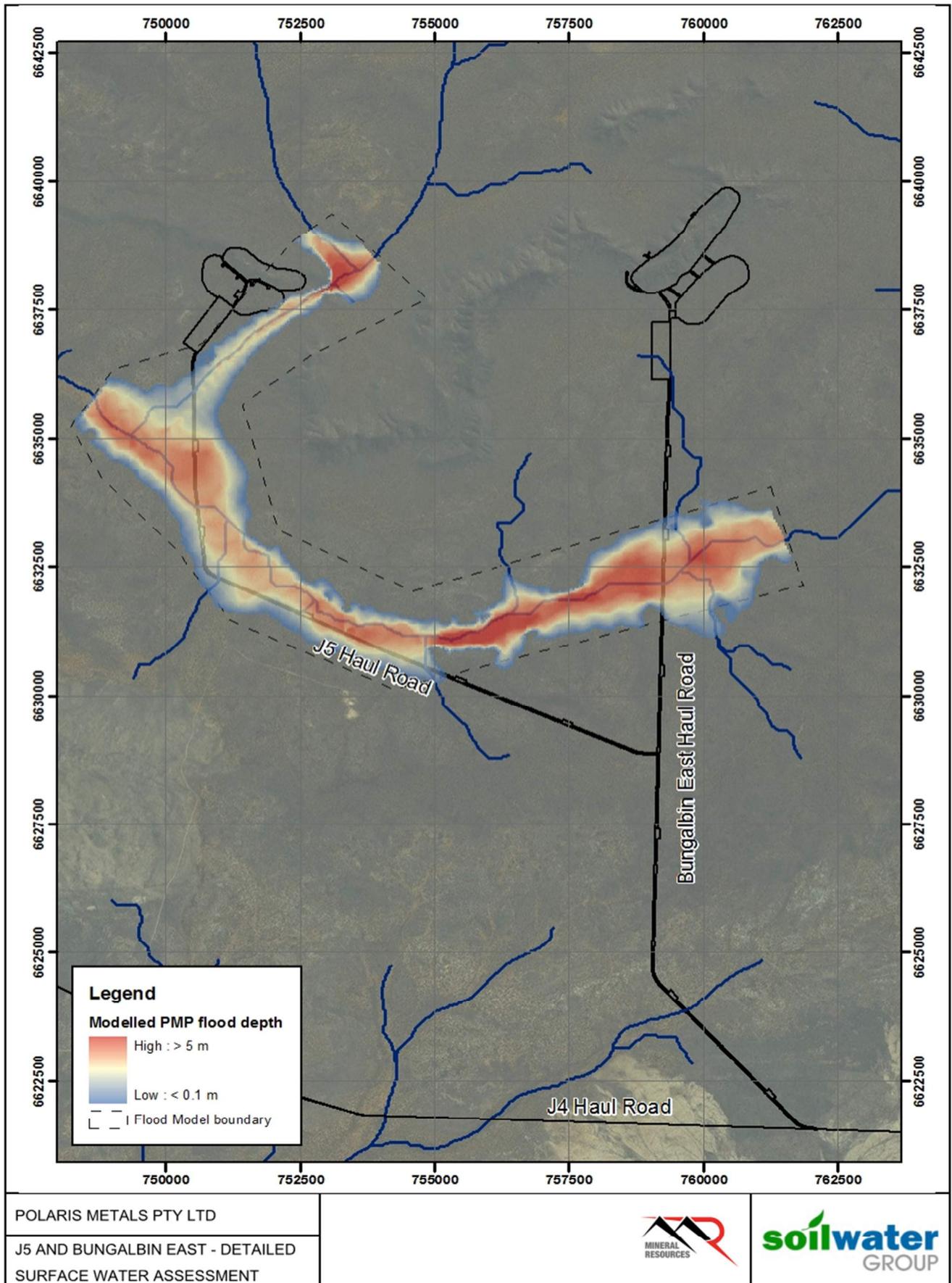
The management targets and related actions outlined in Section 3.2 have been developed based on the results of the risk assessment outlined in Section 2.4.1. Potential environmental impacts which received an overall Risk Rating of "Moderate" or "High" were identified as requiring further management action, and were subsequently assigned a risk-specific management target.

The management practices developed through this process are intended to meet the project-specific environmental objectives.

As all local surface water flows are ephemeral in nature (i.e. only flowing during or shortly after large storm events, with no permanent surface water existing within 60 km), the management targets do not include specific water quality targets. Instead, the management targets focus (a) on ensuring continuity of flood-flows across the sites, and (b) on containing and limiting sediment release into the surrounding local environment.



**FIGURE 2-2: J5 MODELLED PMP FLOOD DEPTH AND EXTENT**



**FIGURE 2-3: HAUL ROAD PMP FLOOD DEPTH AND EXTENT**

### 3. CONDITION EMP PROVISIONS

This section of the SWMP identifies the legal provisions that MRL proposes to implement to meet the Management –based environmental objectives. It identifies the management target/s that MRL will use to measure performance and monitoring that will be undertaken in relation to the management target/s. Finally, it identifies how MRL will review and revise management actions if the management targets are not met.

#### 3.1 Environmental objective

As required in the ESD, management of surface water will be guided by the following project-specific objectives:

- To maintain the hydrological regime so that existing and potential uses, including ecosystem maintenance, are protected.
- To maintain the quality of surface water, sediment and biota so that the environmental values, both ecological and social, are protected.

#### 3.2 Management actions to be implemented

Risk-based management actions have been identified and prioritised to achieve the proposed environmental objective (Table 3-1). These management actions focus the greatest management effort on (proposal activities that have the highest likelihood of causing environmental impact) or (where the consequence of an impact is severe and likely to be irreversible). These management actions were specifically developed to maintain the hydrological regime of the area as well as the quality of surface water, sediment and biota and will be implemented by MRL for the J5 and Bungalbin East Proposal.

**TABLE 3-1:- RISK-BASED MANAGEMENT ACTIONS**

Risk and key impacts	Management actions	Risk based priority	Timeframe / Project phase
1. Surface water flows modified by site infrastructure	<ul style="list-style-type: none"> <li>• Ensure diversions/drains maintain continuity of flow through the catchment by returning diverted flows to natural flow pathway.</li> <li>• Remove drains and re-establish natural drainage at site closure.</li> <li>• Design and construct haul roads with low-pass floodways and other appropriate cross-road drainage and turnouts</li> </ul>	Moderate	<ul style="list-style-type: none"> <li>• Site planning</li> <li>• Construction</li> </ul>
2. Degrade natural water quality as a result of contaminant release	<ul style="list-style-type: none"> <li>• Any chemical storage areas, including bulk fuel storage and fuelling areas will be self-bunded to capture any spills, and additionally accommodate the 1:100-yr, 72-hr design storm volume.</li> <li>• Water from the wash-down bay will be directed to a sump or “turkey’s nest” dam, tested for hydrocarbons (TPH, BTEX), and if meeting NEPM guidelines reused for dust suppression.</li> </ul>	Moderate	<ul style="list-style-type: none"> <li>• Site planning</li> <li>• Construction</li> </ul>

Risk and key impacts	Management actions	Risk based priority	Timeframe / Project phase
<p>3. Degrade natural water quality as a result of sedimentation</p>	<ul style="list-style-type: none"> <li>• Install containment bunding around the Supporting Infrastructure areas to ensure that any rainfall falling on these cleared areas will be retained within the pads</li> <li>• Install sediment control bunding along the southern edges of the Waste Dump disturbance areas to ensure that any rainfall falling on these cleared areas, which includes topsoil and subsoil stockpile areas, will be retained within the disturbance areas.</li> <li>• Utilise sediment traps, installed at low points along the perimeter of the bunded areas, to reduce sediment concentrations in runoff water prior to releasing the water back to the surrounding environment.</li> <li>• Design and construct haul roads with low-pass floodways and other appropriate cross-road drainage and turnouts</li> </ul>	<p>Moderate</p>	<ul style="list-style-type: none"> <li>• Site planning</li> <li>• Construction</li> </ul>
<p>4. Impact terrestrial ecosystems as a result of increased sedimentation</p>	<ul style="list-style-type: none"> <li>• Install containment bunding around the Supporting Infrastructure areas to ensure that any rainfall falling on these cleared areas will be retained within the pads</li> <li>• Install sediment control bunding along the southern edges of the Waste Dump disturbance areas to ensure that any rainfall falling on these cleared areas, which includes topsoil and subsoil stockpile areas, will be retained within the disturbance areas.</li> <li>• Utilise sediment traps, installed at low points along the perimeter of the bunded areas, to reduce sediment concentrations in runoff water prior to releasing the water back to the surrounding environment.</li> <li>• Design and construct haul roads with low-pass floodways and other appropriate cross-road drainage and turnouts</li> </ul>	<p>Moderate</p>	<ul style="list-style-type: none"> <li>• Site planning</li> <li>• Construction</li> </ul>

### 3.3 Management targets

Management targets will be employed to measure and report against achievement of the environmental objective. The results of the baseline hydrological assessment suggest that management targets should focus on ensuring continuity of flood-flows across the sites as well as control of erosion and sedimentation.

**TABLE 3-2: MANAGEMENT TARGET/S**

<b><u>Proposed environmental objective 1</u></b>	To maintain the hydrological regime so that existing and potential uses, including ecosystem maintenance, are protected.
<b>Management target 1</b>	All surface water diversions / drains have been designed, based on appropriate hydrological analysis, and constructed and maintained to convey the 1:100-yr ARI peak flow rate in a way that maintains continuity of surface water flow through the site.
<b>Management target 2</b>	Haul roads have been designed with floodways, based on appropriate hydrological analysis, and constructed and maintained to convey the 1:100-yr ARI peak flow rate in a way that maintains continuity of surface water flow, and minimises erosion of the road surface.
<b><u>Proposed environmental objective 2</u></b>	To maintain the quality of surface water, sediment and biota so that the environmental values, both ecological and social, are protected.
<b>Management target 3</b>	All rainfall falling on disturbed land areas is retained within the disturbance footprint, and is infiltrated or directed through a well-maintained, appropriately sized sediment trap prior to release of the water into the surrounding environment.
<b>Management target 4</b>	All chemical storage area are self-bunded to capture any spills and have capacity to accommodate a 1:100yr 72hr design storm event.

### 3.4 Monitoring

The purpose of monitoring is to inform, through the management targets, if the environmental objective is being achieved and when management actions will have to be reviewed and revised. This section describes how MRL will undertake monitoring to determine whether the management targets are achieved.

The following specific monitoring activities will be conducted:

- A design audit will be undertaken by a suitably qualified person to ensure that diversion drains, bunding, and sediment traps have been designed, based on appropriate hydrological analysis, to convey the 1:100-yr ARI peak flow rate through the catchment.
- A construction audit will be undertaken of drains, bunds, and sediment traps to ensure they have been constructed according to the design.
- Monitoring of drains, bunds, and sediment traps will occur after each runoff-producing rainfall event (or at a minimum frequency of once each quarter). This monitoring will consist of a visual

inspection of these infrastructure items to identify areas where failures have occurred, and/or where repairs may be necessary

- Quarterly monitoring of wash-down bay water quality for hydrocarbons (TPH, BTEX) and assessment against NEPM Guidelines.
- Monitoring for sediment deposition will occur on a quarterly basis, or where monitoring of infrastructure integrity indicates that a loss of sediment outside of the disturbance area may have occurred. This monitoring will consist of a visual inspection (1) directly downslope of sediment trap outlets, and (2) around the perimeter of the site.
- A design audit will be undertaken by a suitably qualified person to ensure that the haul roads, including all floodways, table drains, and turnouts, have been designed, based on appropriate hydrological analysis, to convey the 1:100-yr ARI peak flow rate through the catchment.
- A construction audit will be undertaken of the haul roads, including floodways, table drains, and turnouts, to ensure they have been constructed according to the design.
- Monitoring of the haul roads will occur after each runoff-producing rainfall event (or at a minimum frequency of once each quarter). This monitoring will consist of a visual inspection of the road surface, floodways, table drains, and turnouts to identify areas where erosion is occurring, and/or where repairs or improvements may be necessary.
- Monitoring of vegetation health (lag indicator) surrounding infrastructure and disturbance areas will be conducted annually to identify potential impacts from the operations.

### 3.5 Review and revision of Management Actions

Where the management target/s is not met, MRL will review and revise the risk assessment, review and revise management actions, and identify additional management actions where necessary.

Risks and key impacts with associated management actions and priorities in Table 3-1 will be reviewed and revised. The following are examples of revised and additional management actions for each of the risks listed in Table 3-1:

Risk 1: Surface water flows modified by site infrastructure

- Consider implementation of additional diversions or haul road cross-drainage.
- Repair of any damaged diversions or haul road drainage.

Risk 2: Degrade natural water quality as a result of contaminant release

- Put in place additional contaminant control policies and procedures.
- Repair or upgrade any damaged or insufficient containment bunding.

Risk 3: Degrade natural water quality as a result of sedimentation

- Repair or upgrade of any damaged or insufficient sediment control infrastructure.
- Put in place additional sediment minimisation practices or control measures.

Risk 4: Impact terrestrial ecosystems as a result of increased sedimentation

- Survey of vegetation health in any areas affected by sedimentation.
- Repair of any damaged sediment control infrastructure.
- Removal of excess sediment where practicable.
- Installation of additional sediment fencing.

Reviewed and revised management actions will be implemented by MRL to mitigate and manage impacts so they once again will meet the management target and the condition environmental objectives.

### **3.6 Reporting provisions**

#### **3.6.1 Annual reporting**

The Compliance Annual Report (CAR) will include a summary of monitoring activity for the reporting year, as well as achievement or not of the environmental objectives, as indicated in Table 3-3. In the event that the environmental objective is not achieved during the reporting period, the CAR will include a description of the effectiveness of revised and/or additional management actions implemented and an analysis of trends.

The first CAR will be submitted within 15 months of the date of issue of the Ministerial Statement addressing the 12 month period from the date of issue the Statement then annually from the date of submission of the first compliance assessment report.

#### **3.6.2 Reporting on exceedance of the management target**

In the event that the management target is exceeded (or not met), the CEO of the OEPA will be notified within 28 days of identification of the exceedance.

**TABLE 3-3 ENVIRONMENTAL MANAGEMENT PLAN REPORTING TABLE**

Key environmental factor: Hydrological process and water quality (Ministerial Statement [xyz], conditions [x-x] to [x-y])					
Condition environmental objective and management target set in the Condition EMP		Reporting on the management objective and management target for [Month 20xx] to [Month 20yy]		Status - Condition environmental objective achieved?	
<b>Objective 1</b>	Maintain the hydrological regime so that existing and potential uses, including ecosystem maintenance, are protected.	The hydrological regime [was/was not] maintained with respect to drainage lines intersecting the disturbance area, to the extent that ecosystem maintenance is protected.		<input type="checkbox"/> Yes	<input type="checkbox"/> No
Target 1	All surface water diversions / drains have been designed, constructed, and maintained to convey the 1:100-yr ARI peak flow rate in a way that maintains continuity of surface water flow through the site.	Surface water diversions / drains convey the 1:100-yr ARI peak flow rate and maintain continuity of surface water flow through the site.			
Target 2:	Haul roads have been designed with floodways, constructed and maintained to convey the 1:100-yr ARI peak flow rate in a way that maintains continuity of surface water flows, and minimises erosion.	Cross haul road drainage conveys the 1:100-yr ARI peak flow rate and maintains continuity of surface water flows as well as minimising erosion.			
<b>Objective 2</b>	To maintain the quality of surface water, sediment and biota so that the environmental values, both ecological and social, are protected	The quality of surface water, sediment and biota [was/was not] maintained.		<input type="checkbox"/> Yes	<input type="checkbox"/> No

Key environmental factor: Hydrological process and water quality (Ministerial Statement [xyz], conditions [x-x] to [x-y])				
Condition environmental objective and management target set in the Condition EMP		Reporting on the management objective and management target for [Month 20xx] to [Month 20yy]	Status - Condition environmental objective achieved?	
Target 3:	All rainfall falling on disturbed land areas is retained within the disturbance footprint, and is infiltrated or directed through a well-maintained sediment trap prior to release into the surrounding environment	Stormwater [was/was not] retained on-site and infiltrated or directed through a well-maintained sediment trap prior to release into the surrounding environment.		
Target 4:	All chemical storage area are self-bunded to capture any spills and have capacity to accommodate a 1:100yr 72hr design storm event	All chemical storage areas [were/were not] sufficiently self-bunded.		

#### 4. ADAPTIVE MANAGEMENT AND REVIEW OF THE CONDITION EMP

MRL will also implement adaptive management to learn from the implementation of mitigation measures, monitoring and evaluation against management targets, to more effectively meet the environmental objective. The following approach will be followed:

- Monitoring data will be systematically evaluated and compared to baseline and reference site data on a quarterly basis in a process of adaptive management to verify whether responses to the impact are the same or similar to predictions.
- Re-evaluate the risk assessment and revision of risk-based priorities on the basis of monitored information.
- Increased understanding of the ecological regime.
- Revision when management actions are not as effective as predicted.
- External changes during the life of the Proposal (e.g. changes to the sensitivity of the key environmental factor, implementation of other activities in the area, etc.).
- Review of SWMP will occur if changes to SWMP provisions are required by revisions to condition, timeframe, etc.

## 5. STAKEHOLDER CONSULTATION

Consistent with the EPA's expectations for this AMP to align with the principles of EIA, MRL will review this AMP in response to stakeholder consultation. This review will be undertaken in the event that this AMP is required to satisfy a condition of approval under Part IV of the EP Act.

This section provides a summary of comments raised during consultation with stakeholders conducted to date which were considered in the development of the AMP. Table 5-1 presents stakeholder comments in relation to the Proposal as well as MRL's responses to these comments.

**TABLE 5-1 STAKEHOLDERS CONSULTED, COMMENTS AND RESPONSES**

Organisation(s)		Comments	MRL Response to Comments/Concerns
Government agencies - assessment departments (2012-2016)		<ul style="list-style-type: none"> <li>Tenure requirements, access track realignment, geochemical characterisation and soil studies approach, groundwater impacts, approach for undertaking the VIA and peer review, potential for assessment of offsets.</li> <li>Lessons learnt at MRL's Carina mine to be applied in the J5 and Bungalbin East Project.</li> <li>PER to consider and address relevant government policies.</li> <li>EPA to arrange site visit following submission of the draft PER.</li> </ul>	Follow up meetings with various government assessment departments
NGOs 2013 - 2014	Wildflower Society	Opposed to all development	
	Wilderness Society	Opposed to all development	
	Conservation Council	No response	
	Helena Aurora Range Advocates	Sought support for upgrading MMHARCP to a National Park with no mining	

Organisation(s)	Comments	MRL Response to Comments/Concerns
Community (2015)	<ul style="list-style-type: none"> <li>• Meeting at Kalgoorlie Country Club:               <ul style="list-style-type: none"> <li>○ Local employment, transport design options, type of haul road, purpose of the Proposal in the location.</li> <li>○ Proposed rehabilitation, progressive mining and backfilling, general environmental and heritage queries, company environmental track record.</li> <li>○ Sealed road created by Proposal used for tourism access for emergency services use.</li> </ul> </li> </ul>	
	Southern Cross Community Group - no response	-
Industry groups (2012-2014)	Discussions regarding the Proposal.	-
Indigenous - Traditional Owners	Heritage surveys undertaken.	-

## 6. REFERENCES

- Golder (2013). Yilgarn Region Prospects - Surface Water Risk Assessment. August 2013. Unpublished report 137646039-002-R-Rev0 prepared by Golder Associates for Mineral Resources Limited.
- Golder (2014a). J5 Mine Area and Haul Road Surface Water Study. November 2014. Unpublished report 147646027-004-R-Rev0 prepared by Golder Associates for Mineral Resources Limited.
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- Ecologia (2016). J5 and Bungalbin East Project - Flora and Vegetation Assessment. January 2016. Unpublished report prepared by ecologia environment for Polaris Metals Pty Ltd.
- SWC (2016a). J5 and Bungalbin East - Detailed Surface Water Assessment. February 2016. Unpublished report prepared by Soilwater Consultants for Polaris Metals Pty Ltd.
- SWC (2016b). J5 and Bungalbin East Soil Characterisation. 1 February 2016. Unpublished report prepared by Soilwater Consultants for Polaris Metals Pty Ltd.